NC-1182 Progress Report
October 1, 2013 to September 30, 2014

University of Arkansas

Objective: Evaluate fertilizer regimes, harvesting practices, and grazing management interactions with plant communities and soils emphasizing N capture and forage quality

Project: Legume establishment, persistence, and performance under grazing

Overall Objective: Identification of legume establishment strategies, species persistence, and legume performance under grazing.

Specific Objectives: 1) Determine the N-turnover from annual clovers when grown before summer annual grasses; 2) Evaluate the effects of overseeded annual and perennial clovers on animal performance in bermudagrass-based pastures.

A. Project Project 1: N-turnover from three annual legumes followed by annual summer grasses. **Project 2**: Performance of subterranean clover and white clover in bermudagrass-based grazing system.

B. Personnel: D. Philipp, K.P. Coffey

C. Summary:

Project 1. *Methods:* This project was initiated in autumn of 2013. Three annual legumes (crimson clover, arrowleaf clover, and hairy vetch) were no-till planted in a randomized complete block design. Seven treatments include 3 legume species and 4 nitrogen fertilizer treatments of teff which will be planted after the legumes have been terminated with an herbicide and incorporated into the soil via disking. The nitrogen treatments will include 0, 50, 100, and 150 kg ha^{-1} application rates. Teff was harvested from these plots and from those that were planted with legumes the previous autumn. *Results:* There were no obvious differences between the treaments, i.e., legume treatments had no statistically significant effect on teff biomass accumulation. This project will be repeated and plots established in autumn of 2014.

Project 2. *Methods*: This project was also initiated in autumn of 2013. Three subterranean clovers and two white clover varieties were no-till drilled into a bermudagrass pasture that was lightly disked or left untreated before planting. Crimson clover was used as control. A randomized complete block design with three replications was used for this experiment. *Results:* This project failed because the used legume species did not emerge. Therefore, the experiment will be repeated and plots reestablished in autumn of 2014.

Objective 2: Quantify the effect of dietary and animal factors on utilization and excretion of forage N by beef and dairy cattle.

Project: Intake and digestibility of haylage made from alfalfa treated with dairy slurry and baled at different moisture concentrations

Objective: Our objective was to determine intake and digestibility of alfalfa haylage that was baled at two different moisture concentrations and harvested after no dairy slurry application or slurry application on stubble at different times after a previous harvest.

Personnel: J. Hanlin, K. Coffey, W. Coblentz, D. Philipp, and J. Caldwell

Summary: Replicated plots of alfalfa in Marshfield, WI were either not sprayed with dairy slurry (C) or received dairy slurry application on stubble (S) or after 2 weeks of regrowth (R) following a previous harvest. All plots were harvested 39 d after the initial harvest was baled and removed. Alfalfa was allowed to field wilt, then packaged at either 46.2% (ideal moisture) or 34.5% (dry) moisture. The each of the slurry treatment by moisture combinations were offered to 3 Katahdin ewes in each of 2 periods. The forage was offered for ad libitum consumption following chopping through a commercial mulch chopper. Each period consisted of a 14-d adaptation followed by 7 d of total fecal collection. Dry matter and organic matter digestibilities tended ($P < 0.10$) to be greater from the dry haylage compared with the wet haylage, but dry matter intake (g/kg body weight) was not affected by moisture ($P = 0.76$), manure treatment ($P = 0.28$) or their interaction ($P = 0.33$). Total white blood cell counts (WBC) were greater from sheep offered S compared with C, but WBC did not differ ($P > 0.26$) among other treatment combinations. Lymphocytes expressed as a percentage of total WBC were greater from the dry haylage compared with ideal and with C compared with S and R. Total red blood cell counts were greater from sheep offered R compared with those offered C or S. Therefore, slurry application to alfalfa prior to ensiling may not affect intake, but other measures of inflammation may be impacted.

Project: Nitrogen use efficiency and environmental impact by beef cattle limit-fed co-product feedstuffs

Overall Objective: to determine if co-product feedstuffs could be used to meet the energy demands for cows, and how using co-product feedstuffs as the major component of cow diets affects nitrogen use efficiency and estimated greenhouse gas emissions

Personnel: W.B. Smith, K.P. Coffey, E.B. Kegley, D. Philipp, and J.D. Caldwell

Summary:

Eight ruminally-fistulated cows (671 ± 32.0 kg BW) were stratified by BW and allocated randomly to1 of 4 treatments in a 2-period study: limit-fed soybean hulls (LSH), limit-fed distillers' dried grains with solubles (LDG), a limit-fed mixture of soybean hulls and distillers' dried grains with solubles (MIX), or ad libitum mixed-grass hay (HAY; 10.6% CP, 71% NDF). Limit-fed diets were formulated to meet the ME requirements of an 11-mo post-partum mature

beef cow. Cows were housed in indoor 3 × 4.3 m concrete pens fitted with rubber mats for a 14-d adaptation and 5 d of total fecal collection period. Carbon footprint and emissions were predicted according to IPCC (2006). Excretion of total N, as well as percent excreted in feces and urine, was not different ($P \geq 0.31$) among treatments. Concentration of ammonia-N in the urine was greater ($P = 0.02$), and concentration of urea-N tended to be greater ($P = 0.07$), from LDG than from any other treatment. Both ammonia-N and urea-N, when expressed as a percent of the total urinary N, were greater ($P \leq 0.04$) from LDG than other treatments. Predicted enteric CH_4, CH_4 from manure, direct loss of N_2O, as well as N_2O from volatilization and leaching were not different ($P \geq 0.12$) among treatments. Contribution of feedstuffs to total CO_2 load tended to be greatest ($P = 0.07$) from LDG and least from HAY, with MIX intermediate to LDG and LSH and LSH intermediate to MIX and HAY. However, total carbon footprint (kg CO_2eq d^{-1}) was not different ($P = 0.55$) among treatments. Based on this information, co-product feedstuffs may be used in lieu of hay to meet the energy requirements of cows without adverse effects on total N excretion or environmental impact.

