163 Silage process affects chemical composition and digestion site in high moisture sorghum grain. M. Torterolo[1], A. Curbelo[2], C. Cajarville[2], J. L. Repetto[1], and M. Aguerre*[1], *[1]Departamento de Bovinos, Facultad de Veterinaria, Universidad de la República, Montevideo, Uruguay, [2]Departamento de Nutrición Animal, Facultad de Veterinaria, Universidad de la República, Montevideo, Uruguay.*

The aim of this work was to evaluate the effect of silage process on chemical composition and DM digestion site in high moisture sorghum grain. Commercial paddocks of sorghum grain (n = 25) were harvested as high moisture grain. A sample was immediately frozen and another sample was ensiled in 1 L drums. For silage production, sorghum grain was compacted with a manual press, and the drum was hermetically sealed. After 60 d silages drums were opened. Chemical composition, rumen and intestinal DM digestibility and in vitro digestibility were determined. For rumen and intestinal digestibility, 3 Holstein steers equipped with ruminal and duodenal cannulas and fed a diet composed by 2 parts of forage and one part of sorghum grain were used. In vitro digestibility was determined after 48 h of incubation in a DAISY fermenter. The effect of silage process on the variables studied was analyzed with the mixed procedure of SAS. While crude protein and condensed tannins contents decreased 4 and 35%, respectively, by silage process ($P \leq 0.028$), in vitro digestibility tended to increase by silage process ($P = 0.062$) (Table 1). Although silage process did not affect total digestibility, it improved rumen degradability by 14% ($P < 0.001$) and reduced intestine digestibility by 20% ($P < 0.001$; Table 1). In conclusion, silage process produced decreases in CP and condensed tannins contents and improved in vitro digestibility. Although total digestibility was not affected, silage process produced changes in the site of digestion.

Table 1. Chemical composition, in vitro digestibility, rumen degradability, intestine and total digestibility of high moisture sorghum before (no silage) and after (silage) silage

	No Silage	Silage	SEM	*P*-value
Moisture (%)	26.2	26.5	1.92	0.298
Composition (% of DM)				
OM	98.9	98.9	0.07	0.947
Ash	1.02	1.03	0.07	0.947
NDF	9.76	9.53	0.33	0.461
CP	7.87	7.56	0.22	0.028
Condensed Tannins	0.66	0.43	0.08	0.004
In vitro rumen digestibility (%)	93.7	94.6	0.56	0.062
Digestibility (%)				
Ruminal	51.4	58.5	1.68	<0.001
Intestinal	32.0	25.4	2.17	<0.001
Total	83.4	83.8	1.07	0.744

Key Words: high moisture grain silage, intestinal digestion, rumen degradation

164 Effect of corn residue removal on cattle performance and subsequent grain yield. A. L. McGee,* J. L. Harding, T. J. Klopfenstein, S. J. van Donk, and L. A. Stalker, *University of Nebraska, Lincoln.*

A 53 ha, center pivot irrigated, corn field near Brule, Nebraska, was utilized to evaluate the effects of residue removal by grazing and baling on subsequent residue quality, grain yield, and cow performance. The field was divided into 8, 6.6 ha paddocks with 4 treatments that have been maintained for 4 yr: heavy stocking (0.8 AUM/ha), light stocking (0.4 AUM/ha), baled, and no residue removal. Pre-grazing residue was collected from 10 randomly located 0.5 X 0.5 M quadrats in each paddock and sorted into 7 plant part categories. Cattle were weighed and body condition scored before and after grazing each year. There was 16.4 kg (DM) of residue per 21.8 kg (DM) grain yield of which 5.8 kg was the bottom 2/3 of the stem, 3.4 kg was leaf, 2.7 kg was cob, 2.2 kg was leaf sheath, 1.4 kg was husk, 0.6 kg was top 1/3 of the stem, and 0.3 kg was shank which did not differ among treatments ($P \geq 0.23$). Assuming cattle eat only the leaf, leaf sheath, husk and shank, there was 7.2 kg of forage /21.8 kg grain yield after harvest. In vitro organic matter disappearance was similar among treatments ($P \geq 0.37$) and ranged from 67.6% in the husk to 36.8% in the bottom 2/3 of the stem; with the top 1/3 of the stem (43.9%), leaf (51.1%), leaf sheath (50.3%), cob (46.2%), and shank (42.9%) intermediate. Corn yields reflecting the effect of multiple years of treatment application are not different (10.7, 10.0, 10.4, 10.4 Mg/ha for high stocking, low stocking, baling and control, respectively; $P = 0.31$). Final BW was 33 kg greater ($P = 0.005$) and final BCS was 0.3 greater ($P = 0.003$) for cows assigned to the light stocking rate treatment compared with cows assigned to the heavy stocking rate treatment. Stocking rate affected cow performance but residue removal has not affected corn grain yield after 3 yr of data collection.

