

T63 Microencapsulated isoflavone to apply into milk and hypocholesterolemic effect. B. J. Jeon, N. C. Kim, E. M. Han, and H. S. Kwak*, *Sejong University, Seoul, Korea.*

This study was designed to develop the microencapsulation of water-soluble isoflavone to apply into milk and to examine the hypocholesterolemic effect in rats. Coating material was medium-chain triglyceride (MCT) and core material was water-soluble isoflavone. The microencapsulation efficiency was 70.2% when the ratio of coating material to core material was 15:1. The isoflavone released from microcapsules was 8% at 4°C for 3 day storage. In vitro study, water-soluble isoflavone from microcapsules was released 4.0-9.3% at the range of 2 to 5 pHs for 60 min incubation. In simulated intestinal fluid, 87.6% of isoflavone was released at pH 8 for 40 min incubation. In sensory analysis, the scores of bitterness, astringency, and off-taste in encapsulated isoflavone-added milk were slightly but not significantly different from those in uncapsulated isoflavone-added milk. In blood analysis, total cholesterol was significantly decreased in isoflavone-added group compared with in control for 6 week feeding, however, no difference was found in blood HDL-cholesterol. The present study suggested that as a coating material, MCT was suitable for the microencapsulation of water-soluble isoflavone, and isoflavone showed blood cholesterol lowering effect.

Key Words: Microencapsulation, Water-Soluble Isoflavone, Hypocholesterolemic Effect

T64 Hydrolysis of isoflavone glycoside by β -galactosidase and stability in the form of microcapsule. N. C. Kim, B. J. Jeon, J. Ahn, and H. S. Kwak*, *Sejong University, Seoul, Korea.*

The objectives of this study were to find conditions for conversion to aglycone form which showed a high biological activity using β -galactosidase and to examine the stability of microencapsulated β -galactosidase and isoflavone in the simulated gastric and intestinal conditions in vitro. Three different β -galactosidases were tested and the conversion of isoflavone glycoside by selected β -galactosidase was determined by different factors, such as pH, temperature and time in incubation, and enzyme activity. The rate of conversion was about 35% in optimum conditions. For stability study, isoflavone and β -galactosidase were microencapsulated to prevent beany flavor and sweetness in milk. When microencapsulated isoflavone was incubated in simulated gastric fluid with the pH range of 2 to 4, isoflavone was released 6.5 to 5.9mg(9.3 to 8.4%) and the release of β -galactosidase was 0.41 to 0.40 unit/ml (13.7 to 13.3%), respectively. However, 84.4% of isoflavone was released and 80.7% of β -galactosidase were in simulated intestinal fluid after 3 hr incubation(pH7). The contents of aglycone converted from isoflavone glycoside were 2.6mg in control and 18.8mg in β -galactosidase containing sample. Finally, this study showed that the converted high amount of aglycone was found by microencapsulated β -galactosidase when incubated in simulated intestinal fluid. In addition, the result may improve milk digestion.

Key Words: Isoflavone, β -Galactosidase, Microencapsulation

Forages and Pastures: Additives, Nutrient Content, and Quality

T65 Addition of enzyme or/and wheat bran on fermentation characteristics and in vitro gas production of rice straw silage. J.-M. Lv*, W.-L. Hu, and J.-X. Liu, *Zhejiang University, Hangzhou, China.*

A two-way factorial trial was designed to study the technique aspects of ensiling rice straw (RS) mixed with Strawzyme (an experimental preparation of cell-wall degrading enzymes containing cellulase and xylanase) and wheat bran (WB). The WB was added at levels of 0, 3, 6 or 9 % (fresh basis), respectively, and the RS was untreated (C-0, C-3, C-6 and C-9), or treated with Strawzyme at level of 1300g/t DM (T-0, T-3, T-6, and T-9). The fermentation characteristics of ensiled rice straw were evaluated for pH value, percentage of ammonia N in total N and organic acid (lactic acid, butyric acid, acetic acid and propionic acid) content. The in vitro gas production technique (Menke et al, 1988) was utilized to assess the nutritive value of silages.

Addition of WB improved the fermentation quality and nutritive value of RS silage. The pH value, percentage of ammonia N in total N and butyric acid content were decreased ($p < 0.05$) and the lactic acid content and in vitro gas production (GP48) were increased with the increasing levels of WB ($p < 0.01$). Compared to the silages added with WB alone, the RS silages added with WB along with Strawzyme treatment had a higher 48h GP and a faster rate of GP ($p < 0.01$). The content of NDF was 3.3 and 5.3 percent unit lower in treatments T-6 and T-9 than in C-6 and C-9, respectively ($p < 0.01$). Proportion of ammonia N of total N was decreased by 37.9 or 15.5% ($p < 0.05$), and the lactic acid was increased by 67.8 or 5.7% respectively ($p < 0.01$), when Strawzyme plus 6 or 9% WB was added. It can be concluded that combination of Strawzyme with WB was more effective in the improvement of RS silage quality than addition of WB alone.

Key Words: Rice Straw Silage, Enzyme, Wheat Bran

T66 Effect of adding enzyme on fermentation quality and nutritive value of corn stover silage. J.-M. Lv*, W.-L. Hu, and J.-X. Liu, *Zhejiang University, Hangzhou, China.*

This experiment was carried out to assess the effect of adding enzyme on fermentation quality and nutritive value of corn stover silage. About 120 kg corn stover was used as materials. The DM content of the corn stover was 22.1% The CP, NDF and WSC in corn stover (on DM basis) were 8.1, 74.2 and 3.5%, respectively. The enzyme containing cellulase (3500 IU/g) and xylanase (450 IU/g) was added to corn stover to ensile at four levels: 0(control, C), 800(1), 1300(2), 1800(3) g/kgDM.

Materials for each treatment were ensiled in triplicate in experimental silos with capacity of 50 L. After ensiled for 40 days, silages were taken for analysis in terms of chemical composition, pH value, ammonia nitrogen and organic acid. The in vitro gas production technique (Menke et al, 1988) was utilized to assess the nutritive value of silages.

