932 Estimation of energy value of feed and its use in ration formulation. H. F. Tyrrell*, *Cooperative State Research, Education & Extension Service, USDA, Washington, DC.*

Estimation of the energy value of a ration is fundamental for the determination of the quantity required to meet the energy requirement of the animal. Net Energy is the best estimate of the energy value of a feed/ration, but is difficult, time consuming and costly to determine. In addition, it is virtually impossible to measure the energy value of a single feedstuff fed to a representative animal because few, if any, feedstuffs contain the appropriate balance of nutrients required by the target animal. In practice, estimated net energy value of individual feedstuffs used in ration formulation have been derived from equations relating net energy to some more easily determined characteristic of a feedstuff, typically some measure of digestibility such as Total Digestible Nutrients (TDN). This method is reasonably accurate as long as the TDN value used is appropriate for the target animal. For example, it is well established that the TDN value of a ration fed to a lactating dairy cow at a daily intake required to support lactation is significantly lower than the TDN value of the same ration fed to the same cow at a maintenance level of intake when the cow is not lactating. Level of intake is only one of several factors which can depress the TDN value of a ration fed at production levels of intake. Protein quantity/quality which is adequate to support maximal digestibility in an animal at maintenance may significantly depress TDN value when protein is limiting for lactation. TDN measured using sheep may be appropriate for the estimation of the energy value of feedstuffs for cattle where appropriate equations are available. Variation in digestibility of feed is the main source of variation in energy value of feed.

Key Words: Net Energy, Digestibility, TDN

933 Feed efficiency is driven by dry matter digestibility. D. P. Casper*, L. Whitlock, D. Schauff, D. Jones, D. Spangler, and G. Ayangbile, *Agri-King, Inc., Fulton, IL.*

The improvement in Feed Efficiency (FE; Milk/Dry Matter Intake) by dairy cows can have a dramatic impact on the profitability of the dairy operation. This study was conducted to evaluate the range in FE across several farms and to determine what factors may affect FE. Total mixed rations (TMR) and fecal samples were collected from six dairy farms that were feeding a total mixed ration, along with measurements of milk production, milk composition, and dry matter intake (DMI). The forages fed on these farms consisted of haylage, corn silage, balage, and dry hay. Total mixed rations and fecal samples collected at the same time were analyzed for standard nutrients. Acid insoluble acid was used as an internal marker to calculate nutrient digestibility coefficients. Twenty-three observations were collected over a period of several months. Milk production averaged 30.8 kg/d and ranged from 21.4 to 36.6 kg/d across the study. Milk fat percentage averaged 3.78% and ranged from 3.43 to 4.10%. 3.5% fat-corrected milk averaged 32.0 and ranged from 27.8 to 35.3 kg/d. Dry matter intake averaged 21.2 kg/d and ranged from 16.3 to 25.9 kg/d. Feed efficiency (Milk/DMI) averaged 1.47 and ranged from 1.23 to 1.85. Dry matter digestibility averaged 70.5% and ranged from 57.7 to 84.6%. Regression analysis demonstrated that the dry matter digestibility of the ration fed to lactating dairy cows was the most significant predictor of FE (FE = 0.032 + 0.02 * DMD; R2 = 0.59, P < 0.01). This study also demonstrated that as FE increased the DMI by the cows decreased (FE = 2.76 0.062 * DMI, kg/d; R2=0.72, P < 0.01). The dry matter digestibility of the ration is the major factor affecting the FE by lactating dairy cows. The biggest factor affecting ration dry matter digestibility is forage quality and the digestibility of that forage.

Key Words: Feed Efficiency, Digestibility, Forage Quality

934 Predicting feed passage rate in dairy cattle. S. Seo*[1], L. Tedeschi[1], C. Schwab[2], and D. G. Fox[1], [1]*Cornell University, Ithaca, NY,* [2]*University of New Hampshire, Durham.*