Publications:

Coblentz, W. K., R. E. Muck, M. A. Borchardt, S. K. Spencer, W. E. Jokela, M. G. Bertram, and **K. P. Coffey**. 2014. Effects of dairy slurry on silage fermentation characteristics and nutritive value of alfalfa. J. Dairy Sci. 97:7197-7211.

Kanani, J., D. Philipp, **K. P. Coffey**, E. B. Kegley, C. P. West , S. Gadberry, J. Jennings, A. N. Young, and R. Rhein. 2014. Comparison of acid-detergent lignin, alkaline-peroxide lignin and acid-detergent insoluble ash as internal markers for predicting fecal output and digestibility by cattle offered bermudagrass hays of varying nutrient composition. J. Anim. Sci. Biotechnol. 5:7

Smith, S. A., M. P. Popp, D. Philipp, **K. P. Coffey**, E. E. Gbur, and T. G. Montgomery. 2014. Overseeding bermudagrass pastures with ryegrass and clovers: estimating partial returns. J. Am. Soc. Farm Managers Rural Appraisers (In press).

Abstracts:

Bartimus, H. L., J. D. Caldwell, B. C. Shanks, **K. P. Coffey**, D. S. Hubbell, III, J. D. Tucker, C. R. Krehbiel, C. L. Maxwell. 2014. Performance and carcass measurements by fall-born calves weaned in the morning or evening using either fenceline or traditional weaning metholds. *J. Anim. Sci. 92(Suppl. 2):101.*

Coblentz, W. K., R. E. Muck, M. A. Borchardt, W. E. Jokela, M. G. Bertram, and **K. P. Coffey.** 2014. Effects of dairy slurry on the nutritive value and fermentation characteristics of alfalfa silages. *J. of Anim. Sci. 92(E-Suppl. 2):152.*

Smith, W. B., **K. P. Coffey,** R. T. Rhein, E. B. Kegley, D. Philipp, J. D. Caldwell, and **A.** N. Young**.** 2014. Nitrogen use efficiency and carbon footprint by beef cattle limit-fed co-product feedstuffs. *J. Anim. Sci. 92(E-Suppl. 2):276.*

Smith, W. B., K. P. Coffey, J. D. Tucker, D. S. Hubbell, III, R. T. Rhein, E. B. Kegley, D. Philipp, J. D. Caldwell, and A. N. Young. 2014 Production, digestion and ruminal fermentation by beef cattle limit-fed co-product feedstuffs. Proc. South. Sec. ASAS. pp. 14.

Arkansas Animal Science Reports

Bax, A. L., J. D. Caldwell, L. S. Wilbers, B. C. Shanks, T. Hampton, S. E. Bettis, Y. Liang, G. I. Zanton, and **K. P. Coffey.** 2015. Performanc of Holstein steers offered hay and supplement with or without added methionine. *Arkansas Animal Science Department Report. Arkansas Agri. Exper. Sta. Research Series 620:14-15.*

Smith, W. B., **K. P. Coffey**, R. T. Rhein, E. B. Kegley, D. Philipp, J. D. Caldwell, and A. N. Young. 2015. Ruminal forage digestibility following a period of limit-feeding co-product feedstuffs. *Arkansas Animal Science Department Report. Arkansas Agri. Exper. Sta. Research Series 620:39-41.*

Coffey, K.P., A.N. Young, E.B. Kegley, J.A. Hornsby, J. Hollenback, D. Philipp. 2014. Intake, digestibility and in situ disappearance of bermudagrass hay diets supplemented with different types of distillers' grains for lactating cows. *Arkansas Animal Science Department Report. Arkansas Agri. Exper. Sta. Research Series 612:19-21.*

Smith, W.B., K.P. Coffey, E.B. Kegley, J.D. Caldwell, A.N. Young, E.A. Backes, J. Kanani, and D. Philipp. 2014. Intake and digestibility of heat-damaged hay by Katahdin ewes. *Arkansas Animal Science Department Report. Arkansas Agri. Exper. Sta. Research Series 612:101-104.*

Smith, W.B., K.P. Coffey, R.T. Rhein, E.B. Kegley, D. Philipp, J.D. Caldwell and A.N. Young. 2014. Intake, digestibility and ruminal fermentation characteristics of cows limit-fed co-product commodity feeds. *Arkansas Animal Science Department Report. Arkansas Agri. Exper. Sta. Research Series 612:67-70.*

Smith, W.B., K.P. Coffey, J.D. Tucker, D.S. Hubbell, III, E.B. Kegley, D. Philipp, J.D. Caldwell and A.N. Young. 2014. Production characteristics and blood metabolites of gestating cows limit-fed soybean hull. *Arkansas Animal Science Department Report. Arkansas Agri. Exper. Sta. Research Series 612:71-73.*

University of Nebraska-Lincoln

NC-1182 Annual Progress Report

October 1, 2013 to September 30, 2014

NC-1182 Objective 2: Evaluate supplementation practices, use of growth promoting compounds, and synchronization of plant nutrient supply and animal requirements to increase N capture or alter mode of excretion by livestock.

Project: Effects of distillers grains and monensin supplementation grazing steers

A. **Objectives:** 1) Investigate the interaction of monensin use and distillers grains supplementation on calves grazing smooth bromegrass; 2) Quantify forage intake of steers receiving 0.4% BW distillers grains with and without monensin.