The result showed that while all corn stover silages were of good quality with low pH, low ammonia nitrogen (NH₃-N) and high lactic acid content, enzyme addition reduced the NDF content, pH value and the ratio of NH₃-N to the total N, meanwhile increased the concentration of lactic acid as well as the total organic acid. Compared to control, the NDF content was 6.5% and 3.2% ($p < 0.05$) lower, and lactic acid content was 32.6% and 29.1% ($p < 0.01$) higher for the silages in group 2 and 3, respectively. PH value and the ratio of NH₃-N to total N in group 3 were lower than those in group C ($p < 0.01$). Enzyme addition improved the silages's nutritive value by increasing in vitro gas production (GP) parameters. The organic matter digestibility (OMD) estimated from the GP was higher ($P < 0.01$) for the enzyme added silages than for group C. In conclusion, enzyme addition can improve both fermentation quality and nutritive value of corn stover silage, in this experiment, the best addition level of enzyme was 1800g/tDM.

Key Words: Corn Stover Silage, Enzyme, Nutritive Value

T67 Dietary cation-anion difference of forage grasses as affected by species and chlorine fertilization. G. F. Tremblay^{*1}, S. Pelletier^{1,2}, H. Brassard^{1,2}, G. Bélanger¹, P. Seguin³, R. Drapeau¹, A. Brégar², R. Michaud¹, and G. Allard², ¹Agriculture and Agri-Food Canada, Québec, QC, Canada, ²Université Laval, Québec, QC, Canada, ³McGill University, Montréal, QC, Canada.

For milk fever prevention, a target Dietary Cation-Anion Difference [DCAD=(Na+K)-(Cl+S)] of -50 meq/kg DM is used in balancing rations for dry dairy cows. Low DCAD rations induce a mild compensated metabolic acidosis that stimulates bone resorption and improves Ca homeostasis. Dry cow rations contain a high proportion of forage and forages fed 4 weeks prepartum should have a low DCAD. We compared the DCAD of 5 grass species and we determined the effect of Cl fertilization on the DCAD of timothy. In a first experiment, 2 to 4 cultivars of orchardgrass, tall fescue, meadow brome grass, smooth brome grass, and timothy were harvested at 3 sites during spring growth and summer regrowth of 2 years; sites were considered as replicates for the species and cultivars were nested within species. In a second experiment, we applied increasing rates of Cl fertilization (0, 80, 160, and 240 kg Cl/ha) to timothy harvested during spring growth at 4 sites with contrasting soil K contents (311, 289, 197, and 123 kg K/ha) with sites as main plots and Cl rates as sub-plots. All harvests were taken at the early heading stage. For all harvests, the DCAD of orchardgrass was the highest (522 to 785 meq/kg DM) and that of timothy the lowest (272 to 420 meq/kg DM) (P<0.05); the DCAD of the other 3 species were intermediate. Cultivars within a species did not differ in DCAD. With no Cl fertilization, timothy DCAD was lower (199 meq/kg DM) at the low soil K content site than at the other 3 sites (365-459 meq/kg DM, SEM=28). Chlorine fertilization decreased timothy DCAD (P<0.05); with the highest rate of Cl fertilization, the DCAD ranged from 8 to 319 meq/kg DM at the 4 sites. Chlorine fertilization increased timothy Cl concentration (P<0.05) but had no effect on DM yield. Among the 5 cool-season grasses tested, timothy is best suited for the production of low DCAD forages for dry cows. Timothy forage with a DCAD close to 0 meq/kg DM can be produced using Cl fertilization on a soil with a low K content.

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Key Words: Mineral Composition, Parturient Paresis

T68 Ruminal dry matter, crude protein, neutral detergent fiber and acid detergent fiber degradation parameter kinetics of *Vicia villosa*, *Festuca ovina*, and *Taeniatherum caput-medusaen*. P. Shawrang^{*1}, A. Nikkhah¹, and A. A. Sadeghi², ¹Tehran University, Karaj, Iran, ²Islamic Azad University, Tehran, Iran.

An in situ experiment was conducted to determine rate and extent of DM, CP, NDF and ADF degradation parameter kinetics of *Vicia villosa* (VV), *Festuca ovina* (FO), and *Taeniatherum caput-medusaen* (TC). Four mature rumen cannulated Holstein steers were fed a total mixed ration containing 85% alfalfa hay and 15% concentrate. Duplicate in situ digestion bags containing five grams substrate were incubated for 72, 48, 24, 12, 6, 3 and 0 h. Immediately after submersion of the 0 h bags of substrate into the ruminal fluid, all bags were removed and rinsed with an automatic washing machine and rinsed using 4 to 6 gentle cycles of agitation until rinse water was clear. Bags were then freeze-dried and weighed. Data was fitted to non-linear degradation characteristics to calculate effective rumen degradation (ERD). Crude protein contents of VV, FO and TC were 197, 54, and 124 g/kg, NDF contents were 398, 626, and 512 g/kg and ADF contents were 287, 190 and 357 g/kg DM, respectively. There were significant (P<0.05) differences between effective DM, CP, NDF and ADF degradability of these pasture species. The ERD of DM, CP, NDF and ADF for VV at rumen outflow rate of 0.05/h were 541, 677, 310 and 292 g/kg, for FO were 307, 402, 295 and 486 g/kg, and for TC were 535, 732, 389 and 379 g/kg, respectively. Constant degradation rate of DM, CP, NDF and ADF for VV were 5.6, 9.6, 3.6 and 3.8 %/h, for FO were 7.3, 9.1, 3.5 and 6.2 %/h and for TC were 4.2, 9.2, 2.7 and 2.9 %/h, respectively. The differences between pasture species in the rate and extent of DM, CP and fiber degradation are likely to lead to major differences in forage intake, therefore these characteristics must be con-

sidered as main parameters in developing models and ration formulation of grazing ruminants.

Key Words: Pasture Species, Degradability, Nylon Bags

T69 Evaluation of yield and nutritive value of Hairy indigo (*Indigofera hirsuta* L.) in Venezuela. Omar Araujo-Febres*, La Universidad del Zulia, Maracaibo, Zulia, Venezuela.