The database used to develop the passage rate (kp) equations of the 2001 Dairy NRC was used to perform a sensitivity analysis on the variables used to derive the equations and to investigate the sensitivity of MP supply and allowable milk production using a Monte Carlo technique. Three equations were developed by the 2001 Dairy NRC to predict kp for dry forage, wet forage, and concentrate using a meta-analysis technique (trial as a random effect). The database was comprised of studies that used rare earth markers. Outliers were identified by acceptance criteria defined a priori or the difference in fit statistic (DFFITS) value. We found the sign of the regression coefficient of ConcpDM in the equation for kp dry forage in 2001 Dairy NRC was inverted; it should be positive: kp dry forage = 3.362 + 0.479 DMIpBW 0.017 NDFF + 0.007 ConcpDM (n=319), where kp is passage rate, %/h; DMIpBW is DMI as % of BW; NDFF is NDF content of the forage, %DM; and ConcpDM = Concentrate content as % of dietary DM. The sensitivity analysis indicated that kp predictions were more sensitive to the variation in DMI than to any other variable. Additionally, based on the 90% confidence interval, a variation in kp resulted in a change in MP supply and MP allowable milk of 188 g and 4 kg, respectively. The kp for concentrate had the highest standardized regression coefficient (0.906) compared to kp for dry forage (0.092) and wet forage (0.019) in the prediction of MP allowable milk from supply of MP. The variation in RDP, RUP, and MP supply were mainly caused by the variations in kd, CP, and kp values of concentrates in the simulation. Accuracy was improved when new kp equations were developed using the entire database (1,271 treatment means). The new equations were: kp dry forage = 2.819 + 0.684 DMIpBW 0.015 NDFF + 0.003 ConcpDM (n=399); kp wet forage = 2.384 + 0.854 DMIpBW 0.012 ConcpDM (n=74); and kp concentrate = 3.374 + 1.123 DMIpBW - 0.016 ConcpDM (n=264). We conclude these empirical equations are suitable for predicting passage rate. However, the development of a more mechanistic model that accounts for more of the biologically important variables affecting passage rate is needed.

Key Words: Passage Rate, Sensitivity Analysis, Dairy Cattle

935 Effect of peNDF and starch source on digestibility and ruminal pH and turnover in dairy cows. P. Berzaghi*[1] and D. R. Mertens[2], [1]*University of Padova, Italy,* [2]*ARS-US Dairy Forage Research Center, Madison, WI.*

The effects of ration physically effective NDF (peNDF) and starch source on ruminal characteristics and digestibility were investigated. A negative control (NC) diet was formulated to induce milk fat depression, which contained 19% peNDF using finely chopped (TLC = 6.4 mm) corn silage as the main fiber source. Three diets were formulated to increase peNDF to 22% by adding about 9.5% finely chopped corn silage (CS), 12.2% chopped alfalfa hay (AH), or 6.7% chopped grass hay (GH) to NC. Diets for the four fiber sources were formulated with dry ground corn (DGC) or finely ground high moisture corn (HMC) to obtain eight diets that varied in starch source and peNDF source and concentration. Twenty-four cows were blocked for milk production and half were assigned to either DGC or HMC diets in replicated 4x4 Latin squares with 21d periods. One Latin square for starch source contained ruminally fistulated cows. In the cannulated cows ruminal pH was measured for one day every three hours and rumen contents were manually evacuated before and after feeding and separated into solids and liquids. Fecal samples were obtained during the last week of each period. Indigestible NDF of feeds, ruminal contents and feces was determined by 240-h in situ incubation in all cows in the period following their collections. Mixed-model ANOVA indicated that NC and CS had lower ($P<0.05$) ruminal pH at 3-h post feeding, but similar average (24 h) ruminal pH across diets. Rumen pool of DM and indigestible NDF (INDF) was not affected ($P>0.05$) by diet and starch source. However, turnover rate of INDF was increased ($P<0.05$) by the addition of AH and GH to the NC diet. Apparent DM digestibility (DMD) was not affected by starch source, but was highest for NC diet and lowest ($P<0.01$) in AH and GH. A positive relationship ($r^2=0.54$; $P<0.01$) between retention time and DMD partially explained the differences in digestibility. In conclusion, dietary peNDF altered ruminal pH and affected DMD possibly by changes in retention time and associative effects

Key Words: Physically Effective Fiber, Digestibility, Ruminal pH

936 In situ estimation of dry matter digestibility and degradable intake protein to evaluate the effects of corn processing method and length of ensiling. J. R. Benton*, T. J. Klopfenstein, and G. E. Erickson, *University of Nebraska, Lincoln*.

