

Forages and Pastures: Dairy Forages

813 Milk production and feed efficiency in dairy cows fed corn silage hybrids varying in fiber digestibility. L. E. Chase*, *Cornell University, Ithaca, NY.*

A trial with lactating dairy cows was conducted to examine the relationships between corn silage hybrid fiber digestibility, milk production, dry matter intake and feed efficiency. Brown midrib (BMR), NutriDense (ND) and a conventional (C) hybrid were used. Twenty cows were assigned to each treatment at 7–12 d after calving and individually fed the treatment rations for 10 weeks. The same ration was fed to all cows with the only difference being the corn silage hybrid used. This ration contained 59% corn silage, 5.5% straw and 35.5% grain. Nutrient composition of this ration averaged 46.5% DM, 17.4% CP and 34.1% NDF. Nutrient composition of the BMR hybrid was 32.9% DM, 8.4% CP, 38.6% NDF and 36.5% starch. The ND hybrid was 32.9% DM, 8.36% CP, 41.3% NDF and 33.6% starch. The conventional hybrid was 36.3% DM, 7.8% CP, 38.3% NDF and 39% starch. NDF digestibility (30-h) values were 59.6, 46.8 and 49.4% for the BMR, ND and C hybrids. Data analysis was done using the GLM procedure in SAS with a covariate. Cows fed the BMR corn silage had greater DMI (26.1 kg/day; SEM = 0.32) than either the ND (23.5 kg/day) or the C (24.2 kg/day) hybrids ($P < 0.001$). Daily milk production was also greater (46.6 kg/day; SEM = 0.71) for cows fed the BMR hybrid ($P < 0.0047$). Milk production was not different between the C (43.6 kg/day) and ND (43.5 kg/day) hybrids. Milk fat did not differ between the 3 hybrids. Milk true protein was lower in cows fed the ND ration (2.67%; SEM = 0.027) than cows fed either the BMR (2.77%) or C (2.78%) rations ($P < 0.007$). Feed efficiency (kg 3.5% FCM/kg DMI) was greater for cows fed the ND ration (1.87; SEM = 0.028) compared with either BMR (1.76) or C (1.74) rations ($P < 0.002$). Dairy cows fed BMR corn silage had higher milk production in this trial. However, cows fed the ration containing ND corn silage had significantly higher feed efficiency.

Key Words: corn silage, feed efficiency

814 Performance of dairy cows fed high water soluble carbohydrate sorghum silage. S. Amer* and A. F. Mustafa, *McGill University.*

Twelve lactating Holstein cows were used in a cross-over study ($n = 2$) to determine the performance of dairy cows fed high water soluble carbohydrate sorghum silage (SS, sweet sorghum, cultivar CSSH45) relative to alfalfa silage (AS). The sweet sorghum cultivar contained 8% water soluble carbohydrates while the regular counterpart (CFSH30) contained 3% water soluble carbohydrates. Sweet sorghum was harvested at early heading stage while alfalfa was a second cut crop. Experimental periods consisted of 14 d of diet adaptation and 8 d of data collection. Two isonitrogenous diets with 50:50 forage: concentrate ratio were formulated. Sweet sorghum silage and AS constituted 70% of the forage in each diet. Two lactating Holstein cows fitted with ruminal cannulas were used to determine the effects of dietary treatments on ruminal fermentation parameters. Relative to AS, SS contained 58% more NDF, 70% less CP but similar ADF concentration. Cows fed SS consumed ($P < 0.05$) less DM (23.3 vs. 26.1 kg/d) and CP (4.1 vs. 4.7 kg/d) but more ($P < 0.05$) NDF (9.1 vs. 7.9 kg/d) than those fed AS. Milk yield (33.5 vs. 36.7 kg/d) was higher ($P < 0.05$) for cows fed AS than for those fed SS. However, energy-corrected milk was similar for both dietary treatments (average 37 kg/d). Cows consumed SS produced milk with greater ($P < 0.05$) concentrations of fat and total solids but lower ($P < 0.05$) concentrations of lactose and SNF. Ruminal pH was higher ($P < 0.05$) whereas ruminal NH₃-N was lower ($P < 0.05$) for

cows fed SS than those fed AS. Total VFA concentration and molar proportions of propionate and butyrate were greater ($P < 0.05$) whereas molar proportion of acetate was lower ($P < 0.05$) for cows fed SS than for those fed AS. It was concluded that SS when compared with AS, had a negative impact on feed intake and milk yield, whereas energy corrected milk and milk efficiency were similar.