B. **Personnel:** Tyler Hasenauer, Jim MacDonald, Terry Klopfenstein, Robby Bondurant, Dirk Burken.

C. **Summary of Research:** Yearlings steers rotationally grazing smooth bromegrass were individually supplemented monensin at 0 or 200 mg with modified distillers grains plus solubles (MDGS) at .05, 0.4, 0.6, and 0.8% BW. Cannulated steers continuously grazing smooth bromegrass were assigned randomly to one of 2 treatments: 0.4% BW MDGS supplementation with 0 or 200 mg monensin. Monensin did not affect ADG of steers supplemented MDGS ≥0.4% BW. Steers supplemented with monensin had a decrease in estimated average forage intake from 16.16 lb to 14.75 lb/m day. Supplementation of monensin tended to decrease FDMI 9%.

D. **Application of Results:** The common belief is cattle on finishing diets and cattle on forage diets respond differently to monensin. The response to monensin in a finishing diet is a decrease in DMI without decreasing ADG, while cattle on forage diets respond with no change in DMI but increase in ADG. However, when monensin is supplemented along with DGS in a forage diet, the animal may respond similarly to an animal on a finishing diet. When cattle grazed smooth bromegrass, the addition of monensin to MDGS supplementation did not increase ADG. Instead, when monensin was supplemented with MDGS, forage intake decreased 9%. Supplementing monensin and MDGS may be an effective way to decrease forage intake and increase stocking rate and grazing efficiency.

Figure 1: The effect of monensin supplementation on ADG of grazing steers

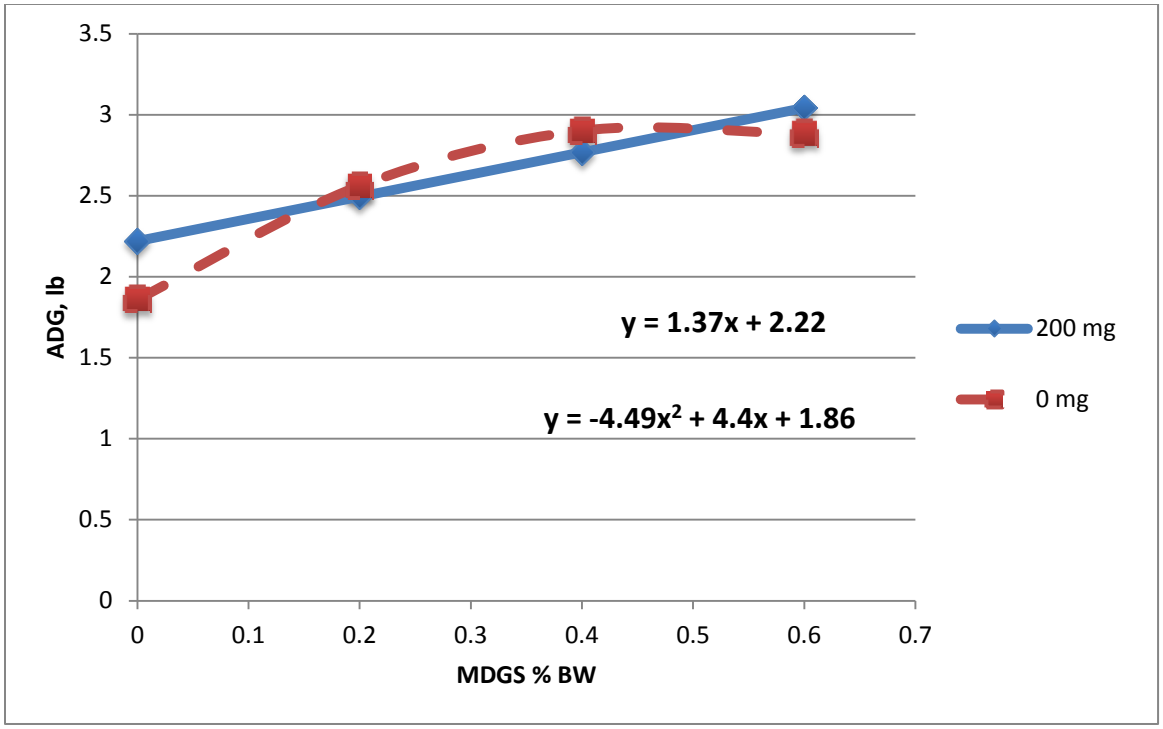
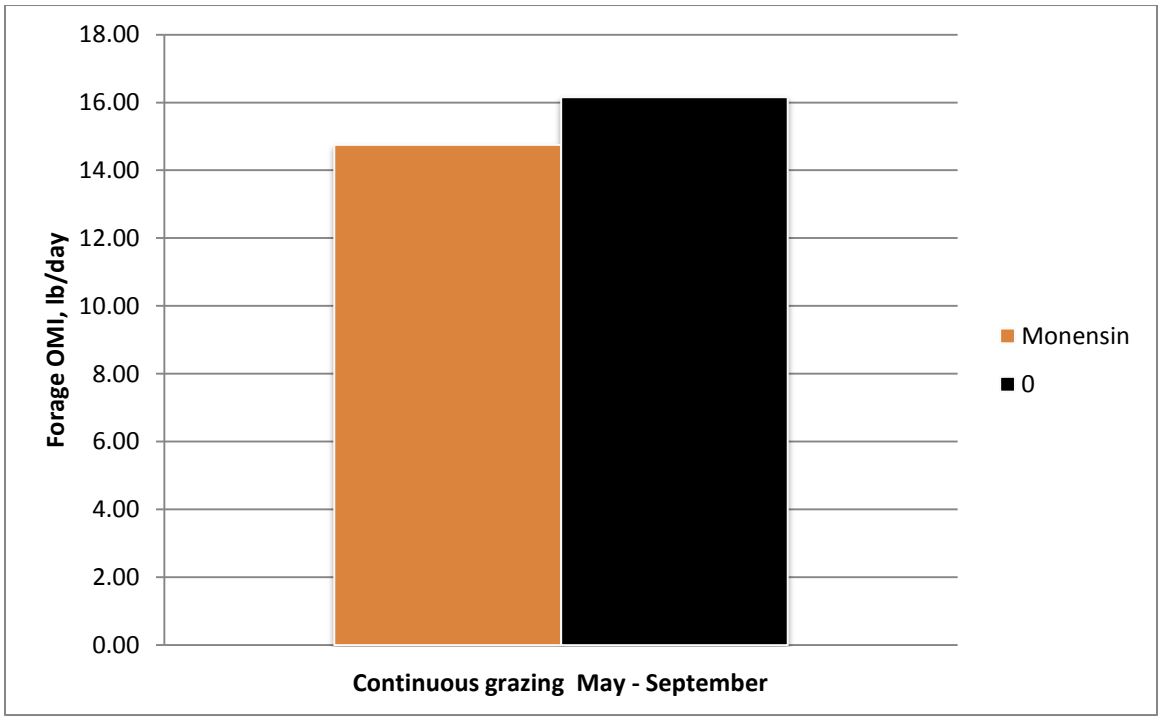


