T186 Effect of trucking density and transport time of market pigs on behavioural pattern during transport, plasma concentrations of stress-related biochemical markers and carcass quality. J. H. Woo, D. M. Ha, C. Y. Lee, and D. H. Kim*, [1] *Regional Animal Industry Research Center, Jinju National University.*

A total 114 market pigs weighing approximately 110 kg were transported to a local abattoir for 1 h or 3 h under a high (H; 0.34m/100 kg BW)-, medium (M; 0.38m)-, or low (L; 0.42m)- trucking density, under a 2 (transport time) x 3 (trucking density) factorial arrangment of treatments. Behavioural pattern of the pigs during transport were video-taped. Blood samples were taken at slaughter, after which Longissimus Dorsi muscle (LM) was taken for physicochemical analysis following overnight chilling of the carcass. Most of the pigs stood during transport at H-trucking density, whereas at M- or L-density, a substantial percentage of the pigs sat or lied. Plasma glucose concentration was greater ($P<0.05$) in the 3 h-transport group than in the 1 h-transport; lactate dehydrogenase concentations were less in the L-density and 1 h-transport than in M- or H-density and 3 h-transport groups, respectively. The lightness (L* value) of LM, which exibited no main effect, was affected ($P<0.01$) by a density x transport time interaction. The incidence of PSE (pale, soft and exudative) carcass was less in 1 h-transport group than in 3 h-transport group at H- (23.5 vs 29.4%) and L-density (11.5 vs 26.9%), but not at M-density (14.3 vs 14.3%). It is concluded from these results that a short transport within 1 h at L-trucking density is desiable in terms of animal welfare. However, under practical situations, M-density trucking density may be the most economical.

Key Words: Pig, Transport, Stress

T187 Exposure to short days during the dry period increase milk production in subsequent lactation in dairy goats. S. J. Mabjeesh*[1], A. Shamay[2], G. E. Dahl[3], and T. T. McFadden[4], [1] *The Hebrew University of Jerusalem, The Faculty of Agriculture, Israel,* [2] *The Volcani center, Agricultural Research Organization, Israel,* [3] *University of Illinois, Urbana,* [4] *University of Vermont, Burlington.*

The effect of long day photoperiod (LDPP) or short day photoperiod (SDPP) during late gestation on subsequent milk yield was examined under thermoneutral conditions (23±1 °C; NT). The experiment was conducted on 4 goats in each group, which were held on metabolic crates in fully controlled rooms. The LDPP treatment group was held in 16 h light: 8 h dark and the SDPP in 8 h light: 16 h dark cycles in 70% relative humidity atmosphere. Blood samples were collected every 5 d until week 12 after kidding to assess concentrations of IGF-I and PRL. After kidding, goats were held in outdoors yards and had the same management like the other goats on the farm. Goats were milked twice daily and milk samples were taken every 7 days and analyzed for milk components. Milk production was measured automatically by flow meters.Milk yield was higher in the SDPP group by 26% compared to the LDPP for the 12 weeks post kidding (2932 vs 2320 g/ d, $P< 0.001$, SE = 105). Plasma prolactin concentration was higher in the LDPP group from week 6 prior to kidding compared to SDPP and averaged 169 and 112 ng/ ml ($P< 0.005$, SE = 11). However, prolactin concentration across the 12 weeks post kidding was similar for both groups and averaged 13411.9 ng/ ml. Similar profile was measured to IGF-1 concentration. IGF-1 concentration averaged 0.177 ng/ ml compared to 0.073 ng/ ml ($P< 0.001$, SE = 0.01) in the LDPP and SDPP groups, respectively. After kidding IGF-1 concentration was 0.075±0.01 ng/ ml for both treatments. These results are the first to demonstrate the effect of photoperiod during the prepartum period on subsequent lactational performance in dairy goats. These results further confirm the association of LPDD with higher prolactin and IGF-1 in plasma prepartum. It is believed that the sensitivity of the mammary gland to prolactin during the dry period or early in postpartum is the mechanistic explanation for the higher milk production observed in SDPP.

Key Words: Milk production, Dairy goats, Photoperiod

Forages & Pastures

T188 Forage mineral concentrations in West Virginia pastures. E. B. Rayburn, W. L. Shockey*, and R. M. Wallbrown, *West Virginia University, Morgantown, WV.*

Mineral nutrition of grazing livestock is directly related to pasture mineral concentration. Livestock mineral intake varies because pasture forage species are not constant, fertilizer application varies, and most pastures are not tested for mineral content. An evaluation of pasture mineral status was conducted over 5 years (1997 through 2001) and involved the cooperation of 17 extension agents in 18 counties. Objective was to develop a livestock mineral supplement that would insure adequate mineral intake for livestock grazing West Virginia pastures. Data represents over 105 site-years with monthly samples taken randomly from selected farms from May to September. Forage samples were analyzed by commercial laboratory for protein, fiber, and mineral concentration. Mineral concentration mean and 10, 50 and 90 percentile values were Ca 0.68, 0.44, 0.65, 0.96; K 2.46, 1.76, 2.46, 3.21; Mg 0.25, 0.17 0.24 0.33; P 0.34, 0.23, 0.34, 0.46; S 0.24, 0.17, 0.24, 0.32; Al 254, 48, 154, 522; Cu 10.9, 7.0, 10.0, 15.2; Fe 403, 124, 253, 792; Mn 110, 54, 93, 194; Mo 1.08, 0.30, 0.88, 2.08; Na 0.237, 0.009, 0.020, 0.070; and Zn 34.7, 20.0, 27.8, 47.0, respectively. Concentration vs probability percentile was calculated for each mineral to determine the % of time pastures were below a given animal nutrient requirement. By comparing an acceptable risk level (for example the 10th percentile) to the animal's mineral requirement, a mineral supplement requirement can be calculated that should ensure that 90% of the animals consuming the supplement would meet NRC established requirements. Most pastures in West Virginia are adequate for average producing cattle used in a cow/calf production system, the primary pasture use in the state. Where animals of above average production ability are desired, above average management is needed to provide adequate forage quantity and quality over the grazing season.