Tropical grassland has a high potential yield of dry matter, but the nutritive value of tropical grasses declines rapidly. The aim of this work was to evaluate the effect of cutting age on nutritive value of Hairy indigo (*Indigofera hirsuta*). *I. hirsuta* is a tropical annual legume and has relatively high dry matter yield and crude protein concentration, but intake under grazing is limited. The study was conducted at La Esperanza university farm of La Universidad del Zulia (Venezuela). Three cutting ages (28, 56 and 84 d) were established. Dry matter yield was 1,410, 4,068 and 8,947 kg/ha (P<0.05; SE=83). Leaf CP content was 274, 244, and 231 g kg DM (P<0.05; SE= .47). Leaf to stem ratio was 1.87, 1.48, and 1.16 (P<0.05; SE= .08). Leaf ADF content was 198; 217 and 249 g/kg DM (P<0.05; SE= .95). The NDF content in leaves was 224, 242, and 299 g/kg DM (P<0.05; SE= .74). IVDMD was 69.3, 68.8, and 60.9% (P<0.05; SE= 1.20) for each cutting age, respectively. Dry matter, CP yield, and ADF, NDF, and lignin concentrations increased when delaying harvest from 28 to 84 d. Crude protein percentage and leaf to stem ratio decreased with age of plant. Ensiling may be a useful alternative to grazing hairy indigo. Further research is being conducted to evaluate acceptability and silage quality.

Key Words: Indigofera Hirsuta, Dry Matter Yield, IVDMD

T70 The effect of *Lactobacillus buchneri* on aerobic stability, fungal growth, and mycotoxin concentrations of corn silages. C. Iglesias^{*1}, A. Bach^{1,2}, C. Adelantado³, and M. A. Calvo³, ¹Unitat de Remugants, Institut de recerca i tecnologia agroalimentàries (IRTA), Barcelona, Spain, ²Institució catalana de recerca i estudis avançats (ICREA), Barcelona, Spain, ³Departament de Sanitat i Anatomia Animal, Universitat Autònoma de Barcelona (UAB), Barcelona, Spain.

A total of 24 different corn silages were used to evaluate the effects of *Lactobacillus buchneri* inoculation on aerobic stability, fungal growth, and mycotoxin concentrations. During the ensiling process, in each silage, two 7-kg samples of plant material were treated with 200 ml of water (Control) or with 200 ml of water containing 10 g of *L. buchneri* (strain NCIMB 40788) at 4.3x10⁸ CFU/g (Treatment) and placed in two permeable nylon bags. These bags were then placed in the bunker silo at the same level and separated about 80 cm from each other in a location that ensured that bags would remain in the silo for at least 3 months. After this period, the materials from each bag were removed and placed in two separate pans and kept at room temperature for 1 wk. Temperature was monitored daily during this time. Also, after retrieving the bags from the silo, a grab sample was analyzed to determine volatile fatty acids, fungal counts, and mycotoxin concentrations. At 4-d after removal from the silo, another grab sample was taken from the pans to determine fungal counts and mycotoxin concentrations. Inoculation of *L. Buchneri* resulted on lower (P < 0.001) temperatures compared with the Control silages (17.22 vs 17.43 C, respectively). Acetic acid concentrations were greater (P < 0.04) in Treated than in Control silages (279.4 vs 248.7 mM, respectively). Fungal counts (CFU/g) were numerically lower in Treated than in Control silages on days one (5.38x10² vs 7.85x10³, respectively) and four (2.13x10³ vs 2.59x10⁴, respectively) after opening the silages. Aflatoxin concentrations tended (P < 0.09) to be lower in Treated than in Control silages (0.28 vs 1.09 ppm), but concentrations of DON and zearalenone did not differ between treatments. Inoculation of *L. buchneri* increases acetic concentrations in corn silages, improves aerobic stability, and may reduce aflatoxin concentrations.

Key Words: Fungi, Silage, Mycotoxin

T71 Inoculum source effects on *in vitro* gas production of forages. E. Grings* and R. Waterman, *USDA-ARS, Miles City, MT.*

Buffer N concentration and forage protein fermentability can both influence *in vitro* gas production profiles. Therefore, we tested the impact of using inoculum from cattle fed grass or grass and alfalfa on *in vitro* gas production profiles of forages and ruminal extrusa. Four ruminally cannulated beef cows were used in a 2 x 2 Latin Square design experiment. Dietary treatments consisted of grass hay or grass hay plus 1.4 kg/cow of alfalfa pellets fed once daily. Ruminal fluid was used to inoculate an *in vitro* gas production system using 100 ml glass syringes. Twenty ml of media were placed in each syringe containing from 200 to 250 mg substrate. All substrates were run in media containing ruminal fluid at concentrations of 24, 29 or 34%. Substrates tested included two alfalfa hays, one grass hay, *Pascopyron smithii* harvested in either June or December, and lyophilized ruminal extrusa collected from cattle grazing native range in May, August, or December. Gas production was read manually at 0, 2, 4, 6, 8, 10, 12, 14, 24, 30, 34, 36, 48, 54, 72, and 96 h of incubation. Net gas production was calculated on an OM basis. Rate, maximal gas production, and lag time were evaluated using a Gompertz model. Gas production at each time point, the relative standard deviation of duplicate readings, rate, maximal gas production, and lag time were subjected to analysis of variance procedures using a model containing the terms diet, cow group, gas run, ruminal fluid concentration, and the ruminal fluid concentration by diet interaction. The residual error term was used to test effects. Relative standard deviations were less ($P < 0.05$) for many individual gas production measures when only grass was fed to inoculum donors. Grass inoculum resulted in increased ($P < 0.05$) gas production at all time points earlier than 48 h, faster ($P < 0.05$) rates of gas production, and decreased ($P < 0.05$) lag times compared to inoculum from cows fed grass plus alfalfa. Addition of alfalfa into the diet of inoculum donors to increase dietary protein did not improve the precision of *in vitro* gas measures.