Key Words: corn residue quality, grazing corn residue, beef cattle

165 Effects of restricted versus conventional dietary adaptation over periods of 9 and 14 days on rumen papillae of feedlot Nellore cattle. T. V. B. Carrara[2], D. D. Millen*[2], M. D. B. Arrigoni[1], C. L. Martins[1], R. S. Barducci[1], F. T. V. Pereira[2], L. M. N. Sarti[1], M. C. S. Franzói[1], D. D. Estevam[2], L. L. Cursino[2], P. L. P. Fontes[1], R. D. L. Pacheco[1], R. A. Rizzieri[1], C. F. da Costa[1], L. D. F. Miranda[1], *[1]São Paulo State University (UNESP), Botucatu, São Paulo, Brazil, [2]São Paulo State University (UNESP), Dracena, São Paulo, Brazil.*

This study was designed to determine effects of restricting DMI of the final finishing diet (REST) as a means of dietary adaptation compared with diets increasing in concentrate (STEP) over periods of 14-d and 21-d on rumen wall absorptive surface area (RASA) of feedlot Nellore cattle. The experiment was designed as a completely randomized block with a 2 × 2 factorial arrangement with repeated measures over time, replicated 6 times (5 bullocks/pen), in which 120 22-mo-old yearling Nellore bulls (361.3 ± 30.2 kg) were fed in 24 pens for 84-d according to the treatments: STEP for 14-d and 21-d, REST for 14-d and 21-d. The STEP program consisted of ad libitum feeding of 3 adaptation diets over periods of 14-d or 21-d with concentrate level increasing from 55% to 85% of diet DM. The REST program consisted of restricted DMI of the final diet with programmed increases in feed offered until animals reached ad libitum access over periods of 14-d or 21-d. After adaptation one animal per pen was slaughtered for rumen papillae evaluations. The remaining 96 animals were harvested when achieved about 490 kg of BW. At harvest a 1-cm^2 fragment of each rumen was collected from cranial sac. Manually, the number of papillae per cm^2 of rumen wall (NOP) was determined and 12 papillae were randomly collected from each fragment; scanned, and mean papillae area (MPA) in cm^2 was measured. RASA in cm^2 was calculated as follows: 1 + (NOP*MPA) – (NOP*0.002). Animals in REST protocol had larger ($P < 0.05$) MPA (0.59 vs. 0.52) than those in STEP protocol. Significant (P

< 0.05) interactions were observed between days and harvesting dates, and protocols and harvesting dates. Animals adapted for 9-d had reduced RASA after adaptation than: 1) after finishing (19.5 vs. 33.2), and 2) animals adapted for 14-d after adaptation (19.5 vs. 26.4). Animals in STEP protocol had reduced RASA after adaptation (20.8 vs. 25.1), but no differences were detected after finishing when compared with animals in REST protocol (33.6 vs. 31.8). The REST protocol and 14-d of adaptation led to greater RASA than STEP protocol and 9-d, respectively, which could indicate lesser extent of rumen lesions. Grant provided by São Paulo Research Foundation (FAPESP), São Paulo, Brazil.