Key Words: Pasture, Minerals, Livestock

T189 The effects of irrigation of soil and stage of harvest on mineral contents of grasslands located at high altitude. A. Hayirli*[1], I. Kaya[2], K. Haliloglu[3], and B. Karademir[4], [1] *Dept. of Animal Nutrition, School of Veterinary Medicine, Ataturk University, Erzurum 25700, Turkey,* [2] *Dept. of Animal Nutrition, College of Veterinary Medicine, Kafkas University, Kars 36100, Turkey,* [3] *Dept. of Agronomy, College of Agriculture, Ataturk University, Erzurum 25100, Turkey,* [4] *Dept. of Internal Medicine, College of Veterinary Medicine, Kafkas University, Kars 36100, Turkey.*

In this study, the effects of soil irrigation and maturity stage on mineral concentrations were evaluated on 4 irrigated and 4 non-irrigated grasslands located at altitude of 2100 m. Grasslands were irrigated for one week and composites of plant subsamples (n = 10) from each grassland were pooled by cut with 14-d interval (n = 5) between May 21-July 30, 1999. The model included main effects of soil irrigation and maturity stage and their interaction in 2-way ANOVA. Irrigation did not affect soil pH (6.92), and clay (28.84%), sand (39.14%), OM (6.69%), K (50.60 Meq/g), Ca (1.22%), Mg (3.17 g/kg), Al (0.05 ppm), Ba (1.27 ppm), Co (0.07 ppm), Cu (1.82 ppm), Fe (6.59 ppm), Li (0.09 ppm), Mn (8.14 ppm), Zn (0.38 ppm), and Sr (2.54 ppm) levels. However, concentrations of Na (109.6 vs. 39.9 mg/kg), P (19.1 vs. 4.68 g/kg), Cd (0.02 vs. 0.001 ppm), Cr (0.09 vs. 0.001 ppm), Ni (1.62 vs. 0.97 ppm), and Pb (0.39 vs. 0.07 ppm) were greater in irrigated soils than non-irrigated soils. Concentrations (ppm) of Mn (79.62), Al (472.6), B (8.27), Ba (4.55), Cr (1.90), Cu (2.44), Fe (397.7), Li (9.19), Se (0.81), and V (4.20) in plants were not affected by irrigation. However, concentrations of plant K (262.6 vs. 220.8 Meq/g) P (3.24 vs. 2.62 g/kg), Mg (1.71 vs. 1.47 g/kg), S (555 vs. 529 g/kg), Na (0.87 vs. 0.52 g/kg), and Zn (19.09 vs. 13.52 mg/kg) were greater and Ca (4.18 vs. 5.60 g/kg) and Sr (6.71 vs. 12.11 mg/kg) levels were lower in irrigated grasslands than non-irrigated grasslands. There was no effect of stage of maturity on plant Mg, S, Mn, Na, Al, B, Ba, Ca, Cr, Fe, Li, Se, and V levels. There were linear decreases in concentrations of plant K from 258.8 to

221.9 Meq/g, P from 3.36 to 2.70 g/kg, Cu from 4.05 to 1.25 mg/kg, and Zn from 20.15 to 13.11 mg/kg and there was a linear increase in concentration of plant Sr from 4.32 to 15.77 mg/kg as maturity progressed from 1 to 5th cut. There was no effect of irrigation of soil by stage of maturity interaction on plant mineral concentrations. Apparently, regardless of maturity stage, soil irrigation tends to alter both macro- and micro-mineral levels in soils and only macro-mineral levels in plants.

Key Words: Irrigation of grassland, Stage of maturity, Mineral

T190 Effects of soil irrigation and maturity stage on organic macronutrient composition and nutritive value of grasslands at high altitude. I. Kaya[1], A. Hayirli*[2], K. Haliloglu[3], and S. Yildiz[4], [1]*Dept. of Animal Nutrition, College of Veterinary Medicine, Kafkas University, Kars 36100, Turkey,* [2]*Dept. of Animal Nutrition, School of Veterinary Medicine, Ataturk University, Erzurum 25700, Turkey,* [3]*Dept. of Agronomy, College of Agriculture, Ataturk University, Erzurum 25100, Turkey,* [4]*Dept. of Physiology, College of Veterinary Medicine, Kafkas University, Kars 36100, Turkey.*

Effects of soil irrigation (SI) and maturity stage (MS) on nutrient composition and nutritive value of grasslands located at altitude of 2100 m were studied. Four of 8 grasslands were irrigated after each cut (n = 5, with 14-d interval between May 21-July 30, 1999). Pooled plant composites (n = 10) by grassland at each cut were analyzed for DM, OM, CP, NDF, CF, EE, and ash. Three cannulated rams were utilized for nutritive value. Kinetic parameters for degradability of nutrients were assessed using equation $P= a+b(1-e^{-ct})$, where P = degradability (%), a = soluble and readily degradable fraction, b = insoluble and slowly degradable fraction, and c = rate constant, and t = time relative to incubation, respectively. For effective degradability (Pe), passage rate was assumed to be 0.02, 0.05, and 0.08% per h. Two-way ANOVA was used in data analyses. There was no effect of SI on OM (90.8), CP (16.1), NFE (43), and ash (9.2) levels (%), but DM (25.1 vs. 32.0%) and EE (1.8 vs. 2.0%) were lower and NDF (60.1 vs. 55.7%) was greater in irrigated grasslands than non-irrigated grasslands. There was no effect of MS on OM, EE, NFE, and ash levels. There were linear increases in DM from 28 to 33% and NDF from 50.9 to 65.2% and there was a linear decrease in CP from 20.8 to 10.4% as MS advanced. There was no effect of SI by MS interaction on nutrient density. SI did not affect parameters "c" (0.06), lag phase (2), and Pe at 2 (76.3), 5 (66.6), and 8% (61.3) for CP, but parameter "a" (43.3 vs. 39.4) was greater and parameter "b" (45.7 vs. 48.8) was lower for irrigated grasslands than for non-irrigated grasslands. Parameter "a" and Pe at 2, 5, and 8% decreased and lag phase increased linearly as MS advanced. SI affected only parameter "a" for CF (3.6 vs. 5.3 for irrigated vs. non-irrigated grasslands) and average of parameters "b" and "c", lag phase, and Pe at 2, 5, and 8% was 75.9, 0.05, 2.4, 58.8, 42.9, and 34.5, respectively. MS linearly decreased parameters "a", "b", and Pe at 2, 5, and 8% for CF. Regardless of MS, SI mainly affects plant fiber level and its effects on nutritive value seem to be related to changes in nutrient compositions.