Three ruminally cannulated steers were used to evaluate the effects of corn processing method and length of ensiling on dry matter digestibility (ISDMD) and degradable intake protein (DIP). Corn processing consisted of dry-rolled (DRC), high-moisture at 24% (24HMC) or 30% (30HMC) moisture, and reconstituted corn at 28% (28RECON) or 35% (35RECON) moisture, all of the same hybrid. All corn (except DRC) was ensiled for at least 298 d, and sampled every 28 d. Corn samples were incubated in situ for 0, 22, 30, and 72 h and ISDMD (%) and DIP (% of CP) were calculated. Values (22 h) were regressed over ensiling days. The intercept represents changes in ISDMD or DIP during the first 28 d of ensiling where the greatest changes occurred, with the greatest increase for 35RECON followed by 30HMC and then 28RECON. The slope represents changes in ISDMD or DIP over time of ensiling after 28 d. The slopes of reconstituted corn (RECON) were greater than high-moisture corn (HMC) because RECON had a greater increase in total ISDMD and DIP compared to HMC. The slope of 24HMC was not different from 30HMC for ISDMD, while the slope of 24HMC was greater than 30HMC for DIP. The slope of 28RECON was greater than 35RECON for ISDMD and DIP. When moisture was increased for HMC (from 24 to 30%) and RECON (from 28 to 35%), total ISDMD and DIP increased, and both HMC and RECON had increased total ISDMD and DIP compared to DRC. Results suggest that as moisture and length of fermentation increase, ISDMD and DIP are increased.

	ISDMD	(%)		DIP	(% of CP)	
Corn	day 0	Intercept[a]	Slope[ab]	day 0	Intercept[a]	Slope[ab]
24HMC	38.0	37.7[c](1.2)	0.44[c](0.06)	45.1	41.6[c](0.9)	0.51[c](0.05)
30HMC	45.4	61.3[d](1.0)	0.38[c](0.06)	48.8	68.1[d](0.8)	0.40[d](0.05)
28RECON	29.0	46.3[e](1.0)	1.21[d](0.05)	34.3	47.1[e](0.7)	1.38[e](0.04)
35RECON	29.0	68.8[f](1.0)	0.70[e](0.06)	34.3	64.9[f](0.7)	0.95[f](0.05)
DRC	29.0	—	—	34.3	—	—

[a]Values in parenthesis are standard errors
[b]Predicted ISDMD or DIP=Intercept+Slope(10 days of ensiling)
[cdef]Slopes within a column with different superscripts differ (P<0.10)

Key Words: Grain Processing, In Situ, Protein Digestion

937 Effects of nonfiber carbohydrate source and protein degradability on ruminal protein fractions and NDF disappearance. M. B. Hall* and C. C. Larson, *Department of Animal Sciences, University of Florida, Gainesville*.

Effects of nonfiber carbohydrate source (NFC) and protein degradability (RUP) on concentrations (mM) of ammonia (NH3), amino acid (AA), and branch chain VFA (BCVFA) in ruminal fluid, and on in situ disappearance of NDF from sorghum silage were evaluated using 6 ruminally cannulated Holstein cows in a three period (21 d) partially balanced incomplete latin square design with a 3x2 factorial arrangement of treatments. Dietary treatments included three NFC sources (ground corn=starch=ST; molasses+sucrose=sugar=SU; and citrus pulp=soluble fiber+sugar=SF) and two concentrations of ruminally degradable protein (+or-RUP) achieved by addition or omission of expeller soybean meal. Total mixed rations were formulated to be isonitrogenous and offered ad libitum. Sorghum silage (2 mm Wiley mill grind) was incubated in situ in polyester bags (53 $\pm$ 10 μm pore size) inserted via the rumen cannula on days 16, 17, and 18 at intervals to allow incubation times of 0, 6, 12, 18, 24, 30, and 48 h; residual NDF was measured. Ruminal fluid samples were collected on day 20 just prior to feeding and hourly for 12 h. Protocols were applied in each period. Significance was declared at P#88040.05; values presented are least squares means. NH3 differed only for RUP x hr in hours 1 through 3 post-feeding, with -RUP greater than +RUP. AA differed by NFC in hr 1 through 3, with ST less than SU + SF, and for interactions of NFC x hr and RUP x hr for all hours. BCVFA differed by NFC source with ST greater than SU+SF, and SF tended to be greater than SU (P=0.07). BCVFA tended to differ by RUP x hr (P=0.10). In situ disappearance of NDF differed for NFC and NFC x RUP in hours 6, 18, 24, and 30, and tended to differ for NFC x RUP at 48 h (P=0.054). Differences did not appear to be solely due to ruminal pH. Differences in ruminal AA and BCVFA suggest that ruminal protein digestion or use differs by NFC source. Differences in in situ disappearance of NDF suggest that in situ results are not likely to be uniform across diets and may be best suited for relative evaluation of NDF digestibility.