Key Words: papillae, zebu

166 Fatty acid composition of backfat, intermuscular, KPH and tail fat depot sites of Angus cross steers finished on grass or high grain diets. G. Acetoze*[1] and H. A. Rossow[2], [1]*Department of Animal Science, University of California, Davis,* [2]*Veterinary Medicine Teaching and Research Center, School of Veterinary Medicine, University of California- Davis, Tulare.*

Fatty acid profiles of backfat, intermuscular fat, KPH and tail fat depots from 15-mo old steers (n = 18) finished on a grass diet at Yolo Land and Livestock Cattle Company were compared with those finished on a grain diet at UC Davis feedlot (n = 14). Grass finished steers grazed on average 10-mo on ryegrass and white clover irrigated pasture (CP = 15.1% and ME = 2.58 Mcal/kg DM). Grain finished steers were fed an 80% corn diet (DM basis) (CP = 11.5% and ME = 2.83 Mcal/kg DM), for 4-mo. Grass finished fat depots contained higher percentages of C6:0, C12:0, C14:0, C16:0 and C20:0 while grain finished had higher percentages of C18:0 and C18:3 ($P < 0.01$) (Table 1). Percentages of C18:1 *trans*9, C18:2 *cis*9 *cis*12 and C18:2 *trans*9 *trans*12 were higher in grass finished steers than grain ($P < 0.01$) (Table 1). C18:0 content was higher in the KPH region (20.7%) compared with outer fat depots such as backfat, intermuscular and tail (16.5%, 19.7% and 14.8%, respectively, ($P < 0.05$) while C18:1 *cis*9 content was lower in the KPH region (29.8%) as compared with outer fat depots such as backfat, intermuscular and tail (46.5%, 39.9% and 48.7%, respectively, ($P < 0.05$). In conclusion, percent inner fat depots were higher in saturated fatty acids compared with outer fat depots. No interaction was found between diet and fat depots. Finishing cattle on grass provided fat with higher percentages of conjugated linoleic acid (CLA).

Table 1. Percentages of fatty acids (FA, g FA/100g FA) of grain and grass finished steers

Fatty Acid	Grain ± SE	Grass ± SE	*P*-value
C6:0	1.3 ± 0.3	2.4 ± 0.4	0.008
C10:0	1.7 ± 0.1	1.5 ± 0.2	0.401
C12:0	0.7 ± 0.1	0.9 ± 0.1	0.003
C14:0	2.4 ± 0.3	3.9 ± 0.55	0.001
C16:0	10.8 ± 2.0	19.1 ± 2.6	0.002
C18:0	22.4 ± 1.1	15.4 ± 1.4	< 0.0001
C18:1 c9	44.0 ± 2.6	39.1 ± 3.5	0.162
C18:2 c9c12	1.3 ± 0.1	2.1 ± 0.1	< 0.0001
C18:1 t9	2.2 ± 0.4	3.8 ± 0.5	0.004
C18:2 t9 t12	0.1 ± 0.1	0.4 ± 0.1	< 0.0001
C18:3	2.1 ± 0.1	1.1 ± 0.4	0.008
C20:0	0.2 ± 0.1	0.4 ± 0.1	< 0.0001

Key Words: beef cattle, fat depot sites, fatty acid profile

167 Replacing corn and soybean meal in lactating dairy cow diets with field peas (*pisum sativum*) on milk production and nitrogen utilization. J. J. Albrecht,* K. F. Kalscheur, A. R. Hippen, D. J. Schingoethe, and D. P. Casper, *South Dakota State University, Brookings.*

Sixteen lactating Holstein cows were used in a multiple 4 × 4 Latin square design with 28 d periods to evaluate replacing corn and soybean meal (SBM) with field peas (FP) on milk production and N utilization. Cows were 122 ± 47 DIM, producing 35.4 ± 6.7 kg of milk, and weighed 645 ± 82 kg at the start of the study. All diets contained 37.5% corn silage, 12.5% alfalfa hay, and a 50% concentrate mix. Diets were formulated to replace corn and SBM with FP at 0 (FP0), 12 (FP12), 24 (FP24) and 36% (FP36) (DM basis) of the diet. Milk and DMI data were collected the last 2 wk of each period and milk composition samples were collected on d 17, 18, 24 and 25. No changes in body weight or BCS were observed. With increasing inclusion rate of FP in the diet DMI, milk yield, protein %, fat yield, protein yield, and ECM all linearly ($P \leq 0.03$) decreased while MUN linearly ($P < 0.01$) increased (Table 1). Feed efficiency (ECM/DMI) responded quadratically ($P < 0.01$) to increased inclusion of FP. In the milk, total antioxidant capacity (TAC; 238, 240, 263, and 252 µmol/L FeSO47H2O) tended ($P = 0.10$) and NPN (0.166, 0.168, 0.170, and 0.175%) linearly increased ($P = 0.03$) with the inclusion of FP. True protein (2.91, 2.85, 2.74, and 2.68%), casein (2.33, 2.29, 2.17, and 2.15%), and whey protein (0.57, 0.55, 0.56, and 0.53%) decreased linearly ($P \leq 0.01$) with the inclusion of FP. These results show that replacing corn and SBM with FP at 24% of the diet or greater negatively affects the percentage and yield of milk protein. A deficiency of methionine could have possibly occurred due to the low Met content of FP.