Key Words: Organic macronutrient, Irrigation of soil, Stage of Maturity

T191 Nitrate concentration of cereal forage species at three stages of maturity. L.M.M. Surber*, S. D. Cash, J.G.P. Bowman, and M. C. Meuchel, *Montana State University, Bozeman, MT USA.*

Cereal forages have become an increasingly economical source of winter feed for livestock producers, comprising 11% of all hay harvested in Montana. Livestock producers need to be concerned with nitrate concentrations when feeding annual cereal forages. Six cereal forage species (18 varieties) were grown in a randomized complete block design field trial (r = 4) under irrigated conditions in Bozeman, MT, and were used to test the effects of cereal forage species and stage of maturity on forage nitrate concentration. Plots were 1.52 x 6.10 m in length and spaced 0.46 m apart. Forage clip samples were collected at three stages of plant maturity; boot, anthesis and when the plots were harvested for hay (milk stage of maturity). A 0.15 m clip sample of one row was cut at stubble height and dried at 60C for 48 h. Forage clip samples were ground to pass a 1-mm screen in a Wiley mill and evaluated for DM and nitrate-nitrogen (NO_3-N). The range in NO_3-N was from 0.01 to 0.55 % (CV = 47.2%). There were significant ($P < 0.05$) cereal forage species, stage of maturity and species x maturity interaction effects on NO_3-N concentration. Nitrate-nitrogen concentration at the boot stage of maturity did not differ ($P > 0.05$) when compared to the anthesis stage of maturity (avg. 0.244 %). However, NO_3-N concentration at harvest was 36% lower than at anthesis (0.168 vs. 0.230 %). Barley forage NO_3-N was similar ($P > 0.05$) when compared to emmer, triticale and wheat x spelt crosses (avg. 0.195 %) and lower ($P < 0.001$) when compared to oats and spelt forage (0.186 vs. 0.341 and 0.258 %, respectively). Barley forage NO_3-N concentration was highest ($P < 0.05$) at the boot stage, intermediate at anthesis and lowest at harvest (0.230, 0.195 and 0.131 %, respectively). Oat forage maintained high NO_3-N concentrations at all growth stages ($P > 0.05$; avg. 0.341%). It appears that stage of maturity and cereal forage species greatly affect NO_3-N concentration. Also, NO_3-N concentrations of various cereal forage species respond differently at boot, anthesis and harvest. This implies that different harvest management must be implemented for oats when compared to other cereal forage species.

Key Words: Cereal forage, Stage of maturity, Nitrate concentration

T192 Relationship of ADICP and NDICP to crude protein and soluble protein in forages fed to dairy cattle. R. T. Ward*[1], M. J. Stevenson[2], and R. A. Patton[3], [1]*Cumberland Valley Analytical Service, Maugansville, MD,* [2]*Degussa Canada, Inc., Burlington, ON,* [3]*Nittany Dairy Nutrition, Mifflinburg, PA.*

New computer models for balancing rations as well as 2001 NRC depend on measurement of ADICP and NDICP for accurate prediction of energy content of forages. Accurate predictions of either ADICP or NDICP could reduce cost of analysis. As part of the development of a database for the Amino Cow-Mepron Ration Evaluator, we examined the relationships between ADICP and NDICP to CP and soluble protein (SP). In this study ADICP, NDICP, CP and SP were determined chemically as a percent of dry matter. Simple correlations and regression equations were developed using PROC CORR and PROC REG of SAS. Means, standard deviations and simple correlations are presented below. Overall relationships between ADICP and NDICP among DM, CP, SP, ADF and NDF were weak (i.e. no regression equations with R^2 greater than .55). The magnitude of ADICP and NDICP values significantly affects calculation of energy and protein flows in ration formulation. Since accurate prediction of these terms does not appear to be feasible, ADICP and NDICP should be analyzed. These data are generally consistent with the values reported in 2001 NRC.

Feed	N	ADICP	SD	R^2CP	R^2SP	NDICP	SD	R^2CP	R^2SP
Alfalfa hay	1017	1.43	0.43	-.02	-.33	3.14	1.56	.05	-.45
Alfalfa silage	978	1.78	0.58	-.07	-.19	3.40	1.28	-.03	-.54
Corn silage	3793	1.05	0.27	.25	.00	1.60	0.50	.35	-.16
Grass hay	236	1.51	0.67	.16	.04	4.10	1.78	.26	-.03
Grass silage	160	1.68	0.63	-.15	-.18	3.57	1.33	.31	-.15
Mixed legume-grass silage	266	1.98	0.55	.05	-.12	3.75	1.20	-.03	-.42
Sorghum silage	114	1.64	0.60	.60	.13	2.44	0.97	.51	-.05
Wheat silage	119	1.22	0.33	.09	-.07	1.98	0.84	.38	-.05

Key Words: ADICP, NDICP, Forages

T193 Relationship of starch content in common forages to dry matter, crude protein, non-fiber carbohydrate and neutral detergent fiber. R. T. Ward[1], M. J. Stevenson[2], and R. A. Patton*[3], [1]*Cumberland Valley Analytical Service, Maugansville, MD,* [2]*Degussa Canada, Inc., Burlington, ON,* [3]*Nittany Dairy Nutrition, Mifflinburg, PA 17844.*

Improvement in prediction of microbial protein synthesis requires better knowledge of nutritionally relevant carbohydrate amounts in feedstuffs. Although data exists for starch in grains and byproducts, few data are available for forages. Analytical variation was minimized by using results from one laboratory using current best practice for starch analysis. Samples varied widely in quality / nutrient content. Our objective was to determine whether starch content could accurately be predicted by more traditionally measured nutrients. CP, NDF and starch were determined chemically, while NFC was determined by difference. Investigation of relationships was by the PROC REG of SAS using the MaxR option. Equations that improved the R^2 less than 5 percent were rejected. Starch contents are presented below (DM basis). Regression for starch as a percent of NFC was always less significant than as a percent of dry matter except for grass hay where R^2 =.73. Due to high standard deviation and low correlations, this data suggests that starch should be expressed on a percent of dry matter basis. Accuracy in prediction of starch content from other constituents was only achieved for silages with high starch content.

Feed	N	Mean	Std Dev	Min	Max	Regression Equation	R^2
Alfalfa hay	159	1.80	0.76	0.40	4.55	(0.058*NFC) -(0.084*CP)+2.208	.09
Alfalfa silage	132	2.67	2.63	0.30	13.47	(0.125*NFC) -(0.231*CP)+4.964	.17
Corn silage	1771	26.7	6.74	1.34	65.43	(0.870*NFC) -5.628	.77
Grass hay	20	2.25	0.97	0.96	13.47	(0.016*NDF) + (0.087*NFC)+0.0248	.12
Grass silage	45	2.08	1.19	0.52	7.57	(0.018*DM) +(0.035*NDF)- 0.928	.11
Mixed legume-grass silage	30	2.39	1.88	0.73	10.80	(0.244*CP) -2.763	.27
Sorghum silage	84	12.16	7.50	0.96	29.89	(0.836*NFC) -7.800	.59
Wheat silage	39	5.88	6.75	0.67	26.09	(0.736*NFC) -(0.401*NDF)+17.350	.80

Key Words: Starch, Forage

T194 Sugar content in common forages and its relationship to non-fiber carbohydrate percentage.