Key Words: sweet sorghum silage, alfalfa silage, dairy cows

815 Effects of water soluble carbohydrate content of ensiling characteristics, chemical composition and in vitro digestibility of sorghum silage. S. Amer*¹, P. Seguin¹, F. Hassanat², R. Berthiaume², and A. Mustafa¹, ¹*McGill University, Ste-Anne-de-Bellevue, QC, Canada,* ²*Dairy and Swine Research and Development Centre, Lennoxville, QC, Canada.*

A study was conducted to determine the effects of water soluble carbohydrate (WSC) concentration on ensiling characteristics, chemical composition and in vitro digestibility of forage sorghum in a completely randomized study. A low (2.5% of DM) and a high (8% of DM) WSC forage sorghum cultivars were field-grown (3 plots per cultivars) and harvested at early heading stage. Following harvest, forages were ensiled in mini-silos for 0, 2, 4, 8, 16, and 45 d. Results showed that both silages went through a rapid fermentation as indicated by the significant decline in pH between d 0 d 16 post-ensiling. However the decline in pH at all ensiling times was greater for high than low WSC sorghum silage. Lactic acid concentration followed a trend similar to that of pH. Chemical analysis of the 45-d silages showed that high WSC sorghum silage contained 11% less CP and 35% less acid detergent lignin than low WSC sorghum. However, NDF and ADF concentrations were similar for both silages. Asymptotic gas production and degradation rate were both higher for high than for low WSC sorghum silage. In vitro true DM digestibility was greater for high than for low WSC sorghum silage while in vitro NDF digestibility was unaffected by WSC concentration. In vitro protein synthesis as well as molar proportions of volatile fatty acids were similar for both types of sorghum silage. We concluded that increasing WSC concentration improved the fermentation and digestibility of forage sorghum silage.

Key Words: water soluble carbohydrate, sorghum silage, in vitro digestibility

816 A meta-analysis approach to model the effect of increased organic matter digestibility on milk solids production from dairy cows fed fresh ryegrass. D. Pacheco*¹, R. E. Vibart¹, and B. A. Barrett², ¹*Food, Metabolism & Microbiology, AgResearch Grasslands, Palmerston North, New Zealand,* ²*Forage Improvement, AgResearch Grasslands, Palmerston North, New Zealand.*

Research efforts are underway to produce temperate forages with increased digestibility of NDF (NDFd) and organic matter (OMd) as a means for increasing the feeding value (FV: intake x nutritive value) of grazed forage. A database of feed composition and milk production comprising 132 treatment means from publications in which lactating dairy cows were fed at least 70% of the daily DMI as fresh perennial ryegrass (*L. perenne*) was collated. A 2 step approach using the MIXED procedure in SAS to account for random effects of study allowed quantifying the effect of OMd and other significant variables on the 2 elements of FV: prediction of DMI, and prediction of the feed conversion efficiency (FCE) expressed as milk solids yield (g of milk protein plus

milk fat) per kg of DMI. Initial bivariate data exploration determined that DMI had significant ($P < 0.01$) linear relationships with days in milk (DIM), body weight (BW) and OMD; and a quadratic effect of DIM was also apparent. The best model (RMSPE = 1.13; adjusted $r^2 = 0.62$) was $DMI = 0.0188 (SE 0.0044) \times BW (kg) + 0.0328 (0.015) \times DIM - 0.0002 (0.00006) \times DIM^2 + 0.0662 (0.0289) \times OMD (g/100 g)$. Exploration of the relationships of FCE with variables in the database determined that FCE and DIM had a linear, negative relationship ($P < 0.01$). Feed conversion efficiency and OMD had a significant ($P < 0.05$) albeit weak relationship, with OMD values having little effect on FCE when DIM were greater than 200. The best model (RMSPE = 4.44; adjusted $r^2 = 0.94$) was $FCE = 54.38 (SE 19.80) - 0.254 (0.04) \times DIM + 0.855 (0.24) \times OMD$. In seasonal, spring calving dairy systems such as the one predominating in New Zealand, the potential responses in milk production from ryegrass with greater OMD need to be assessed accounting for the timing of the expression of the improved forage trait. Improvements in OMD need to be achieved as early as possible during lactation to benefit both DMI and FCE. Responses in milk solids yield to greater OMD occurring after ryegrass transitions from vegetative to reproductive may be compromised by decreasing FCE in advanced lactation.

