12 hr macro in situ digestibility of starch and NDF of HMEC and steam rolled corn grain was: 18, 77, 22, and 69, respectively. The data shown below supports the conclusion that 25 % of steam rolled corn could be replaced with HMEC.

Item	Ratio HMEC:steamed rolled corn 100:0	75:25	25:75	0:100	P≤
Milk, kg	34.9	37.2	38.6	38.7	NS
Milk fat, %	3.46^{c}	3.69^{bc}	3.85^{ab}	3.73^{b}	.12
3.5 /% FCM, kg	34.7^{c}	38.1^{bc}	40.8^{ab}	40.1^{ab}	.19
Milk fat, kg	1.21^{c}	1.36^{bc}	1.49^{ab}	1.44^{ab}	.12
Milk protein, %	2.99	2.97	3.00	2.92	NS
Milk protein, kg	1.04	1.11	1.15	1.12	NS

Key Words: dairy, nutrition, high moisture ear corn

ASAS/ADSA Ruminant Nutrition: Feedlot

651 Effects of supplemental phosphorus concentrations on inorganic phosphorus serum concentrations, growth performance, carcass characteristics, and cost of gain of finishing cattle. Wendy R. Flatt*[1], Tim Stanton[1], Jessica Davis[1], and Dave Schutz[2], [1]*Colorado State University,* [2]*CSU-Eastern Colorado Research Center.*

ABSTRACT: The objective of this study was to evaluate the effects of dietary phosphorus (P) concentration on cattle growth, performance, blood serum levels and carcass characteristics. Two hundred and twenty-one beef cattle (119 heifers, 102 steers) with an average initial live weight of 296 ± 70.5 kg were used in a randomized experimental design. Calves were randomized by live weight, stratified by breed, and assigned to one of two treatments (four pens/treatment). Control (C) was fed at 0.34% (DM basis) for 147 days on feed (DOF). Low phosphorus (LP) cattle were fed at 0.34% P (DM basis) until day 85 at which time supplemental P was dropped to 0.24% until finish. Over the 147 d feeding period, feed intake was not affected (P > 0.05) by P level. Feed intake was 9.30 and 9.32 kg DM (± 0.02kg) of feed per day for C and LP, respectively. Average daily gain, although not significant (P > 0.05), was higher for cattle on C compared to cattle on LP (1.64 vs. 1.60 ± 0.04 kg/day). Feed efficiency was not affected by P treatments. No significant differences were determined between serum levels of inorgainic P of cattle on C vs. LP. Dressing percent, hot carcass weight, muscling score, percent grading choice, and yield grade were not affected by the level of dietary P in the supplement. However, percent dark cutters for C and LP were significantly different as the percent not grading because they were dark cutters was 4.50% for cattle on C vs. 13.64% for cattle on LP. The calves on LP also had a higher (P < 0.05) incidence of morbidity than those calves on C, 13.51% vs. 4.50%, respectively. Reducing supplemental P from the diet at reimplant time may increase the incidence of morbidity and dark cutters.

Key Words: Phosphorus, Dark cutters, Feed efficiency

652 Effects of wet corn gluten feed and intake level on diet digestibility and rumen passage rate in steers. S. P. Montgomery*, J. S. Drouillard, E. C. Titgemeyer, J. J. Sindt, T. B. Farran, J. N. Pike, C. M. Coetzer, A. M. Trater, and J. J. Higgins, *Kansas State University, Manhattan.*.