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The aim of the present study was to determine whether sugar content could be correlated with nutrients more commonly measured in forage. It was felt that a single laboratory analyzing a broad cross-section of forage submitted by farms would offer the best opportunity to detect correlations. Sugar was determined enzymatically. CP, NDF and starch were determined chemically, while NFC was determined by difference. Investigation of relationships among nutrients was by PROC REG of SAS using the MaxR option. Regression equations that provided less than a 5% improvement in R^2 were rejected. Sugar data for common forages on a percent dry matter basis are below. Regression for sugar as a percent of NFC was generally of greater significance than was sugar as a percent of dry matter except for corn silage and sorghum silage. However, all regressions on sugar as a percent of NFC explained less than 45% of total variation, and thus are not sufficiently accurate for practical use. Hays contained more sugars than did silages. Since sugar content is known to influence rumen fermentation, this data suggests sugar determination should be included in forage analysis.

Feed	N	Mean	Std Dev	MIN	MAX	%NFC	Std Dev	High R^2
Alfalfa hay	121	6.80	1.95	1.20	11.70	25.76	7.38	.24
Alfalfa silage	89	2.51	1.57	0.10	7.00	12.18	8.20	.18
Corn silage	897	2.42	1.99	0.10	14.90	6.74	5.95	.01
Grass hay	12	5.89	1.93	2.10	8.30	46.97	15.99	.19
Grass silage	34	2.88	1.69	0.50	6.60	31.18	15.67	.27
Mixed legume-grass silage	21	3.71	3.23	0.50	13.90	20.86	20.50	.34
Sorghum silage	57	3.41	2.11	0.60	9.20	20.86	11.30	.07
Wheat silage	27	3.56	2.08	0.90	8.30	23.86	19.01	.10

Key Words: Sugar, Forage

T195 Utility of near infrared reflectance spectroscopy to predict forage energy content derived by summative models.

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Legume-grass silage (LGS; n = 210) and corn silage (CS; n = 300) samples were collected from submissions to the Marshfield Forage Laboratory, Marshfield, WI. Samples were dried and ground for chemical or NIRS determinations. Samples were scanned on a Model 6500 near infrared reflectance spectrophotometer and spectra retained. Center and select procedures using Infrasoft International software (version 2) were implemented, resulting in 90 and 70 spectrally different LGS and CS samples retained for NIRS equation development. Forages were evaluated for CP, ADF CP, NDF, NDF CP, 48 hr in vitro NDF digestibility (dNDF, % of DM), fat, and ash which are required for the NRC, 2001 summative (forage energy) prediction model. Lignin was not determined and dNDF was substituted as the digestible NDF fraction as prescribed by the NRC, 2001.

The NIRS cross validations (r^2) for CP, ADF CP, NDF, NDF CP, dNDF, fat and ash were 0.97, 0.70, 0.96, 0.35, 0.87, 0.52, and 0.51 for CS and were 0.93, 0.71, 0.94, 0.75, 0.79, 0.53, and 0.73 for LGS, respectively. Data suggest NIRS prediction of ADF CP, NDF CP, fat, and ash content of forages has limitations. Data also suggest prediction of dNDF via NIRS has limitations and may be co-dependent with NDF prediction. Nutrient composition of each forage as determined by laboratory chemistry (LC) or NIRS was then used in NRC, 2001 summative (forage energy) prediction models and TDN for each forage was determined. The TDN determinations for the forages were compared to 48h in vitro, organic matter (dOM, % DM) digestibility.

The relationship (r^2) between NRC, 2001 predicted TDN and dOM was 0.98 and 0.98 for LGS and CS, respectively, when components were determined LC. When NIRS was used to determine model components, the relationship between NRC, 2001 predicted TDN and dOM of forages was 0.78 for CS and 0.69 for LGS. Data indicates some nutrient components in forage required by the NRC, 2001 summative (forage energy) models are poorly predicted by NIRS, ultimately reducing the utility of NIRS to predict forage energy content. ®

Key Words: Forage, Near infrared, In vitro

T196 Optimal sampling schedule of diet components.

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Various recommendations have been issued regarding sampling schedules of diet components, especially forages. Their bases are unclear and none are justified from an economic standpoint. The process of forage removal from storage can be conceptualized as a quality control issue that can be monitored using a Shewhart X-bar chart. This procedure requires three inputs: number of samples (n), frequency of sampling (h), and control limits (L). All three affect the performance of the chart and, thus, the total cost of quality. A quality cost function made of four parts is proposed: cost per cycle while the process is in-control (A); cost per cycle while the process is out-of-control (B); cost per cycle for sampling and analyses (F); and expected duration of a cycle (D). A = C_0 / J, where C_0 is quality cost/d while producing in control, and J = 1/mean time process is in control. B = C_1 (E - τ - A_2h + T_1 + T_2) + sY/A_1 + W, where C_1 is quality cost/d while producing out of control, E = time to sample and analyze one item, $\tau = [1-(1+Jh)e^{-Jh}]/[J(1-e^{-Jh})]$ and is the expected time of occurrence of the assignable cause given that it occurs between the i^{th} and the $(i+1)^{th}$ sample, $A_2 = 1/(1-\beta)$ and is the average run length while out of control, T_1 is the expected time to discover the assignable cause, T_2 is the expected time to fix the diet, b is the probability(in control signal — process is out of control), s = (e^{-Jh}) / $(1-e^{-Jh})$ and is the expected number of samples taken while in control, $A_1 = 1/\alpha$ and is the average run length while in control, α is the probability(out of control signal — process is in control), and W = cost to fix the diet. F = $[(a + bn)/h$ $(1/J-\tau+E+A_2h+T_1+T_2)$, where a is the fixed cost per sample, and b is the cost per unit sampled. D = $1/J-\tau+E+A_2h+T_1+T_2$. The total quality cost per day (TCQ) = (A+B+F)/D. The TCQ function can be optimized with respect to n, h, and L to yield an optimal sampling schedule. Because of the highly nonlinear structure of the TCQ function, gradient-based optimization algorithms are not well suited for the optimization task. Instead, a modified genetic algorithm is proposed.

Key Words: Feed sampling, Quality control, Quality costs

T197 Evaluation of the profile of fatty acids extracted from fresh alfalfa.