Key Words: Gas Production, Forage, Digestion

T72 Predictability of *Streptomyces griseus* RUP, methionine and lysine content of randomly selected alfalfa silages. M. J. Stevenson*¹, W. Heimbeck², and R. A. Patton³, ¹*Degussa Corporation, Kennesaw, GA*, ²*Degussa AG, Hanau, Germany*, ³*Nittany Dairy Nutrition, Mifflinburg, PA.*

Alfalfa silages vary widely in terms of protein, amino acids (AA) and RUP content with significant consequences for amino acid delivery post ruminally. Because RUP and AA composition are difficult and expensive to determine, we investigated the feasibility of predicting these values using more cost-effective analyses. Alfalfa silages (n=27) were obtained from 19 farms in central Wisconsin. Silages varied in sward purity and preservation quality typical of dairy farms. Samples were analyzed for nutrient fractions and RUP using a *S. griseus* assay at Cumberland Valley Analytical Services and AA at Degussa AG (AOAC method 994-12). Regression equations were developed using the MaxR option of SAS. Analyzed means and ranges for significant regressors are presented. RUP, MET and LYS content were predicted from the most efficient models and compared to observed values. $RUP = 70.36 + (2.70 * NDICP) + (1.10 * starch) - (2.66 * titratable\ acidity) - (9.46 * pH)$ with $R^2 = 0.82$, mean predicted value (MPV) = 27.2 and mean residual (MR) = 1.23. $MET = 0.1096 + (0.0109 * CP) - (0.0464 * ADICP)$ with $R^2 = 0.87$, MPV = 0.232 and MR = 0.013. $LYS = 0.2683 + (0.0383 * CP) - (0.0508 * NDICP) - (0.0310 * NH_3)$ with $R^2 = 0.81$, MPV = 0.785 and MR = 0.043. We conclude there is potential to accurately predict RUP and AA in alfalfa silages using commonly performed analyses.

Analyzed Variable	Mean	Std Dev	Min	Max
DM%	43.6	10.4	27.1	66.7
CP%DM	19.3	3.5	13.2	26.9
RUP%CP	27.0	3.4	21.2	34.2
MET%DM	0.24	0.04	0.17	0.34
LYS%DM	0.79	0.14	0.58	1.18
Neutral Detergent Insoluble CP%DM (NDICP)	3.20	0.74	2.04	4.61
Acid Detergent Insoluble CP%DM (ADICP)	1.91	0.31	1.24	2.45
NH ₃ %CP Equivalent	2.29	1.42	0.57	5.81
Starch%DM	1.12	0.90	0.30	4.60
Titratable acidity	2.64	1.35	0.65	5.22
pH	4.98	0.52	4.30	6.85

Key Words: Alfalfa Silage, RUP, Methionine

T73 Nutrition implications of differences in amino acid composition between crude and true protein in randomly selected alfalfa silages. W. Heimbeck*¹, M. J. Stevenson², and R. A. Patton³, ¹*Degussa AG, Hanau, Germany*, ²*Degussa Corporation, Kennesaw, GA*, ³*Nittany Dairy Nutrition, Mifflinburg, PA.*

Alfalfa undergoes considerable proteolysis during the ensiling process. This can lead to poor estimates of RUP amounts and amino acid (AA) contents. The purpose of this study was to separate the AA content of alfalfa silages into protein bound and free AA pools and to calculate the apparent degradability of the protein fractions using *in vitro* techniques. We used the same alfalfa silages and laboratories as in the companion abstract with the exception that free AA were determined in addition to total AA. Free AA were subtracted from total AA to calculate true protein (TP) AA. Using RUP and AA composition, potential RUP AA flow was calculated. AA differences and flows between CP and TP were assessed with GLM of SAS. Overall, 71.7% ($13.85 \pm 2.41\%$ DM) of alfalfa silage CP ($19.2 \pm 3.49\%$ DM) was present as AA. Of the total AA, 56.5% ($7.83 \pm 1.07\%$ DM) was in TP meaning that $41.1 \pm 6.1\%$ of total CP was TP. Assuming that all RUP had to arise from the TP fraction, RUP of true alfalfa silage protein was $66.7 \pm 7.9\%$. Essential AA were a greater percent of TP ($51.0 \pm 0.04\%$) than of CP ($31.5 \pm 0.04\%$) ($P < 0.001$). There was no difference in degradation of LYS, ARG or HIS compared to MET between CP and TP. Using the AA composition of CP resulted in less predicted flow of AA from RUP to the intestine than using TP. We conclude that there are more essential than non-essential AA in TP of alfalfa silages. Further, this has the potential to change the estimates of AA flow to the intestine.

Amino Acid	AA Content			AA flow g/kg DM (Calculated)				
	% in CP	% in TP	SE	P	CP	TP	SE	P
MET	1.23	2.47	0.02	<.001	0.63	1.29	0.02	<.001
LYS	4.08	6.62	0.02	<.001	2.11	3.46	0.07	<.001
ARG	2.25	4.98	0.07	<.001	1.16	2.59	0.10	<.001
HIS	1.58	2.83	0.03	<.001	0.80	1.50	0.03	<.001
LYS:MET	3.33	2.69	0.46	NS				
ARG:MET	1.83	2.03	0.22	NS				
HIS:MET	1.29	1.15	0.10	NS				

Key Words: Alfalfa Silage, Amino Acids

T74 Relationships between alfalfa silage nutrient content and in vitro NDF digestibility. R. A. Patton^{*1}, M. J. Stevenson², and R. L. Spitzer³, ¹*Nittany Dairy Nutrition, Mifflinburg, PA*, ²*Degussa Corporation, Kennesaw, GA*, ³*Gladwin A. Read Company, Omaha, NE*.

Our objective was to assess the possibility of predicting in vitro NDF digestibility of alfalfa silage using nutrient analyses. Twenty-seven samples of alfalfa silage were obtained during July 2004 from 25 farms in central Wisconsin. Silages were stored in either bunkers (n=13) or silage bags (n=14). Samples were sent to a commercial laboratory (Cumberland Valley Analytical Service) for analyses including 30 and 48 hr NDF digestibilities. Factors affecting NDF digestion were identified using the regression procedures of SAS with the MaxR option. Effect of silo type on NDF digestibility was assessed with Proc Mixed of SAS.