Twelve ruminally cannulated Jersey steers (534 52 kg BW) were used in an incomplete Latin square design experiment with a 2 × 2 factorial arrangement of treatments to determine effects of wet corn gluten feed (WCGF) and total DMI level on diet digestibility and rumen passage rate. Treatments consisted of diets formulated to contain 40% WCGF or no WCGF, fed once daily either ad libitum or limited to 1.6% of BW. Two consecutive 24-d periods were used, consisting of 18 d for adaptation, 4 d for collection, and a 2-d in situ period. Chromic oxide (10 g/hd) was fed as a digestibility marker, and steers were pulse dosed with Yb-labeled alfalfa hay and a Co-EDTA solution via rumen cannula to measure solid and liquid passage rates. Dacron bags containing 5 g of either steam-flaked corn, WCGF, or ground (2-mm) alfalfa hay were placed into the rumens of all steers and removed after 3, 6, 12, or 48 h. WCGF increased total tract digestion of OM and NDF (P < 0.01), reduced total VFA concentration (P < 0.01), increased rumen NH_3 concentration (P < 0.01), increased rumen pH (P < 0.01), and tended (P < 0.06) to increase total tract digestion of starch. WCGF also increased rumen passage rate of solid digesta (P < 0.01). Limit feeding reduced (P < 0.01) total tract digestion of both OM and NDF, reduced total VFA concentration (P < 0.01), increased rumen NH_3 concentration (P < 0.01), and increased rumen liquid passage rate (P < 0.02). Total tract digestion of starch was not affected by DMI level (P > 0.70). A DMI level × h interaction (P < 0.01) occurred for rumen pH. Limit feeding increased rumen pH at 0 and 12 h after feeding, but reduced rumen pH 4 h after feeding. WCGF or DMI level did not affect (P > 0.25) rate of in situ DM disappearance. This study suggests that WCGF increases OM and NDF digestion, and that limit-feeding high-energy diets once daily may depress OM and NDF digestion.

Key Words: Wet corn gluten feed, Limit feeding , Digestibility

653 Performance of beef heifers limit-fed growing diets containing alfalfa hay and wet corn gluten feed. S. P. Montgomery*, J. S. Drouillard, J. J. Sindt, T. B. Farran, J. N. Pike, C. M. Coetzer, H. J. LaBrune, A. M. Trater, and R. D. Hunter, *Kansas State University, Manhattan,.*

Crossbred beef heifers (n = 339, BW = 277 11.4 kg) were used in a randomized complete block design to determine optimum combinations of alfalfa hay (AH) and wet corn gluten feed (CGF) in limit-fed growing diets containing steam-flaked corn. Heifers were fed a common diet ad libitum for 15 d preceding the growing study to minimize differences in gastrointestinal tract fill. Heifers were then blocked by weight and allotted to pens containing four to seven head per pen, with six pens per treatment. Treatments consisted of diets containing 10, 20, or 30% ground AH, and 0, 40, or 68% CGF in a 3 × 3 factorial arrangement. All diets provided 33 mg/kg of monensin and were fed once daily at 1.6% of BW for 84 d. On d 8, 22, 37, 51, 64, and 79, unconsumed feed was removed from feed bunks 2 h after feeding, weighed, and returned to the respective feed bunk in order to measure rate of DMI. Prior to obtaining final weights, cattle were fed a common diet ad libitum for 15 d. An interaction occurred (P < 0.05) between level of AH and CGF level for both ADG and gain efficiency. ADG for the 99-d growing study were 1.03, .96, .90, .90, .88, .84, .85, .90, and .78 .02 kg/d and gain efficiencies were .196, .185, .175, .171, .172, .160, .163, .180, and .153 .004 kg gain/kg DM for 10AH/0CGF, 10AH/40CGF, 10AH/68CGF, 20AH/0CGF, 20AH/40CGF, 20AH/68CGF, 30AH/0CGF, 0AH/40CGF, and 30AH/68CGF, respectively. Increasing the levels of AH or CGF reduced cattle performance with the exception of 30AH/40CGF, which supported ADG similar (P > 0.10) to 20AH/0CGF or 30AH/0CGF, and improved gain efficiencies (P < 0.05) compared to 30AH/0CGF. DMI 2 h after feeding increased linearly (P < 0.01) with increasing AH, and decreased linearly (P < 0.01) with increasing CGF. This study suggests that 40% CGF can effectively replace steam-flaked corn in limit-fed growing diets containing 20 or 30% AH.