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Quantity and profile of fatty acids from fresh forage samples may be altered by repeated extractions. Fatty acids from fresh alfalfa were extracted by hexane:isopropanol (H:IP, 3:2 v/v) in three sequential extractions. The percentage and profile of fatty acids from each of the three extractions were evaluated by a randomized complete block design with repeated measure in space. Samples of fresh alfalfa were randomly harvested and immediately submerged in liquid nitrogen. For the first extraction, approximately 5 g of the frozen alfalfa was mixed with 18 ml of H:IP per gram of material. Samples were then centrifuged and the supernatant was collected. The second and third extractions were done by adding H:IP to the pellet (3 ml/g of the original sample weight),

mixing for 2 min, and then centrifuging. Samples were submerged in H:IP and stored in the dark at 8 °C at all times. The solvent from each extraction was partially evaporated and the fatty acids methylated by methanolic HCL. Repeated extractions increased the percentage of total fatty acids ($P < 0.01$) recovered from the DM. The concentration of fatty acids in the alfalfa after three extractions was 4.0%. The first, second and third extractions resulted in 92.67%, 4.77%, and 2.56% of the total fatty acids extracted, respectively. There was no effect of extraction on the proportion of 16:0, 18:0, 18:1 and 18:2 fatty acids ($P > 0.05$). However, the proportion of 18:3 in the extract decreased ($P < 0.01$) from the first to the second extraction. Therefore, the ratio of saturated to unsaturated fatty acid tended to increase from the first to the third extraction. The results of this experiment revealed that the profile of fatty acids can vary with the number of extractions performed. The higher amount of 18:3 in the first extraction may reflect the higher proportion of linolenic acid in the more easily extracted plant fractions.

Key Words: Alfalfa, Fatty acids, Fatty acid extraction

T198 The relationship between non-structural carbohydrates and total dry matter yield in cool season grasses.

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The efficiency of grass nitrogen utilization by ruminants tends to be low, due partly to the slow rate of energy release in the rumen. When additional sugars are introduced to the rumen, microbial protein is increased. Recent research reports indicate forages bred for higher soluble sugars can increase milk production and animal growth rates over grasses with average sugar content. Additional work has suggested forage carbohydrate differences influence nitrogen utilization, as indicated by changes in nitrogen excretion in the urine. Authors theorized this was primarily due to differences in the microbial capture of rumen degradable nitrogen. Very little work has been done looking at the natural variations between cultivars in sugar content or the relationship between total nonstructural carbohydrates and yield. The objectives of this trail were to evaluate the non-structural carbohydrate variation found in modern cool season grasses by studying the seasonal and variety variations in comparison to yield. Perennial cool season grasses (n=17) were planted in a randomized plot design replicated three times. Four commercially available varieties of orchard grass (Dactylis glomerata), eleven ryegrasses (Lolium perenne) and two brome grasses (genus Bromus) were included in the study. Plots were harvested mechanically throughout the growing season and yield data recorded. Total non-structural carbohydrates were analyzed each sampling day in April, July and October from each variety. Annual dry matter yields ranged from 14,446 to 21550 kg per hectare averaging 18220 ± 1667. Average total non-structural carbohydrate values ranged from 14.7% to 22.5% averaging 19.3% ± 2.6. Total nonstructural carbohydrates and yield for each variety were compared using correlation analysis. For all varieties, total nonstructural carbohydrate values were negatively correlated (-.67) with total annual yield. Analysis of each variety by cutting indicated that the early (April) and late (October) total non-structural carbohydrate values were also negatively correlated with yield, -.52 and -.73 respectively. The mid-season cutting, however, showed a positive correlation (.16) between yield and total non-structural carbohydrate levels in grasses tested.

Key Words: Non-structural carbohydrates, Cool season grasses

T199 Influence on ration formulation of on-farm variability in methionine and lysine content of alfalfa haylage and corn silage.

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This study was conducted to determine the baseline variability of nutrients, including amino acids, in haylage and corn silage from a well-managed dairy farm. Samples were taken weekly over a 5-month period, a total of 21 individual samples for each forage. Means (%DM), standard deviations and coefficients of variation are shown below for the various nutrient analyses. CVs were generally above 10% for trace minerals and below 10% for macrominerals. The higher CVs associated with MET and LYS in corn silage reflect the low contents and have minimal effect on metabolizable supply. Sample rations using 10 kg DM from either of these forages were evaluated in the 2001 NRC dairy ration balancing program. Adjustment of methionine content +/- one S.D. from the mean did not affect duodenal methionine flow, and adjustment of lysine +/- one S.D. from the mean varied duodenal lysine flow by one gram. Effects of variation in amino acid content of forages can be negligible on well-managed dairy operations.

		DM	CP	ADF	NDF	ADICP	NDICP	Lignin	Fat
Corn Silage	Mean	37.61	7.06	22.05	37.65	0.51	0.95	3.24	3.31
	SD	1.22	0.25	2.02	2.71	0.10	0.17	0.58	0.22
	CV%	3.2	3.5	9.2	7.2	20.2	17.2	17.9	6.5
		Ash	MET	LYS	LEU				
	Mean	3.41	0.11	0.15	0.63				
	SD	0.51	0.01	0.02	0.03				
	CV%	15.0	13.1	15.6	5.3				
		DM	CP	ADF	NDF	ADICP	NDICP	Lignin	Fat
Haylage	Mean	48.47	20.80	38.85	48.23	1.89	3.73	9.65	2.77
	SD	0.56	0.75	1.33	1.98	0.15	0.41	2.27	0.14
	CV%	1.2	3.6	3.4	4.1	8.2	11.1	23.5	5.0
		Ash	MET	LYS	LEU				
	Mean	9.79	0.23	0.78	1.08				
	SD	0.57	0.02	0.06	0.08				
	CV%	5.8	7.1	8.0	7.4				

Key Words: Methionine, Lysine, Forage

T200 Effect of different storage forms of alfalfa hay on the digestion characteristics in Holstein steers.