Nutrient content of silages represented the normal range commonly encountered. In vitro NDF digestibility at 30 hours was highly correlated with 48 hours (38.8 vs. 45.1%; $R^2=0.93$). Acid detergent lignin was most highly correlated with digestibility ($R^2=0.71$ and 0.77 for 30 and 48 hr respectively). Means, ranges and regressions for 30 and 48 hr NDF digestibility are presented below.

$DNDF_{30} = 75.261 - (5.649 * \text{lignin}) - (0.973 * \text{starch}) - (0.770 * \text{sugar}) + (1.239 * \text{ash})$
 $R^2 = 0.78$
 $DNDF_{48} = 62.092 + (6.487 * \text{ADICP}) + (0.366 * \text{NDF}) - (7.853 * \text{lignin}) + (1.542 * \text{ash})$
 $R^2 = 0.82$

NDF digestibility was better in bunker silos (42.0 and 48.0%) compared to bags (36.1 and 42.7%) at 30 and 48 hr respectively ($P < 0.05$). Whether this represents a real difference will require more study. Reasons for negative starch and sugar correlations with NDF digestibility at 30 but not 48 hr are obscure. It does appear correlations are more biologically plausible for 48 hr digestion. This limited data set suggests that for alfalfa silage, prediction of in vitro NDF digestibility may be possible.

Variable	Mean	Std Dev	Min	Max
NDF dig 30 hr %	38.6	6.6	25.7	54.6
NDF dig 48 hr %	44.8	7.2	33.8	61.1
NDF % DM	47.2	5.7	37.1	58.1
Lignin % DM	7.8	1.0	6.5	10.6
Starch % DM	1.1	0.9	0.3	4.6
Sugar % DM	3.2	2.0	0.8	9.6
ADICP % DM	1.9	0.3	1.2	2.4
Ash % DM	9.5	1.7	6.6	13.7

Key Words: Alfalfa Silage, NDF Digestibility

T75 Vacuum-sealed polyethylene bags as mini-silos to assess differences in grasses. D. J. R. Cherney^{*1}, M. A. Alessi², and J. H. Cherney¹, ¹*Cornell University, Ithaca, NY*, ²*Universita Degli Studi Di Palermo, Palermo, Italy*.

Laboratory silos are considered a practical method of comparing a number of treatments, and are necessary when evaluating numerous experimental variables and their interactions involving different grass silages. Objectives of this study were to evaluate the suitability of grasses ensiled in vacuum-sealed polyethylene bags to assess treatment differences. Four field replicates of three grass species, orchardgrass (*Dactylis glomerata* L., OG), reed canarygrass (*Phalaris arundinacea* L., RC), and tall fescue (*Festuca arundinacea* L., TF), harvested at two dates were ensiled whole or chopped. Bacterially-inoculated grass samples (500 g) were ensiled for 0, 2, 4, 8, 16, 24, and 30 d. At 30 d post ensiling, lactic acid was the predominant volatile fatty acid, suggesting good fermentation. There were species differences in lactic acid, with RC silages having lower lactic acid (4.6% of DM) than OG (7.1%) or TF (6.0%) silages (SED=0.63), suggesting that the polyethylene bag is sensitive to treatment differences. Silages were not different in lactic acid ($P > 0.05$) between chops or harvest dates. Lactic:acetic acid ratios were higher in OG (4.9) than RC (2.7) or TF (3.4) (SED=0.52), but there were no differences due to chop or harvest date. There

was little or no butyric or propionic acids in the silages, indicating that the silages did not undergo clostridial fermentation. Despite species and processing differences, pH of silages tended to be under 4.7, considered acceptable for grass silages. There was a species x chop interaction, with the chopped RC being lower in pH than whole material. The differences between chopped and whole TF were small and there was no difference between chopped and whole OG. The species x day interaction was mainly due to the rate of pH decline during the first 4 d. The RC declined in pH faster than the other two species, with whole RC and TF declining at slower rates than OG. Despite these differences, ensiled grasses dropped rapidly in pH and were stable beyond eight days. We conclude that it is possible to use vacuum-sealed plastic bags to ensile temperate grasses to assess treatment differences.

Key Words: Laboratory Silo, Grass-Silage, Fermentation

T76 Alfalfa yield and nutritive quality as influenced by air quality in west-central Alberta. J. Lin^{*1}, M. Nosal², R. Muntifering¹, and S. Krupa³, ¹*Auburn University, Auburn, AL*, ²*University of Calgary, Calgary, Alberta, Canada*, ³*University of Minnesota, St. Paul*.

Phytotoxic effects of individual air pollutants on forage yield are well documented; however, little is known about their combined effects on yield, and even less is known about air pollution effects on forage quality. Alfalfa (*Medicago sativa* cv. Beaver) yield and nutritive quality responses to ambient concentrations of atmospheric ozone (O_3), sulfur dioxide and oxides of nitrogen were assessed at three sites in west-central Alberta, Canada over five growing seasons (1998 to 2002). At each site, primary-growth and regrowth harvests were taken from replicated plots, and air quality and meteorological parameters were monitored at appropriate time scales. Using median values across all study sites and years, yield data were separated into two different ($P < 0.05$) classes (low and high) and utilized in multiple regression analysis of alfalfa yield and nutritive quality responses. Across all harvests, air quality and meteorological factors accounted for two-thirds (adj. $r^2 = 0.67$, $P < 0.001$) of the variability in alfalfa yield; air quality influenced half of the accounted variation, with O_3 alone accounting for 25%. Ozone and precipitation (P) contributed 69 and 17%, respectively, to the variability in percentage CP of low-yielding alfalfa that was attributable (adj. $r^2 = 0.52$, $P = 0.003$) to air quality and meteorological parameters, and temperature (T) and humidity collectively influenced 98% of the accounted variation (adj. $r^2 = 0.52$, $P = 0.003$) in percentage CP of high-yielding alfalfa. Three-fourths of the accounted variation (adj. $r^2 = 0.58$, $P < 0.001$) in relative feed value (RFV, calculated from forage concentrations of ADF and NDF) of low-yielding alfalfa was attributable to meteorological parameters, whereas air quality contributed 25%. In contrast, air quality (primarily O_3) influenced 86% of the accounted variation (adj. $r^2 = 0.47$, $P = 0.199$) in RFV of high-yielding alfalfa, and T and P collectively contributed 14%. Elucidation of causal relationships between air quality, crop yield and nutritive quality represents a novel and potentially useful application of air pollution research to forage-based animal production systems.