Item	ST-RUP	ST+RUP	SF-RUP	SF+RUP	SU-RUP	SU+RUP
NH3	12.3	10.8	12.1	9.6	11.8	10.1
AA	1.64	1.46	1.86	1.73	1.94	1.76
BCVFA	3.79	3.48	3.31	2.87	2.45	2.26
pH	5.99	5.98	6.11	6.03	5.83	6.07
24 h IS	19	26	21	20	16	21
30 h IS	26	32	32	26	22	27
48 h IS	39	42	43	40	39	39

NH3 for sampling hours 1 through 3; AA, BCVFA, and pH for sampling hours 0 through 12.
IS = percentage of in situ NDF disappearance.

Key Words: NFC, Fermentation, Carbohydrate

938 Effect of starch source on supply of glycogenic nutrients in dairy cows. A. M. van Vuuren*, V. A. Hindle, and J. W. Cone, *Animal Sciences Group, Wageningen UR, The Netherlands*.

In ruminants, propionic acid and glucose are the main glycogenic precursors. Thus, the supply of glycogenic precursors from starch is related to its site of digestion. In this study the site of digestion of starch from wheat, corn, and potato was estimated in dairy cows. A Latin square design experiment was performed involving four lactating dairy cows each fitted with a rumen cannula and T-piece cannul in the distal duodenum and terminal ileum. Each cow received either a starch-free diet, containing 43 %DM grass silage, 11 %DM ensiled sugar beet pulp and 46 %DM of a starch free concentrate mixture with 70 % dried sugar beet pulp (DSBP) or diets in which DSBP had been replaced by either wheat (WS), corn (CS) or potato (PS) starch. Diets were fed during periods of four weeks, faecal and digesta collections were performed in the third and fourth week of each period, respectively. The glycogenic nutrient supply for each diet was estimated on the basis of the amounts of OM digested in rumen and large intestine, patterns of VFA concentrations in the rumen and the amount of starch digested in the small intestine. Significance was declared at P<0.05. Starch intake was 0.31[c], 3.47[b], 3.90[a], and 3.69[ab] kg/day for control diet, and diets with WS, CS and PS, respectively. The rumen was the main site of digestion for starches from all origins and was estimated at 90[a], 75[b], and 84[a] % of intake of WS, CS and PS, respectively. In the small intestine, 70% of rumen escaped WS was digested compared to 65% for CS, but this difference was not significant. We observed no disappearance of PS in the small intestine. Almost all starch entering the large intestine was digested, resulting in a faecal starch output of less than 0.10 kg/d. Concentrations of ruminal VFA were similar amongst treatments. The proportion of propionate in rumen fluid differed significantly between the WS diet (21 mol%) and the PS diet (18 mol%). The highest supply of glycogenic nutrients was calculated for the CS diet (0.8 moles per kg ingested OM). According to our calculations, the PS diet yielded the lowest supply of glycogenic nutrients (0.6 mol per kg ingested OM).

Key Words: Dairy Cattle, Starch, Digestion

939 Microbial profiling of ruminal and omasal samples from cows fed different sources of methionine. S. K. R. Karnati*, J. T. Sylvester, Z. Yu, S. M. Noftsger, N. R. St-Pierre, M. Morrison, and J. L. Firkins, *The Ohio State University, Columbus*.

Supplemental methionine improves milk protein yield with diets low in CP either through stimulation of microbial CP synthesis or through escape of methionine. Previous work suggested that HMB (2-hydroxy-4-methylthiobutanoic acid) might promote changes in ruminal bacterial or protozoal populations. DGGE (denaturing gradient gel electrophoresis) and RIS-LP (ribosomal intergenic spacer length polymorphism) were used to monitor treatment-induced changes in microbial populations in the rumen and omasum of cattle fed control, HMB, dl-methionine, or HMBi (isopropyl ester HMB; estimated 50% rumen protection) in a 4 x 4 Latin square design. For DGGE, a hypervariable region of the 18S rRNA gene was amplified from the extracted DNA using PCR with a ciliate-specific primer set. Amplicons were separated on an 8% acrylamide gel with a 28-36% denaturing gradient. The banding patterns

were similar for both ruminal and omasal samples and were not different among treatments. Protozoal counts were not different among treatments ($P > 0.05$) in ruminal or omasal samples. Generic protozoal counts were not different ($P > 0.05$) among treatments, corresponding with similar banding profiles from DGGE. Multivariate statistics showed no difference ($P > 0.05$) in generic distribution of protozoa in ruminal vs. omasal samples, supporting absence of selective retention of Isotrichs in the rumen. Extracted DNA from omasal contents was amplified in PCR using S926f and L189r primers for RIS-LP analysis. Amplicons containing the complete RIS and parts of the flanking rRNA genes were separated on a 4% polyacrylamide gel. The RIS-LP gel image was exported into image analysis software. Cluster analysis of banding profiles grouped the treatments together, suggesting that bacterial populations differed among treatments. Source of methionine appeared to change ruminal bacterial but not protozoal populations. Future research will characterize bacterial populations altered by HMB supplementation.