Figure 2: The effect of monensin on forage organic matter intake.



Project: Dried Distillers Grains Supplementation of Calves Grazing Irrigated Corn Residue

A. **Objectives:** 1) Determine effects of winter and summer distillers grains supplementation on growing and finishing performance; 2) Evaluate the potential interaction between winter and summer distillers grains supplementation on growing and finishing performance.

B. **Personnel:** Mandi Jones, Jim MacDonald, Galen Erickson, Terry Klopfenstein, Robby Bondurant

C. **Summary of Research:** Steer calves grazing irrigated corn residue received supplementation of dried distillers grains plus solubles (DGS) at 0.3, 0.5, 0.7, 0.9 or 1.1% of body weight. Steers were individually supplemented daily through Calan gates. Daily gain improved linearly (0.77 lb/head/day to 2.21 lb/head/day) with increasing supplementation (1.5 lb/day to 7 lb/day). Supplementing DGS to calves grazing corn residue increased gain during the winter period.

D. **Application of Results:** Three studies are now available quantifying the response of distillers grains supplementation to growing calves grazing residue. While one study resulted in linear increases in gain, the average response is quadratic. If stocking recommendations of 8 lb of available forage per bushel of grain are followed, digestibility of residue remains constant across the grazing period.

Figure 1: Effect of gain on level of dried distillers grains

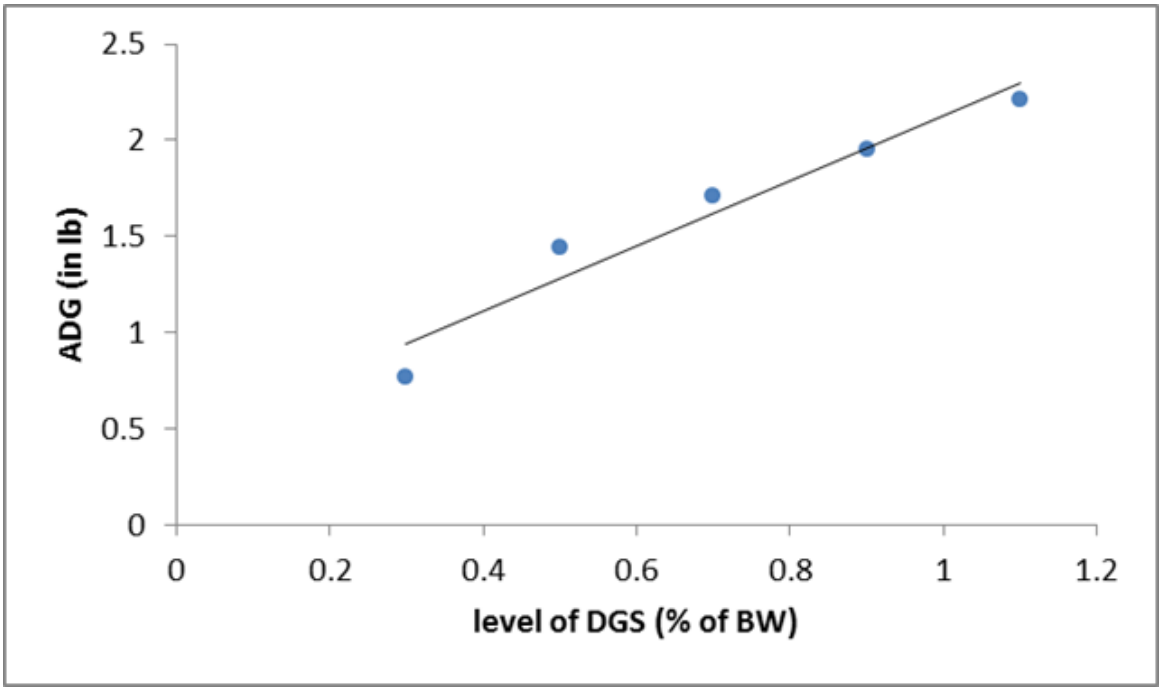


Figure 2: In Vitro Organic Matter Disappearance of diet samples over time

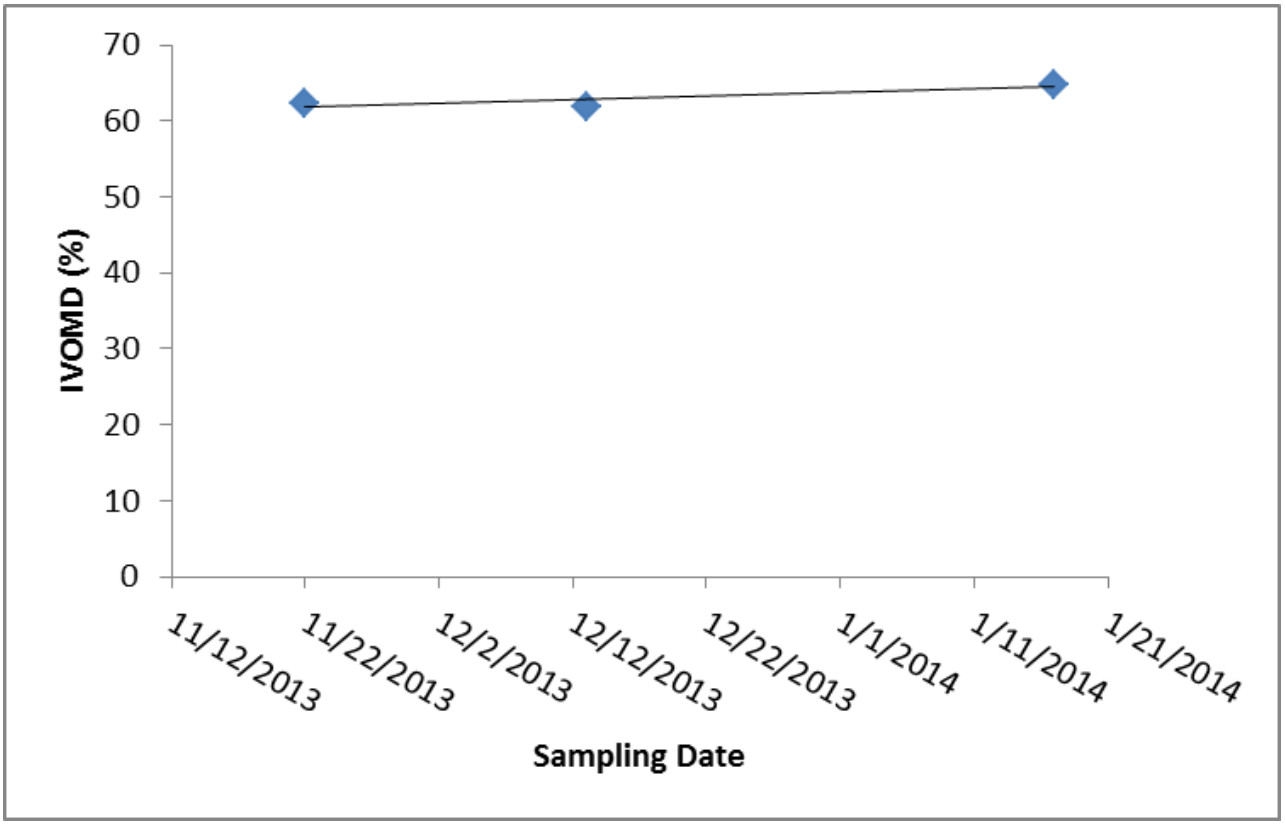
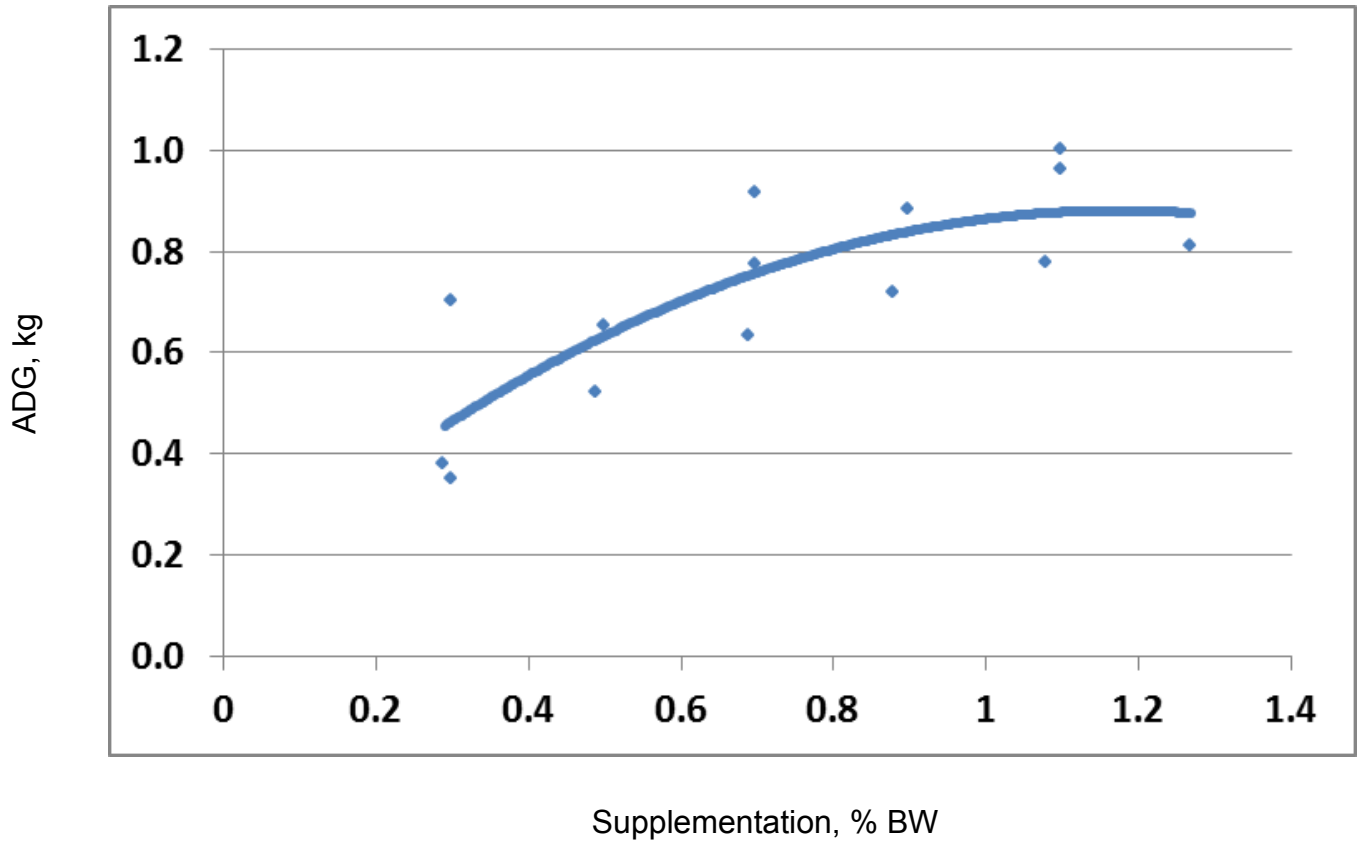


Figure 3: Three trial summary of distillers grains supplementation to calves grazing corn residue.