Key Words: Alfalfa, Nutritive Quality, Air Quality

T77 In situ DM and N disappearance of ryegrass (*Lolium multiflorum*)-rye (*Secale cereale*) mixed swards fertilized with different N rates. J. M. B. Vendramini^{*1}, L. E. Sollenberger¹, J. D. Arthington², A. Adegbola¹, J. C. B. Dubeux, Jr.¹, S. M. Interrante¹, and R. L. Stewart, Jr.³, ¹*University of Florida, Gainesville*, ²*University of Florida, Ona*, ³*Virginia Polytechnic Institute and State University, Blacksburg*.

Protein of fertilized cool-season grasses is often highly degradable and easily fermented to VFAs and NH_3 -N in the rumen, however, the NH_3 -N that is not captured in microbial protein is absorbed and excreted. The objective of this study was to characterize the DM and N fractions in rye-ryegrass herbage from swards harvested at two maturities and fertilized at three N rates. A plot study was conducted from January to April 2003 and 2004 in Gainesville, FL, and treatments were the factorial combinations of three N rates (0, 40, and 80 kg/

ha) and two ages of regrowth (3 and 6-wk). The plots were harvested at a 5-cm stubble height, and duplicate samples of each treatment were incubated in one cow for 0, 3, 6, 9, 12, 24, 48, and 72 h. The McDonald model, $P=A+B(1-\exp^{-ct-L})$, was fitted to the DM and N disappearance with lag time excluded for N evaluation. The DM and N fractions were described as A, rapidly degradable; B, potentially degradable; and C, undegradable. There was a linear ($P<0.01$) increase in total CP (14 to 23%) with increased N fertilization rates from 0 to 80 kg N/ha. Total CP was lower ($P<0.01$) for 6-wk (16%) than 3-wk (20%) regrowth. There was no effect ($P>0.05$) of N fertilization or age of regrowth on DM A, B, and C fraction concentrations; however, there was a linear ($P<0.01$) increase in the concentration of the A fraction in total N (41 to 50%) with increased fertilization rates from 0 to 80 kg N/ha. A linear decrease ($P<0.01$) in the B fraction of total N (53 to 37%) was observed across the range of N fertilization rates. There were no treatment effects on concentration of the C fraction in DM or N. Nitrogen fertilization rate is a major factor affecting the N profile of rye-ryegrass mixed swards in North-Central Florida.

Key Words: Rye-Ryegrass, In Situ, N Fractions

T78 Effects of lactic acid bacteria and formic acid on the silage quality of whole crop rice. B. W. Kim^{*1}, G. S. Kim¹, K. A. Albrecht², and K. I. Sung¹, ¹Kangwon National University, Chunchon, Kangwon-Do, South-Korea, ²University of Wisconsin, Madison.

Silage additives are often used for whole crop rice silage production in Korea, however, little is known about their impacts on the fermentation of this crop. This study was conducted to determine the optimum levels of silage additives by evaluating the effects of lactic acid bacteria (LAB) and formic acid concentrations on the silage quality of whole crop rice harvested at different maturity stages. Rice was established early in May and harvested through October 7th in a rice field at Yupori, Sinbuk-yeup, Chunchon, Kangwon-Do. *Ilpum* mutant rice (Japonica type) was harvested at six different maturity stages; boot (17 Aug), milk (27 Aug), dough (7 Sep), yellow ripe (17 Sep), dead ripe (27 Sep) and full ripe (7 Oct). Each sample was ensiled in laboratory silos in three different ways; with 1) LAB (10^6 , 10^7 and 10^8 cfu/g), 2) formic acids (0.2, 0.3 and 0.4% of sample wt.) and 3) no additive. The additive levels did not affect dry matter content, crude protein, fiber or total digestible nutrient concentrations at any stage. Additives significantly decreased silage pH and butyric acid concentrations, which tended to be inversely related to additive level. Lactic acid concentrations were higher with the use of LAB (7.3, 7.7 and 7.9 % of DM in 10^6 , 10^7 and 10^8 cfu/g, respectively) and formic acid (3.0, 3.3, and 3.4% of DM in 0.2, 0.3 and 0.4% formic acids, respectively) compared to the non-treated control at the dough stage (1.9 % of DM). Lower concentrations of ammonia-N were observed in additive-treated silages at all maturity stages. The results indicate that as the additive levels increase, the silage quality is improved, even with low levels of additives. Therefore, we conclude that the optimum addition levels of LAB and formic acid are 10^6 - 10^7 cfu/g and 0.2-0.3% of the fresh silage weight, respectively.

Key Words: Whole Crop Rice Silage, Silage Additives

T79 Harvesting alfalfa at different stage of growth on nutrient concentrations and digestibility. G. Ayangbile^{*}, K. Kammes, D. Spangler, R. Smith, and K. Thompson, *Agri-King Inc., Fulton, IL.*

This study evaluated the effects of harvesting alfalfa at different stage of growth on: 1) total nutrient profiles, 2) ruminal, abomasal, and intestinal organic matter digestibility, and 3) ruminal and abomasal minerals disappearance. Scissor cuttings of alfalfa were collected once a week for a duration of six weeks from five different farms in Wisconsin. The cuttings were obtained at six stages of maturity ranging from vegetative stage to 75% bloom. Harvested samples from the five locations were processed and analyzed for the initial organic matter nutrient profile using NIRS, Philips XRF 2640. Portions of the samples were grouped together by the stage of maturity, and placed into in situ dacron bags which were suspended for 8 h in the rumen of fistulated non-lactating Holstein

cows. This was followed by a 2 h in vitro abomasal and 24 h intestinal incubations. Non-incubated samples and the residues of the in situ and in vitro incubations were chemically digested and analyzed for minerals with Varian Vista-MPX CCP simultaneous ICP-OES. The progression from vegetative stage to 75% bloom resulted in increased NDF, ADF, lignin, NDIP and ADIP for the non-incubated samples, but decreased values for the 54 h IVDMD (92-75%), NFC (36-28%), CP (31-23%), Ca (1.5-1.3%), P (0.44-0.32%), Mg (0.38-0.26%), and S (0.34-0.25%). The in situ ruminal DMD at vegetative stage to 75% bloom declined from 73-57% ($P<0.001$), but to a lesser range of disappearance ($P<0.005$) for Mg (98.2-94.5%), P (97.5-95.2%), Ca (94.7-87.9%), and Mn (92.2-83.3%).