Key Words: ryegrass, digestibility, milk production

817 Effects of microbial corn silage inoculants on silage fermentation, microbial contents, aerobic stability, and milk production under field conditions. N. B. Kristensen^{*1}, K. H. Sloth², O. Højberg¹, N. H. Spliid¹, C. Jensen³, and R. Thøgersen³, ¹Aarhus University, Tjele, Denmark, ²Agro Tech A/S, Aarhus, Denmark, ³Danish Agricultural Advisory Service, Aarhus, Denmark.

The present study aimed to investigate the effects of 2 corn silage inoculation strategies (homofermentive vs. heterofermentive) under field conditions and to monitor responses in silage variables and milk production over the feeding season from January to August. Thirty 9 commercial dairy farms and 7 contractors participated in the study. Farms were randomly assigned to 1 of 3 treatments: Control (non active), Lactisil (inoculation with 1×10^5 *Lactobacillus pentosus*/g fresh crop and 2.5×10^4 *Pediococcus pentosaceus*/g fresh crop, Chr Hansen A/S; Hørsholm, Denmark), and Lalsil Fresh (inoculation with 3×10^5 *Lactobacillus buchneri* NCIMB 40788/g fresh crop (Lallemand Animal Nutrition, Blagnac, France). Data were analyzed by the MIXED procedure in SAS using a model containing the fixed effects of treatment, time, and their interaction. Contractor by treatment was designated as a random effect. Inoculation with Lactisil was without effect ($P > 0.10$) on any of the measured fermentation variables and aerobic stability except for a trend ($P < 0.10$) on ethanol. Inoculation with Lalsil Fresh doubled ($P < 0.01$) the aerobic stability (temperature increase 2.5°C above ambient $19.0 \pm 0.5^\circ\text{C}$) being 37, 38, and 80 ± 8 h for control, Lactisil, and Lalsil Fresh, respectively. Lalsil Fresh increased ($P < 0.01$) silage pH and contents of acetic acid, propionic acid, propanol, propyl acetate, 2-butanol, propylene glycol, ammonia and free amino acids. Lalsil Fresh increased ($P < 0.01$) the counts of total lactic acid bacteria and reduced ($P < 0.01$) yeast counts. Inoculation treatment did not affect ($P = 0.49$) milk production at the farms when comparing actual test day results with predicted milk production based on the previous 2 yr test data. Under field conditions, the homofermentive inoculant was generally without effects on corn silage fermentation whereas heterofermentative inoculation increased aerobic stability and the silage contents of numerous fermentation variables.

Key Words: corn silage, fermentation, inoculation

818 Some factors with influence on the silage acidity and the aerobic stability. Y. Acosta Aragón^{*1}, K. Schoendorfer², S. Pasteiner¹, A. Schatzmayr², and G. Boeck², ¹Biomín Holding GmbH, Herzogenburg, Lower Austria, Austria, ²Biomín Research Center, Tulln, Lower Austria, Austria.

The aim of this study was to quantify the influence of different silage quality parameters on the decrease of the pH value in the silage and the aerobic stability. Seven different trials with different substrates were ensiled under laboratory conditions in buckets (5 L). The products under study were the biological silage inoculants Biomín BioStabil Plus (grass, alfalfa) and Biomín BioStabil Mays (whole crop maize and wet corn grain silages), blends of homo- and heterofermentative lactic acid bacteria (*L. plantarum*, *E. faecium* and *L. brevis*), as well a product A (similar blend). The opening of the model silos occurred after 90 d. The changes in the pH values, the fermentation acid contents, ethanol, as well as the aerobic stability (AS) during 7 d (Honig, 1990), the dry matter (DM) losses and an organoleptic assessment using a negative point system according to the DLG- Schlüssel (2006) were measured. The database created with the results of the trials was analyzed using one way ANOVA and post hoc tests (Duncan, $P < 0.05$), as well as regressions to find out which fermentation parameters (DM; content of glucose and fructose, ethanol, propandiol, acetic, propionic, butyric acid and total acid; and the proportions between acetic acid and total acid, between lactic acid and total acid; thereafter named as variables entered) have an influence on the pH value content and the AS. According to the results exposed above, the acidification of the silages is determined by different parameters, in which the Lactic acid content plays an important role. The inclusion of the product tested bettered the acidification in the grass silages. The end pH- value was not affected by the use of additives in alfalfa and corn silages. Only the parameters acetic acid and ethanol played a negative role in the decreasing of the end pH-value. The AS is influenced negatively mainly by the DM, fructose, ethanol and the proportion of lactic acid to the total acid. The acetic and butyric acid content as well as the proportion between acetic and lactic acid and between acetic and the total amount of acid plays a positive role.