Project: Comparison of Commercial Lick Tubs to Distillers Grains Supplementation for Calves Grazing Corn Residue

A. **Objectives:** 1) Determine profitability of winter and summer supplementation level and interaction of timing within forage-based systems using spayed heifers.

B. **Personnel:** Mandi Jones, Jim MacDonald, Galen Erickson, Terry Klopfenstein, Kathleen Brooks, Dirk Burken, Robby Bondurant, Andrea Watson

C. **Summary of Research:** Steer calves grazing irrigated corn residue were supplemented dried distillers grains plus solubles (DGS) or allowed continuous access to a commercial lick tub. Dried DGS was fed at 2.94 lb/steer/day and the lick tubs were consumed at 2.04 lb/steer/day (DM basis). Gain was greater for cattle supplemented with dried DGS (1.36 lb/day) compared to those with access to lick tubs (0.83 lb/day). Supplement efficiency varied between calves receiving dried DGS (46%) and those with continuous access to the lick tub (43%) when expressed on a DM basis. Values for dried DGS supplementation (48%) were not different for supplement efficiency on an OM basis when compared to cattle on the lick tub treatment (50%). Economic analysis shows that as the price of DGS increases, the difference in profit between supplementation strategies is reduced.

D. **Application of Results:** Many commercially available tubs are available but few comparisons have been made to distillers grains supplementation. These data suggest that performance from tubs is similar on an OM-basis, but not better than commodity distillers grains.

Table 1: Comparison of dried distillers grains and lick tub supplementation for calves grazing corn residue on a dry matter and organic matter basis

	dried DGS	lick tub	S.E.	F-test
Initial BW, lb	529	529	5.82	0.6
Final BW, lb	608	578	9.2	<0.01
ADG, lb/d	1.36	0.83	0.06	<0.01
DM				
Supp. Intake, %BW	0.52	0.36	0.03	<0.01
Supp. Intake, lb/h/d	2.94	2.02	0.21	<0.01
Supp. Efficiency, %	46	43	0.15	<0.01
OM				
Supp. Intake, %BW	0.5	0.3	0.01	<0.01
Supp. Intake, lb/h/d	2.82	1.68	0.08	<0.01
Supp. Efficiency, %	48	50	0.03	0.64

Table 2: Economics of feeding distillers grains at 120% the value of corn when compared to a commercial lick tub

	$4.00 corn				$5.50 corn				$7.00 corn			
Item	dried DGS	lick tub	S.E.	F-test	dried DGS	lick tub	S.E.	F-test	dried DGS	lick tub	S.E.	F-test
$/steer												
steer cost	792.74	793.68	3.57	0.4	792.74	793.68	3.57	0.4	792.74	793.68	3.57	0.4
supplement cost	28.40	55.89	5.14	<0.01	29.52	55.89	5.33	<0.01	33.54	55.89	5.12	<0.01
yardage cost	20.25	12.66	7.59	<0.01	20.25	12.66	7.59	<0.01	20.25	12.66	7.59	<0.01
grazing cost	7.11	7.22	0.18	0.7	7.11	7.22	0.18	0.7	7.11	7.22	0.18	0.7
total feed cost	25.95	63.10	7.12	<0.01	36.63	63.10	5.43	<0.01	40.66	63.10	5.22	<0.01
total steer cost	852.37	862.89	9.43	0.2	853.49	862.89	6.48	0.3	857.52	862.89	7.14	0.5
revenue	955.91	907.52	34.91	<0.01	955.91	907.52	34.91	<0.01	955.91	907.52	34.91	<0.01
net return	103.54	44.63	26.73	<0.01	102.42	44.63	29.26	<0.01	98.40	44.63	28.96	<0.01
$/lb												
cost of gain	0.75	1.47	0.14	<0.01	0.77	1.47	0.16	<0.01	0.82	1.47	0.16	<0.01

NC-1182 Objective 3: Evaluate fertilizer regimens, harvesting practices, and grazing management interactions with plant communities and soils emphasizing N capture and forage quality.

Project: Uptake and recovery of nitrogen from urine and fertilizer by smooth bromegrass

A. Specific objectives: From 2011-2012, we investigated the effects of ruminant urine input (urine and distilled water control) and N fertilizer rate (0, 45, 90, 135, and 180 kg N ha^{-1}) on N use by smooth bromegrass (*Bromus inermis* Leyss.) in eastern Nebraska. Measured variables included herbage N concentration, annual herbage N uptake, apparent N recovery (ANR), and N use efficiency (NUE).

B. Personnel: Laura K. Snell, John A. Guretzky, Virginia L. Jin, Rhae A. Drijber, and Martha Mamo

C. Summary of Research: In 2011, herbage N concentration and uptake increased linearly with N fertilizer rate in urine- and distilled water-treated plots. In 2012, only urine had an impact as drought limited herbage accumulation. Apparent N recovery averaged 0.42 and 0.63 kg N kg^{-1} DM in urine and distilled water-treated plots, respectively, in 2011 but did not differ between treatments in 2012, averaging 0.24 kg N kg^{-1} DM. Meanwhile, NUE was similar among treatments averaging 13.0 kg DM kg^{-1} N fertilizer applied in 2011 and 6.5 kg DM kg^{-1} N fertilizer applied in 2012.