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An experiment was conducted to evaluate the effect of different storage forms of alfalfa hay on the duodenal flow (DF) and the apparent intestinal digestibility (AID) of amino acids in Holstein steers. The forage was harvested in June, dried on the field, baled, and stored for six months under different conditions. The maximum air temperature at the site where the experiment was conducted ranged from 40 to 49C. Five steers each adapted with cannulas in rumen, proximal duodenum, and distal ileum, were used according to a 5 x 5 Latin Square design. Treatments were: T1) hay stored without any cover, T2) hay stored under a metal hood, T3) hay completely covered with a vinyl tarp, T4) hay stored inside an oven at 45C, T5) hay stored inside a refrigerated room at 22C. The results were: DF (g/d), Arg 36.1, 27.3, 28.8, 36.0, 23.5; His 16.3, 12.4, 13.4, 15.8, 11.2; Ile 39.5, 30.0, 32.4, 38.9, 26.1, Leu 63.3, 48.8, 52.5, 63.6, 42.4; Lys, 50.2, 38.3, 41.2, 48.7, 34.1; Met 29.4, 22.3, 24.1, 29.2, 19.8; Phe 41.8, 31.8, 34.7, 41.7, 27.6; Thr 37.8, 29.7, 31.7, 38.4, 26.4; AID (%), Arg 68.7, 67.1, 67.6, 72.6, 67.9, His 50.6, 49.5, 50.8, 54.3, 52.8; Ile 58.9, 56.0, 58.6, 63.2, 57.2, Leu 59.1, 56.6, 58.8, 63.6, 57.6; Lys 59.6, 59.0, 60.5, 63.6, 61.8; Met, 56.6, 56.1, 58.0, 61.2, 58.2; Phe 63.7, 59.5, 61.9, 66.8, 60.8; Thr 51.5, 51.7, 53.6, 57.2, 53.8, respectively. The DF of all the amino acids was higher (P<.01) when steers were fed the hay either stored without cover or inside the oven, as compared with the other storage conditions. Storing the hay inside a cool room produced the lowest DF of all the amino acids. The AID of all the amino acids was higher when the steers consumed the hay stored inside the oven; no difference was observed between the other storage systems. These data suggest that alfalfa hay stored at high temperatures produces bypass proteins in steers without affecting the intestinal digestibility of amino acids.

Key Words: Alfalfa hay, Storage, Amino acid digestibility

T201 Effect of method of conservation on the n-alkane C_{31} concentration of alfalfa and two temperate grasses.

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The objective of the present study was to compare the effect of two methods of herbage conservation (freezing in liquid nitrogen or refrigeration) on the C_{31} concentration of two grasses (ryegrass and kikuyo grass) and alfalfa.

METHODOLOGY: Perennial ryegrass (*Lolium perenne*) and kikuyo grass (*Pennisetum clandestinum*) samples were collected at a site located at 2,800 m above sea level, where the mean temperature is 9.9 °C and the mean annual rainfall is 1,800 mm. Alfalfa samples (*Medicago sativa* L. var. Puebla 76) were collected at a site located at 2,250 m above sea level, where the mean annual temperature oscillates between

12 and 18 °C and the mean annual rainfall is 625 mm. The aerial part of several plants from each forage species was collected, thoroughly mixed and sub-sampled. **Refrigerated** samples were kept in sealed plastic bags in a plastic cooler with blue ice. **Frozen** samples were placed inside small plastic bags and frozen in liquid nitrogen. The samples were transported to the laboratory and 24 hours later they were freeze-dried. Freeze-dried forage samples, worked in triplicate, were ground (1 mm) and subjected to a Soxhlet extraction, using an internal standard (C_{34}) and n-heptane. The saponification procedure used ethanolic KOH and the reflux time was 3.5 hours. Samples were purified using a silica gel column and were injected into an HP 5890 SII gas chromatograph. Data (mg/Kg of C_{31}) were analyzed as a completely randomized design with a factorial arrangement of treatments.
RESULTS: The forage x method interaction was significant ($P \leq 0.01$). Refrigeration decreased the concentration of C_{31} in alfalfa (218.2 vs 239.3 mg/Kg) and kikuyo grass (41.8 vs 50.7 mg/Kg), but not in ryegrass (36.9 vs 36.3 mg/Kg) (SEM=2.9).
CONCLUSION: Freezing in liquid nitrogen appears to be a better method of forage conservation for n-alkane analysis than refrigeration, but there may be forage species differences.

Key Words: n-Alkane, Forages, Conservation

T202 The effect of milling on physical material lost through dacron bags of 53 micron pore size. C. W. Cruywagen*[1], G. Bunge, and L. Goosen, [1]*University of Stellenbosch, South Africa*.

Dacron bags of 53 μ pore size are typically used in in sacco trials to determine nutrient degradability values. The standard procedure recommended by the 2001 NRC Nutrient Requirements of Dairy Cattle involves the milling of feed samples through a 2 mm screen. A certain proportion of a feed sample would be milled to extremely fine particles (EFP) that could potentially be washed out of the dacron bag. The proportion of EFP would depend on the type of feed, e.g. hay vs. silage, alfalfa vs. wheat straw, etc. The presence of EFP could over estimate the soluble fraction of a nutrient which is usually determined by calculating the nutrient loss following a washing cycle in water. In the present study, samples of alfalfa hay and wheat straw were sieved through a 60 μ stainless steel mesh. The material that passed through the mesh screen is referred to as fine material (FM), while the material remaining on the screen is referred to as course material (CM). For both alfalfa hay and wheat straw, samples of FM, CM and unsieved material (UM) were analyzed for NDF and were also used in dacron bags to determine dry matter (DM) losses into water during a 15 minute washing machine cycle. The NDF content (%±SD) of FM, CM and UM was 52.5 (±1.5), 43.5 (±1.0) and 49.6 (±0.7), respectively, for alfalfa hay and 62.1 (±0.4), 49.7 (±0.9) and 60.2 (±0.1), respectively, for wheat straw. For alfalfa hay, DM losses (%±SD) from dacron bags after washing were 57.8 (±4.4), 25.6 (±0.3) and 32.5 (±0.6) for FM, CM and UM, respectively and for wheat straw DM losses were 62.2 (±2.9), 25.6(±0.8) and 32.2 (±0.4) % for FM, CM and UM, respectively. It was concluded that significant amounts of sample material could potentially be washed out from dacron bags during a water washing cycle and that soluble nutrient fractions of feedstuffs could be over estimated if care is not taken. More research is required to determine magnitudes and composition of fractions and nutrient losses due to washing cycle before final recommendations can be made.

Key Words: Particle size, In sacco, NDF

T203 Measuring detergent insoluble protein and fiber in corn silage using crucibles or filter bags. G. Ferreira*[1,2] and D. R. Mertens[2], [1]*Univ. of Wisconsin*, [2]*USDA-ARS, US Dairy Forage Research Center, Madison, WI*.