Acknowledgements: The authors appreciated Mr. Mike Kabat for harvesting and transporting the forages.

Key Words: Mineral Disappearance, In Situ Disappearance, In Vitro Disappearance

T80 The effects of temperature, rainfall, month of harvest, and/or pasture management on the mineral composition of kikuyu grass (*Pennisetum clandestinum*). V. T. Humphreys^{*1}, J. R. Carpenter¹, and B. W. Mathews², ¹University of Hawaii at Manoa, Honolulu, ²University of Hawaii, Hilo.

Kikuyu grass, a major pasture species found in tropical and subtropical regions, is very persistent and capable of producing large quantities of forage dry matter year-round. However, its rapidly changing nutrient composition, which is affected by environmental factors, influences intake, digestibility, and grazing animal performance. The objective of this study was through a retrospective study to determine whether factors such as temperature, rainfall, month of harvest, and/or pasture management significantly altered the macro- (Ca, Mg, P, Na, K, S) and micro- (Cu, Zn, Fe, Mn) mineral content of grazed kikuyu grass. Macro- and micro-mineral profiles of clipped pasture grass samples, taken every 4 to 6 weeks over a 15 year (1989-2003) period just prior to turning cattle into paddocks at the Mealani Experimental Station (in Kamuela on the Big Island of Hawaii 'i), were analyzed by inductively coupled plasma emission spectroscopy. Harvest months were categorized into seasons by rainfall (wet, dry, average) based on historical weather data (1919-2002) for the Mealani region. Average temperature and rainfall for the 14 and 28 day re-growth periods just prior to sampling were calculated from weather data collected at the Experimental Station. Comparisons of mineral levels by year, harvest month, paddock, treatment, season, and average rain and temperature at 28 and 14 days of re-growth were made. A total of 1405 samples were included in the data base ranging from a low of 60 samples in Feb to 194 samples in July. Ca averaged 0.42% (DMB) and P 0.27%. P was low ($<0.25\%$) during the Jan-Mar time frame and highest ($>0.27\%$) during the Summer and Fall. Mean K was 1.99% (1.71% in July to 2.65% in Dec). Zinc averaged 44ppm and remained relatively constant throughout the year, but both Cu and Mg varied ($P<0.05$) with month of harvest, season, and paddock. Correlations were higher between mean temp (14 and 28 day periods) and mineral levels than they were for rainfall minerals. Data suggests that type and/or level of mineral supplement may need to be varied with seasons.

Key Words: *Pennisetum clandestinum*, Tropics, Macro- & Micro-Minerals

T81 Effect of dry versus plastic wrapped hay on concentration of crude protein and digestible dry matter in large round baled hay. E. Rayburn¹, W. Shockey^{*1}, J. Hatton², and B. O'Doherty³, ¹West Virginia University, Morgantown, ²USDA, NRCS, Kingwood, WV, ³WVCA, Morgantown.

After mowing, hay normally cures for 2 to 3 days so that dry matter (DM) content can increase to approximately 85% and allow hay to be stored as large round bales (DRB) without spoilage. Plastic wrapped, large round bales (WRB) can be stored at 40 to 60% DM without spoilage. Hay stored at 40 to 60% DM requires only 1 or 2 days of curing and reduces the potential for field DM losses and weather damage. In 2003 and 2004, 781 mixed grass hay samples (50:30:20

orchardgrass:timothy:tall fescue) were collected from farms in North Central WV (NCWV). Samples were analyzed by a commercial laboratory for crude protein (CP) and digestible dry matter (DDM). There were no significant differences ($P>0.05$) in CP or DDM (% DM, standard deviation) between samples from hay stored as DRB (CP = 10.8, 3.0; DDM = 57.5, 2.0) or WRB (CP = 12.7, 4.3; DDM = 58.7, 2.6). The general assumption that WRB are of higher nutritive value than hay stored as DRB is not supported by analysis of on-farm data adjusted for date-of-cut. Analysis by date-of-cut showed that producers tended to harvest first cut hay 7 days earlier when storing hay as WRB compared to DRB ($P=0.15$). Although producers used wrapping technology to harvest first cut hay earlier, the mean harvest date of June 30 is well beyond the date when nutrients in forage are high in NCWV. For aftermath cuttings, producers tended to harvest hay 15 days later when storing hay as WRB compared to DRB ($P=0.08$). Producers used wrapping technology to extend the harvest season for aftermath cuttings into periods of the year when it is particularly difficult to cure hay for dry storage. On-farm data shows that NCWV livestock producers use wrapping technology to extend harvest periods, thus increasing the quantity of hay harvested in the fall. This use of wrapping technology suggests that, because of the physiological needs of the livestock, NCWV livestock producers are not using wrapping technology optimally to improve hay quality adequately to pay for the use of this technology.

Key Words: Forage, Hay, Large Round Bales

T82 Factors affecting the quality of corn silage grown in hot, humid areas 3: Effect of maturity at harvest of corn hybrids differing in staygreen ranking. K. G. Arriola*, A. T. Adesogan, D. B. Dean, S. C. Kim, N. K. Krueger, S. Chikagwa-Malunga, T. Ososanya, and M. Huisden, *University of Florida, Gainesville*.