D. Application of Results: In years with growing-season precipitation and temperature near long-term averages of 633 mm and 16.1°C in eastern NE, producers can expect herbage N concentration and annual herbage N uptake in smooth bromegrass pasture to increase with fertilizer applications up to 180 kg N ha^{-1}. Herbage in urine spots will have greater N concentrations but the proportion of N applied that is recovered and NUE by herbage in these spots will be less than pasture areas not affected by urine.

NC-1182 Objective 4: Determine the fate of excess N in grassland agroecosystems by estimating key components of nutrient cycles including aqueous and gaseous N losses.

Project: Nitrogen mineralization and litter decomposition in smooth bromegrass pastures

A. Specific objectives: The objective of this study was to evaluate the effect of pasture management strategies that varied form of N input on soil N mineralization, litter decomposition, and litter N release in smooth bromegrass (*Bromus inermis* Leyss.) pasture. Management strategies included: 1) N-fertilized pasture grazed with unsupplemented beef cattle (FERT); 2) unfertilized pasture grazed with unsupplemented beef cattle (CONT); and 3) unfertilized pasture grazed with dried distillers grains plus solubles (DDGS)-supplemented beef cattle (SUPP).

B. Personnel: Ana B. Wingeyer, John A. Guretzky, Walter Schacht, and Terry Klopfenstein

C. Summary of Research: After 210 days of aerobic soil incubation, cumulative soil N mineralization was 155.1 ± 9.8, 170.5 ± 15.6, and 180.2 ± 13.8 mg N kg^{-1} soil for CONT, SUPP, and FERT pastures, respectively, which represented a supply of 254, 279, and 294 kg N ha^{-1} for the 0-15 cm soil depth, respectively. Decomposition day models incorporating precipitation and temperature generally were the best predictors of litter decomposition. Regardless of the model used, there was no difference in litter decomposition among management strategies in 2010, while in 2011, both leaf and stem litter decomposed faster in FERT than CONT and SUPP pastures.

D. Application of Results: After 8 yr of management, cessation of N fertilization in CONT and SUPP resulted in a soil environment that supported less soil N mineralization litter decomposition than FERT. These soil related responses are consistent with previous research demonstrating reduced herbage accumulation, weed suppression, litter deposition, and litter N return in unfertilized pastures. The results of this pasture study demonstrate that soil N supply in smooth bromegrass pastures that have a long history of N fertilization is significantly reduced by the 8th year of N fertilization cessation – thus negatively affecting production of smooth bromegrass. Soil N mineralization and litter N release of SUPP pastures was in general intermediate between CONT and FERT, but not different than CONT. Use of DDGS as an energy and protein supplement to grazing cattle compensated for the lack of N fertilization and minimized the impacts on N cycling during the first 8 yr of this experiment. Whether SUPP as a management strategy can replace N fertilization in a sustainable fashion over the long term is unknown.

Project: Decomposition and nitrogen cycling of roots and litter in nitrogen-fertilized and legume-interseeded cool-season grass pastures

1. **A. Specific objectives**: Evaluate (a) litter decomposition and N loss from smooth bromegrass, red clover, alfalfa, and birdsfoot trefoil in N-fertilized and legume-interseeded pastures; and (b) effect of N fertilization and supplemental strategy on production and decomposition of rhizomes and roots in smooth bromegrass pasture.

   B. Personnel: John A. Guretzky and Walter Schacht

   C. Summary of Research: A litter decomposition experiment was conducted in 2013 and 2014 to evaluate dry matter and N loss from litter of four species: red clover, alfalfa, birdsfoot trefoil and smooth bromegrass (control) in replicated legume-interseeded and N-fertilized smooth bromegrass pastures. Litter weights are currently being ash corrected and will be analyzed for C and N contents.

   D. Application of Results: Results from the first experiment will show whether N returned through litter is recycled faster in legume-interseeded than N-fertilized pastures and whether DM and N loss from litter of legume species differs from smooth bromegrass litter. The second experiment is evaluating whether root decomposition is faster in N-fertilized and legume-interseeded than unfertilized smooth bromegrass pastures

Publications

Journal articles:

Guretzky, J.A., W.H. Schacht, A.B. Wingeyer, T.J. Klopfenstein, and A. Watson. 2014. Litter deposition and nitrogen return in rotationally stocked smooth bromegrass pastures. Agronomy Journal 106:175-184. doi:10.2134/agronj2013.0282

Guretzky, J.A., W.H. Schacht, L. Snell, J. Soper, S. Moore, A. Watson, and T.J. Klopfenstein. 2013. Nitrogen input effects on herbage accumulation and presence of pasture plant species. Agronomy Journal 105:915-921. doi:10.2134/agronj2012.0458

Beef Reports:

Bremer, M. L., A. K. Watson, D. B. Burken, J. C. MacDonald, and G. E. Erickson. 2014. Energy value of de-oiled modified distillers grains plus solubles in a forage-based diet. Neb. Beef Cattle Rep. MP 99:32-33.

Gillespie, K. L., T. J. Klopfenstein, J. C. MacDonald, B. L. Nuttelman, and C. J. Schneider. 2014. Effect of winter supplementation level on yearling system profit across economic scenarios. Neb. Beef Cattle Rep. MP 99:36-38.

Gillespie, K. L., T. J. Klopfenstein, J. C. MacDonald, B. L. Nuttelman, C. J. Schneider, J. Volesky, and G. E. Erickson. 2014. Distillers grains supplementation in a forage system with spayed heifers. Neb. Beef Cattle Rep. MP 99:32-42.