Table 1.

Item	FP0	FP12	FP24	FP36	SEM	*P*-value[1]
DMI, kg/d	24.2a	24.6a	23.5a	21.8b	0.75	L
Milk, kg/d	37.0a	35.4ab	33.8b	33.0b	1.00	L
Fat, %	3.53	3.57	3.58	3.69	0.14	NS
Protein, %	3.06a	3.02a	2.89b	2.84b	0.06	L
MUN, mg/dL	11.6a	12.2ab	13.2bc	14.0c	0.33	L
Fat, kg/d	1.29	1.25	1.21	1.22	0.05	L
Protein, kg/d	1.13a	1.07a	0.97b	0.93b	0.03	L
ECM, kg/d	36.9a	35.5ab	33.7b	33.3b	1.02	L
ECM, kg/DMI kg	1.54	1.46	1.43	1.55	0.04	Q

[a–c]Different letters significant (P < 0.05).

[1]L = linear treatment effect (P < 0.05); Q = quadratic treatment effect; NS = no significant treatment effect.

Key Words: field peas, milk production, protein

168 Milk production response to increasing net energy intake in dairy cows. A meta-analysis. C. Jensen*[1,2], M. R. Weisbjerg[1], and S. Østergaard[1], [1]*Department of Animal Science, Aarhus University, Denmark,* [2]*Knowledge Centre of Agriculture, Skejby, Denmark.*

The objective of the study was to estimate the effect of increasing net energy intake (NEL) on milk production in dairy cows in early lactation. A new model for economical optimization of the feeding level of dairy cows is to be developed. Previous models are outdated due to higher yield capacity of cows and a new Nordic feed evaluation system, NorFor. This requires development of production functions on milk responses to increased NEL. A data set from recent feeding trials in Norway, Sweden and Denmark were gathered. Prerequisites of data

were that cows were fed ad libitum, planned ration energy density was independent of recorded milk yield, and different energy levels were planned within trials. The data set included treatment means from 66 primiparous groups (primi) and 68 multiparous groups (multi). Cows averaged 69 DIM during trials. Average milk yield was 27 kg ECM for primi and 33 kg ECM for multi. Range of NEL in data set was from 75 to 154 MJ/day for primi and from 95 to 169 MJ/day for multi. Data were analyzed using nlme of R. A mixed effects model regression analysis with random regression of trials was used to model milk production (kg ECM/day). The preliminary models included independent variables for NEL, NEL^2, NDF per NEL, amino acids absorbed in small intestine per NEL and breed. All analyzed ration characteristics were estimated by NorFor. For multiparous cows a significant decreasing marginal milk response (kg ECM per MJ NEL) ($P < 0.001$) was estimated as: 0.919 - 0.00502 × NEL. In the data set the marginal ECM response to NEL for multi decreases from 0.442 to 0.071 with mean at 0.236. For primiparous cows a decreasing marginal milk response to NEL (kg ECM per MJ NEL) was estimated as: 0.454 - 0.00204 × NEL, however the decrease was not significant ($P = 0.1$). In the data set the marginal ECM response to NEL for primi decreases from 0.301 to 0.140 with mean at 0.218. In either of the models there were no interactions between the independent variables. The significant diminishing return of ECM to increasing NEL found in this meta-analysis emphasizes the importance of economic optimization of the energy level for high producing dairy cows.

Key Words: dairy cows, modelling, production response