To address producer concerns about when to harvest corn hybrids with high staygreen rankings, this study determined the effect of maturity at harvest on the nutritive value and aerobic stability of corn hybrids differing in stay-green ranking. One high stay-green corn hybrid and one average stay-green hybrid with similar relative maturity (118 d) were selected from each of two seed companies. The four hybrids were grown in 1 x 6 m plots at random locations within each of four blocks. The hybrids were harvested at 26 (C1), 34 (C2), and 39 (C3) % DM and ensiled (15 kg) in quadruplicate within plastic bags in 20 l mini-silos. After at least 107 d of ensiling, the silos were opened and the silages were chemically characterized and analyzed for aerobic stability and microbial counts. A Split plot design was used for the study. The staygreen ranking or

source (seed company) of the hybrids did not affect their quality. However concentrations (g/kg DM) of CP, NDF, ADF, residual sugars, NH₃N, lactate and acetate were greater ($P<0.001$) at C1, than at C2 or C3, and similar ($P>0.05$) at C2 and C3. In contrast, pH was greater ($P<0.05$) at C2 (3.77) and C3 (3.78) than at C1 (3.71). In vitro DM digestibility and aerobic stability were unaffected by maturity. Yeasts counts (log cfu/g) were lower ($P<0.05$) at C1 (5.93) and C2 (6.05) than at C3 (7.04), but mold counts (log cfu/g) were greater ($P<0.05$) at C1 (3.28) than at C2 (2.60) and C3 (2.44). In conclusion, harvesting the hybrids at 26% DM seems most appropriate.

Key Words: Corn, Maturity at Harvesting, Stay Green Ranking

T83 Effect of maturity at harvest on the nutritive value and biomass yield of *Mucuna pruriens*. S. Chikagwa-Malunga*, A. Adesogan, N. Krueger, D. Dean, and L. Sollenberger, *University of Florida, Gainesville*.

Four, 5 x 1 m plots of *Mucuna pruriens*, velvet bean, were randomly established within each of 6 blocks in order to determine the effect of maturity at harvest on DM yield and nutritive value. The *Mucuna* foliage within each of four quadrats (0.5 m²) that were randomly thrown on six of the plots was harvested at 77, 90, 110 and 123 days after planting (DAP). The total foliage harvested from all the quadrats on each of the six plots was weighed to determine biomass yield. Subsequently, the contents of one of the four quadrats from each plot were chemically analyzed. *Mucuna* yield increased ($P<0.001$) with maturity and the peak biomass yield was obtained at 110 DAP. Biomass yields (t/ha) at 110 (8.64) and 123 DAP (9.22) were similar ($P>0.05$) and higher ($P<0.001$) than those at 77 and 90 DAP. Concentrations of DM (18.0, 19.6, 26.0, 42.2 %) and NDF (31.0, 46.0, 44.6, 48.5 %) increased ($P<0.001$) with maturity, but concentrations of CP (13.1, 13.1, 15.8, 15.9 % DM) and EE (1.22, 0.97, 1.37, 1.29 % DM) were unaffected ($P>0.05$) by maturity. Total tannin concentration (% DM) was highest ($P<0.001$) at 110 DAP (5.6) followed by 123 DAP (4.4), and lowest at 90 DAP (3.0). Whole plant IVDMD was highest ($P<0.001$) at 110 DAP (54.9 % DM) when *Mucuna* had lower ($P<0.001$) lignin concentration (11.7% DM) than at 123 DAP (49.0 % DM IVDMD, 14.1% DM lignin). Concentrations (% DM) of P (0.29, 0.28, 0.24, 0.21; $P<0.001$), and Ca (1.21, 1.11, 0.88, 1.17; $P=0.0694$) also decreased with maturity. Lysine concentration (% CP) was unaffected ($P>0.05$) by maturity, but methionine concentration (% CP) decreased ($P<0.05$, 1.30, 1.12, 0.99, 1.06) with maturity. In conclusion, *Mucuna* should be harvested at approximately 110 DAP to optimize biomass yield and nutritive value.

Key Words: *Mucuna pruriens*, Nutritive Value, Yield and Maturity

Goat Species: Growth, Genetics, Physiology, Health, and Products

T84 Predictive models for goat cheese yield using milk composition. S. S. Zeng*¹, K. Soryal², B. Fekadu³, and M. Villaquiran¹, ¹*School of Agric. & Applied Sciences, Langston University, Langston, OK*, ²*Desert Research Center, Matareya, Cairo, Egypt*, ³*Debu University, Awassa, Ethiopia*.

Prediction of yield and quality of different types of cheeses that could be produced from a given type and/or amount of goat milk is of great economic benefit to goat milk and cheese producers. Bulk tank goat milk was used for manufacturing hard, semi-hard and soft cheeses (N = 25, 25 and 24, respectively) during a whole lactation to develop predictive models of cheese yield based on milk composition. Percentages of fat, total solids, total protein and casein in milk and moisture-adjusted cheese yield were determined to establish relationships between milk composition and cheese yield. In soft cheese, individual components of goat milk or a combination of two or three components predicted cheese yield with a reasonably high correlation coefficient ($r^2 = 0.73-0.81$). However, correlation coefficients of predictions were lower for both semi-hard and hard cheeses. Overall, total solids of goat milk was the best indicator of yield in all three types of cheese, followed by fat, total protein and casein. When compared with moisture-adjusted cheese yield, the developed yield for-

mulae in this study predicted yield of semi-hard and hard cheeses as well as the standard formula used for cow cheese (Van Slyke formula). In soft cheese, however, the Van Slyke formula under-estimated, while the newly derived formulae over-estimated yield. Further validation of the yield predictive models for hard and semi-hard cheeses of goat milk using larger data sets over several lactations might be needed, because of variations in relationships between milk components due to breed, stage of lactation, season and feeding regime.

Key Words: Goat Milk, Cheese Yield, Predictive Models

T85 Distribution of conjugated linoleic acids and trans-fatty acids in longissimus muscles of sheep and goats. J. H. Lee*, G. Kannan, K. R. Eega, B. Kouakou, W. R. Getz, and Y. W. Park, *Fort Valley State University, Fort Valley, GA*.

Meat from ruminants contains high proportions of saturated fatty acids and small amounts of *trans*-fatty acids, both of which are associated with high blood