Gillespie, K. L., T. J. Klopfenstein, J. C. MacDonald, B. L. Nuttelman, C. J. Schneider, G. E. Erickson, and J. Volesky. 2014. Economics of distillers grains supplementation in a forage system with spayed heifers. Neb. Beef Cattle Rep. MP 99:43-45.

Hasenauer, T. L., T. J. Klopfenstein, J. MacDonald, C. J. Schneider, and D. B. Burken. 2014. Effect of distillers grains plus solubles supplementation on grazing cattle performance. Neb. Beef Cattle Rep. MP 99:46-47.

Jones, M., J. C. MacDonald, G. Erickson, T. J. Klopfenstein, and A. K. Watson. 2014. Effect of distillers grains supplementation on calves grazing irrigated or non-irrigated corn residue. Neb. Beef Cattle Rep. MP 99:48-49.

Abstracts:

Bremer, M. L., D. B. Burken, A. K. Watson, J. C. MacDonald, and G. Erickson. 2014. Energy value of de-oiled modified distillers grains plu solubles in a forage-based diet. J. Anim. Sci. 92(E-Suppl 2):93 (abstr.).

Guretzky, J.A., W. Schacht, A. Wingeyer, T.J. Klopfenstein. 2013. Litter dynamics and particulate organic matter fractions in smooth bromegrass pastures under reduced nitrogen inputs. ASA, CSSA, and SSSA International Annual Meetings, Tampa, FL. 5 Nov. 2013.

Jones, M., J. C. MacDonald, G. Erickson, T. J. Klopfenstein, and A. K. Watson. 2014. Effect of distillers grains on average daily gain of cattle grazing corn residue. J. Anim. Sci. 92(E-Suppl 2):92 (abstr.).

Michigan State University

NC-1182 Progress Report
October 1, 2013 to September 30, 2014

Objectives: Evaluate fertilizer regimes, harvesting practices, and grazing management interactions with plant communities and soils emphasizing N capture and forage quality

Project: Legume establishment, persistence, and performance under grazing

Overall Objective: Identification of legume establishment strategies, species persistence, and legume performance under grazing.

Specific Objectives: 1) Determine successful establishment strategies; 2) Screen winter annual and perennial legumes regarding persistence under rotational stocking and mechanical harvest; 3) Evaluate the effects of overseeded annual and perennial clovers on animal performance in bermudagrass-based pastures.

Personnel: K. Cassida.

Summary:

Michigan State University was added to the NC1182 project in June 2013. Because we were added at the end of the funding cycle, MSU did not participate in any of the experimental objectives outlined for this project ending in 2014. MSU did participate in development of the new project proposal which will succeed this one.

Utah State University

NC1182 - Nitrogen Cycling, Loading, and Use Efficiency in Forage-Based Livestock Production Systems

Reporting Scientist

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Progress of Work and Principle Accomplishments

OBJECTIVE 4: *Determine the fate of excess N in grassland agroecosystems by estimating key components of nutrient cycles including aqueous and gaseous N losses.*

This project examines the impact of grass-legume mixtures, and tannins, on nitrogen cycling. Soil samples are collected at the beginning and end of each grazing season. Leachate samples are collected using zero-tension and suction-cup lysimeters. Preliminary data indicates that fertilized tall fescue (TF+N) plots have higher soil N and leachate nitrate concentrations than tall fescue-birdsfoot trefoil (TF-BFT), tall fescue-alfalfa (TF-ALF), and tall fescue-no fertilizer (TF-N) plots. The TF-N treatment had the lowest soil N levels and leachate nitrate concentrations.

TF+N > TF+BFT = TF+ALF > TF-N

Available Soil N
Leachate NO_3 Concentration

Usefulness of Findings

Environmental Impact of Grass-Legume Mixtures:
Grass-legume mixtures generally result in similar yields and rates of gain as that of grass monoculture pastures, but greatly reduce the need for commercial fertilizers. Economically this is of great benefit. It can also be an environmental benefit. Preliminary data suggests that the grass-legume mixtures "hold" the nitrogen better, thereby reducing the potential for nitrogen leaching.

Impact of Tannins on Nitrogen Cycling:
Condensed tannins have the potential to shift N from the urine to the feces. Reducing N in the urine should result in reduced nitrate leaching (nitrate leaching can contaminate groundwater). An increase in fecal N will increase the N available to plants as N in the feces, an organic form, which is released slowly and at a rate which plants can utilize.

Additional Work Planned

Complete soil profile samples (to a depth of 150 cm) are collected at the beginning and end of each grazing season to monitor any nutrient movement and buildup for each treatment. A

composite sample of five subsamples were collected from each plot. The soil samples were analyzed for N and P at six depths (0-15 cm, 15-30 cm, 30-60 cm, 60-90 cm, 90-120 cm, and 120-150 cm). Ammonium sulfate was added to plots, based on the soil tests, to maintain adequate forage production. Herbage dry matter samples were collected before and after each grazing event to determine the nutrients removed by grazing. Leachate samples were collected every two weeks during the grazing season, and as often as possible during the winter months. Leachate samples were analyzed for nitrate-nitrite on a Lachat auto-analyzer using a cadmium reduction method. Climatic data was recorded from a weather station located just outside of treatment plots.

Data collection continued through early spring 2014. Sample analyses are currently underway. All data will be analyzed using PROC GLIMMIX with Repeated Measures. To document the effects of grazing on nutrient cycling, determination of the nutrients in each phase (plant, soil, and soil water) will be made. The nitrogen balance technique will be used to estimate nitrogen losses due to volatilization. This will be done by comparing total nitrogen outputs (recovery in the plant, soil, and soil water phases) against the total amount of nitrogen inputs (fertilizer and legume nitrogen fixation).

Publications

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