Objectives of this research were to compare the crucible (CR) and filter bag (FB) methods of measuring detergent insoluble protein and fiber in corn silage and to evaluate the differences in neutral detergent insoluble protein with or without the use of sodium sulfite and amylase. Thirty-three diverse corn silages (14.9 to 37.1% ADF and 26.8 to 57.4% NDF) were analyzed in duplicate. The CR method followed Official Methods with heating to boiling in 5 min and refluxing for 60 min, followed by three 5-min soakings in water, and two soakings in acetone. The FB method used an in-house procedure that involved heating for 15 min and extracting for 60 min in a closed Ankom Fiber Analyzer, followed by four 5-min washes using hot water (with closed chamber and heating), and two soakings in acetone. Three NDF modifications were used: original NDF (with sulfite and without amylase), neutral detergent residue (NDR?without sulfite and with amylase), and aNDF (with sulfite and amylase). Average blank-corrected results were: 26.6 or 26.1% ADF; 43.4 or 43.3% aNDF; 45.7 or 44.8% NDR; and 45.6 or 47.2% NDF for CR or FB, respectively. Mean fiber differed between CR and FB, except for aNDF. However, when FB was regressed against CR, only NDR yielded an intercept different from zero and slope different from one. CR gave lower fiber for ADF and NDR, but higher fiber for NDF compared to FB. With the exception of NDF, the standard errors of duplicate analyses were less for CR compared to FB: .25 vs .53% ADF; .47 vs .54% aNDF; .42 vs .47% NDR; and 1.08 vs .77% NDF, respectively. Acid detergent and neutral detergent with sulfite obtained lower insoluble crude protein (ICP): .40 or .38% ADICP; .86 or .97% aNDICP; 1.25 or 1.42% NDRICP; and .80 or .95% NDFICP for CR or FB, respectively. Except for ADICP, ICP differed between CR and FB. The in-house FB method obtained results similar to the CR method for aNDF. Small statistical differences in ADF and ICP between CR and FB may not be important in relation to variation in fiber analyses among laboratories.

Key Words: Fiber, Insoluble protein

T204 Orchardgrass soluble carbohydrate and digestibility levels in sward horizons under defoliation sequences initiated in morning and evening. T. C. Griggs[1], J. W. MacAdam[1], H. F. Mayland*[2], and J. C. Burns[3], [1]*Utah State University, Logan, UT*, [2]*USDA-Agricultural Research Service, Kimberly, ID*, [3]*USDA-ARS, Raleigh, NC, and North Carolina State Univ., Raleigh, NC*.

Diurnal cycles of nonstructural carbohydrates (TNC) in forage canopies, and higher TNC levels for hay cut in evening than in morning, have been documented. Temporal patterns of TNC and dry matter digestibility (DMD) have not been assessed in sward horizons under rotational grazing. Timing of herbage allocation in pastures may impact the daily balance of sward photosynthetic gain and respiratory loss and therefore energy intake by livestock. Our objective was to compare TNC and DMD levels in horizons of an orchardgrass sward under sequential clipping during a 24-hr period initiated in morning (AM) or evening (PM). Vegetative orchardgrass initially 40 cm tall was clipped to remove 0.33 of current sward height every 6 hr to a final stubble height of 8 cm. Clipping sequences were initiated at 7 AM and 7 PM in October, 2000 and June and August, 2001 in a randomized block design with 3 replications. Only the uppermost horizon in sequentially-clipped patches was analyzed at each time point. Whole-canopy control samples were also collected at each time point and sectioned into horizons. All samples were analyzed for levels of TNC and in vitro true dry matter digestibility. Conditions varied from cold and cloudy with little diurnal temperature fluctuation in October to high irradiance, temperatures, and temperature fluctuations in summer. Diurnal patterns of TNC and DMD levels were dissimilar among seasons. Levels of TNC and DMD in individual horizons of control samples were unrepresentative of those in uppermost horizons in clipped treatments. In October, horizon TNC levels increased throughout each 24-hr period, but to a greater extent in the PM treatment. In summer, horizon TNC levels decreased over 24 hours in the PM treatment, but increased and decreased diurnally in the AM treatment. Mean diurnal TNC levels for AM and PM treatments were 13.4 vs. 14.8, 8.8 vs. 8.2, and 5.8 vs. 7.1% for October, June, and August, respectively. In all seasons, DMD decreased from approximately 92 to 80-85% with sward depletion, presumably as a function of increasing fiber level, and displayed similar patterns among clipping treatments in spite of differences in patterns of TNC levels.

Key Words: Pasture nutritional value, Herbage composition, Orchardgrass soluble carbohydrates

T205 Nutritional quality of seventy four accessions of elephantgrass (*Pennisetum purpureum* Schum) from Embrapa's Brazil collection. A. V. Pereira[1], H. Carneiro*[1], F. de S. Sobrinho[1], and M. Villaquiran[2], [1]*EMBRAPA CNPGL, Minas Gerais, Brazil*, [2]*E. (Kika) de la Garza. American Institute for Goat Research, Langston, OK*.

Elephant grass is an important forage in Brazilian livestock production systems, especially for dairy cattle production. For several years Embrapa, Brazil's national agriculture research service, has conducted plant breeding studies on elephantgrass and has developed several accessions. However, Embrapa has not evaluated the nutritional quality of the various accessions of elephantgrass. The objective of this study was to determine nutritional quality of Embrapa's elephantgrass collection. Over a 3-yr period, CP, in vitro and in vivo digestibilities (DIG), lignin (L), cellulose (C), and silica (S) of leaf blade and of whole green chopped plants of 74 elephantgrass accessions were evaluated at three different cutting (harvesting) periods of 30, 60, and 90 d. Data were analyzed as a complete randomized block with in two replicates. The statistical model included forage type (leaf vs whole plant), accession, cutting day, all two-way interactions, and the three-way interaction. The greatest variability ($P < 0.02$) was found at 60 d among all accesses. Differences ($P < 0.05$) were found among accessions in nutritional quality except C, L, and S. Crude protein decreased sharply with age from 17 to 4% CP for 30 to 90 day old grasses. For in vitro DIG, largest variability was from 68 to 49% for 30 to 90 day old grasses ($P < 0.02$). Considering the sharp decrease in CP, elephantgrass should be grazed around 30 d and no more than 60 d. For green chopping, CP after 60 d is considered extremely low for rumen function. The differences among nutritional qualities in the elephantgrass accessions could be responsible for wide differences in growth and lactation performance of grazing ruminants. Further research by plant breeders is needed to improve Embrapa's elephantgrass accessions in CP, and in vitro DIG.