Key Words: silage, acidity, aerobic stability

819 Effect of herbage mass and pasture allowance on perennial ryegrass sward structure and milk yield during the grazing season. A. I. Roca-Fernández^{*1}, M. O'Donovan², J. Curran², and A. González-Rodríguez¹, ¹Agrarian Research Centre of Mabegondo, La Coruña, Galicia, Spain, ²Moorepark Dairy Production Research Centre, Fermoy, Co. Cork, Ireland.

The effect of herbage mass (HM) and pasture allowance (PA) on dairy systems varies as the grazing season progresses due to changes in the sward structure. The longer term effects of HM and PA on milk output and grass production must be studied to identify the optimum level of HM and PA to graze. The aim of this study was to investigate the effect of 2 pre-grazing HM (Low, L-1600 and High, H-2400 kg DM ha⁻¹) and 2 PA (Low, L-15 and High, H-20 kg DM cow⁻¹ d⁻¹) on the sward composition of perennial ryegrass in the upper and lower sward horizon (<and >4 cm) and its influence on milk yield. The study was conducted at Moorepark in rotationally grazed pastures, with each treatment assigned farmlets from April to October. Sixty-four spring calving Holstein-Friesian cows (primiparous and multiparous) were balanced on calving date and milk yield. Cows were randomized in a block design with a 2x2 factorial arrangement of treatments (LL, LH, HL and HH). Daily fresh herbage was allocated. Milk yield was recorded daily and milk composition twice weekly. Data was analyzed using PROC MIXED in SAS. The variables included in the model were HM,

PA and the interaction between HM and PA. The low HM treatments completed 9 grazing rotations compared with 7 rotations for the high HM treatments. Mean stocking rates achieved were of 4.0 (LL), 3.85 (LH), 4.01 (HL) and 3.93 cows ha⁻¹ (HH). Sward utilization was greater ($P < 0.001$) when animals offered low PA (98.0%) compared with high PA (89.9%). Stem and dead DM yield were lower ($P < 0.001$) in the upper sward horizon for the low HM (221 and 170 kg ha⁻¹, respectively) compared with high HM (388 and 303 kg ha⁻¹, respectively). Grazing swards with low HM showed a tendency to increase ($P < 0.07$) milk yield and increased ($P < 0.05$) milk protein yield. The high PA had a positive effect ($P < 0.001$) on milk yield (19.5 vs. 18.1 kg day⁻¹, respectively) and milk solids (1.45 vs. 1.36 kg cow⁻¹, respectively) compared with low PA. The highest performance values were achieved by grazing swards at low HM and allocating cows at high PA which is linked to increased nutritive value in the swards.

Key Words: herbage mass, pasture allowance, sward structure

820 High reliance on grass for an improved milk fatty acids composition. A. I. Roca-Fernández^{*1}, A. González-Rodríguez¹, O. P. Vázquez-Yáñez¹, and J. A. Fernández-Casado², ¹*Agrarian Research Centre of Mabegondo, La Coruña, Galicia, Spain*, ²*Agrarian and Fito-pathologic Laboratory of Galicia, La Coruña, Galicia, Spain*.