Key Words: DGGE of Ruminal Protozoa, RIS Analysis, HMB

940 Effects of different components of garlic oil on rumen microbial fermentation in a continuous culture system. Marta Busquet[1], Sergio Calsamiglia*[1], Alfred Ferret[1], and Christopher Kamel[2], [1]*Universitat Autonoma de Barcelona, Spain,* [2]*University of Leeds, UK.*

Preliminary in vitro batch culture trials using garlic oil (G) and 4 of its constituents (diallyl sulphide = Ds; diallyl disulphide = Dd; allyl mercaptan = Am; and allicin = A) indicated that only the doses of 30 and 300 mg/L of G, Dd, and Am modified rumen microbial fermentation profile. Eight 1.3-L dual flow continuous culture fermenters were used in three periods (8 d) to study the effects of these extracts on rumen microbial fermentation profile in a long-term in vitro study. Fermenters were fed 95 g/d of the 50 to 50 forage to concentrate diet. Treatments were: no extract or negative control (C), G (300 mg/L = G10) Dd (30mg/L = Dd, 300mg/L = Dd10) and Am (30mg/L = Am; 300mg/L = Am10). Fermenters were maintained at constant temperature (39C), pH (6.4) and solid (5%/h) and liquid (10%/h) dilution rates. Each day, a sample was taken 2 h after the morning feeding for the determination of ammonia (NH3) N and volatile fatty acids (VFA). During the last 3 days, samples were taken at 0, 2, 4 and 6 h after the morning feeding, and analyzed for peptide (Pep), aminoacid (AA) and NH3 N concentrations. Total VFA were similar across treatments (122.2 mM). Acetate proportion (mol/100mol) was lower in G10 (48.0), Dd (53.5), Dd10 (49.2), and Am10 (51.0) compared with C (60.7). Propionate proportion (mol/100mol) was higher in G10 (30.5) compared with C (21.8). Butyrate proportion (mol/100mol) was higher in Dd10 (20.3) compared with C (12.4). Average Pep-N concentration (mg/100ml) was similar in all treatments. Average AA-N concentration (mg/100ml) tended to increase ($P = 0.07$) in Dd10 (4.6) compared with C (2.9), and the average NH3 N concentration (mg/100ml) tended to increase ($P = 0.08$) in Am10 (15.4) compared with C (10.5), suggesting that Am10 stimulated deamination. All garlic oil components resulted in similar effects to those observed in G10. However, G10 had stronger effects (and similar to ionophore antibiotics) which could be explained by a synergistic activity between its constituents.

Key Words: Rumen Fermentation, Plant Extracts, Garlic

941 Effects of *Lactobacillus acidophilus* and *Propionibacterium freudenreichii* on performance and rumen characteristics of Holstein dairy cows in mid-lactation. M. L. Raeth-Knight* and J. G. Linn, *University of Minnesota, St. Paul.*