Key Words: Elephantgrass, Nutrition Quality, Accession

T206 Yield and growth of *Panicum maximum* Jacq under different fertilization levels with N and P in humid tropical forest conditions. A. Rodriguez-Petit* and J. Zambrano, *Universidad Nacional Experimental Sur del Lago*.

An experiment was carried out to evaluate the yield and growth of the guinea grass (*Panicum maximun* Jacq) under different levels of N and P. The soils was taxonomically classified as Inceptisols, with pH 5.6. Three levels of N (0, 100 and 200 kg/ha/year) and three of P (0, 50 and 100 kg/ha/year) were evaluated in a design of split-pot with factorial arrangement in the secondary plot and four replications. The variables were height (H), total yield (TY), leaf yield (LY), stem yield (SY) and dead material yield (DMY) and were measured every 7, 21 and 35 days in three 35 day cycles. The guinea grass showed significant differences ($P<0.01$) for H, the highest value (172.33 cm) was obtained with the interaction of 200 kg N/ha and 100 kg P/ha. The most highest values to TY, LY and SY were observed at the 35 day by the simple effect of 200 kg N/ha (3940.31, 2381.47 and 1403.18 kg/MS/ha, respectively). The DMY not show statistical differences by treatments effect. The best performance of the guinea grass under this trial conditions was obtained every 35 days with the application of 200 kg N/ha/year and 100 kg of P/ha/year.

Key Words: *Panicum maximum*, Fertilization, Yield

T207 Evaluation of energy efficiency and CO_2 emission from forage production systems. M Wachendorf*, M Kelm, and F Taube, *University of Kiel, Kiel, Germany*.

Fossil energy use in agriculture is an important indicator for both the use of limited fossil resources and the release of carbon dioxide (CO_2) and other combustion gases. Based on experimental data, gathered within an integrated project on nitrogen fluxes in intensive dairy farming, an analysis of fossil energy input and energy efficiency in forage production from permanent grassland and maize was conducted. The grassland experiment consisted of all combinations of five defoliation systems, i.e. cutting-only, rotational grazing, mixed systems with one or two silage cuts plus succeeding rotational grazing respectively, and simulated grazing, four mineral N application rates (0, 100, 200, and 300 kg N ha^{-1} yr^{-1}), and two slurry levels (0 and 20 m^3 slurry ha^{-1} yr^{-1}). Prior to the start of the experiment, white clover was established in all plots by oversowing. Silage maize was grown without and with undersown ryegrass and comprised different rates of mineral N (0, 50, 100, 150 kg N ha^{-1} yr^{-1}) and slurry application (0, 20, 40 m^3 ha^{-1} yr^{-1}). Energy efficiency consistently decreased with increasing rates of mineral N application both in permanent grassland and silage maize. Application of 20 m^3 slurry per hectare increased energy efficiency in grazed grassland and silage maize, but not in cut grassland. Net energy yields of all grassland defoliation systems were much lower compared to maize at the same level of energy input. Silage maize was thus much more energy-efficient due to high net energy yields at low to moderate levels of nitrogen and energy input. The figures for fossil energy input and CO_2 emissions showed an almost similar pattern since the CO_2 emission factors for N fertilizer and diesel fuel were in a similar range. A CO_2 mitigation of 300-500 kg CO_2 ha^{-1} seems to be possible in forage production without a significant reduction in productivity. It is proposed that the environmental performance of dairy farming systems can be improved substantially by a change from N-fertilized grass-only swards towards unfertilized clover/grass swards and silage maize.

Key Words: Forage production, CO_2 emission, Energy efficiency

T208 Impact of maturation on cell wall degradability in corn stem internodes. H. G. Jung*, *USDA-ARS, St. Paul, MN*.

Degradability of forage cell wall (CW) material declines with maturity; however, the causes for this decline have not been adequately described. Stem CW development and degradability were observed in three non-related corn hybrids. The fourth above-ground stem internode was collected in 1998 and 1999 from a randomized complete block design field trial with two replications. Sampling began when the internode was 1-cm long (late June) and subsequent samples were collected 2, 4, 8, 12, 19, 26, 40, 68, and 96 d later. Internodes were analyzed for CW concentration and composition, and 24- and 96-h in vitro rumen degradability. While small significant differences were observed in CW development and degradability of the three corn hybrids, impact of maturity was much greater and all hybrids responded similarly to maturation. Stem internodes increased in length and diameter until 12 d after sampling began. CW concentration was 31% of internode OM in the first samples and did not change during the next 8 d of development. Subsequently, CW concentration increased at each sampling until a maximum (73%) was reached 26 d after sampling began, later CW concentration declined (minimum of 55%) because of sucrose accumulation in the stem. CW glucose and xylose concentrations increased from 35 and 18% of CW, respectively, in the first sample to 52 and 24% of CW 12 d later. In contrast, Klason lignin concentration declined from 11% of CW to 6% by 8 d after sampling had begun and then increased to 20% of CW by d 40. Degradability of internode CW polysaccharides was high and unchanged through d 4 (88 and 93% after 24 and 96 h, respectively), but then declined steeply to 26 and 39% (24 and 96 h, respectively) by d 68. Lignin/polysaccharide cross-linking by ferulates matched the beginning of the decline in CW degradability better than lignin concentration because these ferulates began to increase in concentration at the same time as the decline in degradability started whereas lignin concentration was still decreasing. These data indicate that the decline in CW degradability associated with maturation of grasses is a function of both lignin and ferulate cross-linking.

Key Words: Corn Stem, Cell Wall, Degradability

Dairy Foods: Cultured dairy products and dairy proteins

T209 Dissociation of casein supramolecules. B. S. Oommen* and D. J. McMahon, *Department of Nutrition and Food Sciences, Utah State University*.

Microstructure of dissociated caseins in bovine milk was studied using transmission electron microscopy. Cold and warm milk was treated with excess EDTA and glucono-δ-lactone to dissociate the colloidal casein aggregate. This was diluted 100 times, and caseins were adsorbed on to parlodion coated copper grids. Parlodion coated copper grids were coated with poly-L-lysine to improve the adsorption of protein on to the film. These grids were stained using uranyl acetate and oxalic acid, flash frozen in liquid nitrogen-cooled Freon 22, and freeze dried so that the native casein structure could be preserved. Grids were viewed using a transmission electron microscope and images were photographed at various magnifications ranging from 7,000x, to 250,000x at 80 kV. Cold milk EDTA-treatment resulted in linear and spherical aggregates of proteins. Warm milk EDTA- treatment resulted in filigreed ring-like protein aggregates. Fixing of the colloidal casein particles using gluteraldehyde before EDTA-treatment preserved the supramolecular structure of ca-