Milk from grazing dairy cows had a higher content of polyunsaturated fatty acids (PUFA), especially more conjugated linoleic acid (CLA), and lower proportions of saturated fatty acids (SFA) than milk from silage-fed cows. Nevertheless, few researches are made trying to evaluate the influence of grazing time in milk fatty acids (FA) composition and its variation across the grazing season. The aim of this study was to investigate the effect on milk FA profile of different proportions of grazing in the ration of dairy cows and its variation across the season. Sixty-one autumn calving Holstein-Friesian dairy cows were balanced on calving date and milk yield and randomly assigned to one of 3 grazing treatments (G0: zero-grazing, G12: 12-h grazing and G24: 24-h grazing). Daily milk yields and weekly milk composition were registered from each cow. Sward characteristics and grass quality of each paddock was determined by NIRS System 5000 and milk FA composition was performed using gas chromatography. Daily herbage allowance was higher ($P < 0.05$) in G24 than in G12 (20.94 and 10.76 kg DM cow⁻¹ day⁻¹, respectively). Grazing swards 24-h caused a decrease ($P < 0.05$) in short and medium chain fatty acids (SCFA, 8.34 and MCFA, 39.24 g 100 g⁻¹ of FA in milk, respectively) and an increase ($P < 0.05$) in long chain fatty acids (LCFA, 42.29 g 100 g⁻¹ of FA in milk). The highest ($P < 0.05$) content of monounsaturated and polyunsaturated fatty acids in milk (MUFA, 25.20 and PUFA, 4.24 g 100 g⁻¹ of FA, respectively) were observed in G24. The CLA content showed an increase ($P < 0.05$) with grazing time, ranging from 0.72 to 1.23 g 100 g⁻¹ of FA in milk for G12

and G24, respectively. The FA profile of milk showed some seasonality across the grazing season. In spring, the levels of CLA were 3 times higher in milk from cows grazing grass 24-h than in cows fed silage while at the end of the summer and in autumn these differences were reduced at half. High reliance on grass for sustainable dairy production systems might be a good tool to increase the added value of milk with an improved on milk FA composition.

Key Words: dairy cow, milk fatty acids composition, grazing time

821 Effect of stocking rate on sward characteristics and milk performance in sustainable dairy farms from humid areas. A. I. Roca-Fernández^{*}, A. González-Rodríguez, and O. P. Vázquez-Yáñez, *Agrarian Research Centre of Mabegondo, La Coruña, Galicia, Spain*.

Stocking rate (SR) is one of the most important factors to control in sustainable dairy production systems from humid areas due to its influence on daily herbage allowance (DHA), herbage mass (HM), pasture dry matter intake (PDMI) and sward quality as well as its role on milk performance. The aim of this study was to investigate the effect of SR on PDMI, sward characteristics and milk yield of 44 spring (S, 15th February) and 28 autumn (A, 30th October) calving Holstein-Friesian cows grazing in rotationally grazed pastures of perennial ryegrass and white clover, stocked at medium (M, 3.9 cows ha⁻¹) and high SR (H, 5.2 cows ha⁻¹). Cows were balanced on calving date and milk yield and randomized in a block design with a 2x2 factorial arrangement of treatments (MS, MA, HS and HA). Milk yield and composition were determined. Pasture production, quality and sward utilization were measured during the grazing season. Cows grazed a total area of 19.2 ha, divided into 32 experimental paddocks. The medium SR completed 4 grazing rotations compared with 5 rotations for the high SR. The DHA and PDMI were lower ($P < 0.05$) in HA (14.9 and 10.3 kg DM d⁻¹, respectively) compared with MA (18.4 and 14.1 kg DM d⁻¹, respectively). The low herbage intake in HS was compensated with a higher ($P < 0.05$) sward quality (ADF, 291 g kg⁻¹; NDF, 518 g kg⁻¹; IVOMD, 781 g kg⁻¹) compared with MS (ADF, 310 g kg⁻¹; NDF, 529 g kg⁻¹; IVOMD, 756 g kg⁻¹). An improved on sward utilization was obtained in HS (83%) compared with MS (79%), enough to achieve a higher ($P < 0.05$) milk yield (HS, 25.3 vs. MS, 24.3 kg day⁻¹). The HA showed a detrimental effect on milk yield per cow (18.5 kg day⁻¹) but increased the amount of pasture harvested per hectare. There were differences ($P < 0.05$) for milk protein (HA, 32.0 and MA, 30.6 g kg⁻¹) and fat (HA, 39.9 and MA, 37.0 g kg⁻¹). This could be attributed to the higher pasture crude protein (HA, 153.8 and MA, 139.7 g kg⁻¹) to achieve a higher herbage quality. Increasing the SR is achieved higher sward utilization, grass quality, milk yield and milk quality in both, spring and autumn calving.

Key Words: dairy cow, stocking rate, sward characteristics