A lactation study (Study 1) was conducted from February 12, 2003 to May 6, 2003. Thirty-nine multiparous and eighteen primiparous Holstein cows were blocked by parity and randomly assigned to one of three dietary treatments; remaining on treatment for 84 days. Treatments included: 1 x 10^9 cfu/day live *Lactobacillus acidophilus* strain LA747 and 2 x 10^9 cfu/day live *Propionibacterium freudenreichi* strain PF24 (Diet A), 1 x 10^9 cfu/day live *Lactobacillus acidophilus* strain LA747, 2 x 10^9 cfu/day live *Propionibacterium freudenreichi* strain PF24, and 5 x 10^8 cfu/day *Lactobacillus acidophilus* strain LA45 (Diet B) and lactose (Control- Diet C). Treatments were administered by mixing 45 grams of finely ground corn with 5 grams of live microbial product or lactose and top dressing on the TMR once daily. All cows received the same TMR: 12.7% hay, 46.2% corn silage and 41.1% concentrate (DM basis). A Latin square study (Study 2) was conducted concurrently with the lactation study. Three rumen cannulated, multiparous Holstein cows were randomly assigned to dietary treatments A, B, and C in a 3 x 3 Latin square design with 28 day periods; 21 days of adaptation and 7 days of data collection. In Study 1, there was no difference ($P > .1$) in average DM intake (23.90, 23.60 and 24.19 kg/d) or 4% FCM (36.68, 35.18 and 36.12 kg/d) for treatments A, B, and C, respectively. There was no difference ($P > .1$) in fat, protein or lactose yield, milk urea nitrogen or somatic cell count. Feed efficiency was 1.53, 1.49 and 1.49 kg FCM per kg of DM intake for treatment A, B, and C, respectively. For study 2, there was no difference ($P > .1$) in rumen pH, concentration of ammonia or total volatile fatty acids (VFA) measured at 0, 1, 3 and 6 hours post feeding. For treatments A, B, and C, average rumen pH was 6.20, 6.15 and 6.15 while the average low, 3 hours post feeding, was 6.01, 5.98 and 5.96. Across treatments, average ammonia concentration was 8.76, 19.69, 12.53, and 8.37 mg/dl of rumen fluid at 0, 1, 3 and 6 hours post-feeding.

Key Words: Direct Fed Microbial, Mid-Lactation, Ruminant

942 Effect of calcium source on ruminal soluble calcium and microbial fermentation. E. J. Baird*[1], V. Fellner[1], S. J. McLeod[1], J. W. Spears[1], and F. R. Valdez[2], [1]*Department of Animal Science, North Carolina State University, Raleigh,* [2]*Kemin Americas, Des Moines, IA.*

A study was conducted to determine the effect of Ca level and source on ruminal soluble Ca concentration and microbial fermentation in continuous culture fermentors. Treatments consisted of control diet (0.18% Ca) or the control supplemented with 0.60% Ca from either: 1) $CaCO_3$, 2) Ca propionate-prilled (CaP, NutroCAL#8482) or 3) CaP-powder. Fermentors were fed 14 g DM/d of a diet (DM basis) consisting of 35% corn silage, 18% soybean meal, 15% corn, 22% cottonseed hulls, and 10% whole cottonseed. Following a 2-d stabilization period, fermentors were sampled over a 4-d collection period. Each treatment was replicated five times. Calcium supplementation of the control diet increased ($P < 0.01$) ruminal soluble Ca concentrations. Ruminal soluble Ca concentrations were higher ($P < 0.01$) in cultures receiving CaP treatments compared to $CaCO_3$. Ruminal pH was higher in Ca-supplemented diets compared to control ($P < 0.01$), and $CaCO_3$ was higher ($P < 0.05$) than CaP treatments. Digestibility of NDF was higher in CaP-prilled compared to control ($P < 0.06$), $CaCO_3$ ($P < 0.09$), and CaP-powder ($P < 0.05$) treatments. Total VFA production in ruminal cultures was increased ($P < 0.05$) by supplemental Ca. In response to Ca source, total VFA production was higher for CaP-prilled than $CaCO_3$ ($P < 0.01$) and CaP-powder ($P < 0.08$) treatments. Propionate production and molar proportion were higher ($P < 0.01$) in CaP than control or $CaCO_3$ treatments. Butyrate production was higher ($P < 0.01$) for CaP-prilled and $CaCO_3$ treatments compared to control and CaP-powder treatments. Molar proportion of butyrate was higher ($P < 0.01$) for $CaCO_3$ than the other treatments. Production and molar proportion of isovalerate was lower ($P < 0.01$) for CaP-powder compared to other treatments. These results indicate that both dietary Ca level and source affect soluble Ca concentrations and fermentation in continuous cultures of ruminal microorganisms.

Key Words: Microbial Fermentation, Calcium

Ruminant Nutrition: Dairy - Feedstuffs

943 Impact of feeding high free fatty acid whole cottonseed on milk yield and composition. J. K. Bernard*[1], J. Siciliano-Jones[2], and T. C. Wedegaertner[3], [1]*The University of Georgia, Athens,* [2]*FARME Institute,* [3]*Cotton Incorporated.*

Whole cottonseed (WCS) is used as a source of energy, protein, and fiber by many dairy producers. The concentration of free fatty acids in the oil (FFA) may be elevated after tropical storms delay harvest resulting in concentrations exceeding 12% of the oil. These seed are considered to be off quality. Limited data are available on the feeding value of off-quality WCS. Approximately 300 lactating Holstein cows were used in a 3 x 3 Latin square trial to determine the impact of feeding whole cottonseed