Key Words: Wet corn gluten feed, Alfalfa hay, Limit feeding

654 Wet corn gluten feed and alfalfa hay combinations in steam-flaked corn finishing diets. J. J. Sindt*[1], J. S. Drouillard[1], S. P. Montgomery[1], J. N. Pike[1], T. B. Farran[1], C. M. Coetzer[1], T. J. Kessen[1], and R. T. Ethington[2], [1]*Kansas State University, Manhattan,* [2]*Minnesota Corn Processors, Marshall, Minnesota.*

A 153-d finishing experiment was conducted using 631 heifers (BW = 284 ± 7.9 kg) to determine optimum combinations of wet corn gluten feed (WCGF) and alfalfa hay in steam-flaked corn based diets. Heifers were randomly allocated to pens and stratified by weight to six treatments (2 pens per diet, 48 to 58 heifers per pen). Diets contained 25, 35, or 45% WCGF and 2 or 6% alfalfa hay (25/2, 25/6, 35/2, 35/6,

45/2, and 45/6) on a dry basis in a 2 × 3 factorial arrangement of treatments. Heifers were allowed *ad libitum* access to diets fed once daily. Heifers were implanted with Synovex C on d 1 and were adapted to final finishing diets within 21 d. Final diets provided 300 mg Rumensin, 90 mg Tylosin, and 0.5 mg MGA per heifer daily. On d 56 heifers were re-implanted with Synovex Plus. DMI (7.6, 7.8, 7.9, 8.1, 7.8, and 8.0 kg/d), and ADG (1.15, 1.16, 1.16, 1.17, 1.15, and 1.14 kg) were similar ($P > 0.19$) for cattle fed 25/2, 25/6, 35/2, 35/6, 45/2, and 45/6, respectively. Gain efficiencies (.152, .149, .146, .144, .147, and .143 kg gain/kg DM) decreased ($P < 0.05$) linearly as the level of WCGF increased. Carcass weights and dressing percent were not different ($P > 0.18$) among dietary treatments. A WCGF × alfalfa hay interaction occurred ($P < 0.10$) for ribeye area. For heifers fed 2% alfalfa hay, ribeye area increased with increasing dietary WCGF, however, for heifers fed 6% alfalfa hay ribeye area decreased with additional WCGF. Fat thickness (1.22, 1.22, 1.19, 1.27, 1.09, and 1.14 cm) for cattle fed 25/2, 25/6, 35/2, 35/6, 45/2, and 45/6, respectively, decreased ($P < 0.10$) linearly with increasing dietary WCGF. Incidence of liver abscesses (2.7, 4.7, 1.9, 0.9, 2.8, and 2.9%) for heifers fed 25/2, 25/6, 35/2, 35/6, 45/2, and 45/6, respectively, was lowest ($P < 0.05$) for heifers fed 35% WCGF. Alfalfa hay fed at 2% of diet dry matter is sufficient roughage in steam-flaked corn diets containing 25, 35 or 45% WCGF.

Key Words: Finishing Cattle, Wet Corn Gluten Feed, Roughage Level

655 Wet corn gluten feed and alfalfa hay combinations in steam-flaked corn finishing diets: effects on ruminal characteristics and diet digestibility. J. J. Sindt*, J. S. Drouillard, E. C. Titgemeyer, S. P. Montgomery, J. N. Pike, C. M. Coetzer, and T. B. Farran, *Kansas State University, Manhattan.*

Ruminally cannulated, mature Jersey steers (n = 12, BW = 585 ± 48 kg) were fed steam-flaked corn- (SFC) based finishing diets containing combinations of wet corn gluten feed (WCGF) and alfalfa hay (AH) to determine diet digestibility and ruminal characteristics. Dietary treatments consisted of 25 or 45% WCGF and 0, 2, or 6% AH in a 2 × 3 factorial arrangement. An incomplete Latin square design was used with three 14-d periods each containing a 10-d adaptation and a 4-d sampling period. Steers were offered *ad libitum* access to diets fed once daily. Chromic oxide (15 g) was fed as a digestibility marker, and Co-EDTA was pulse dosed to measure rumen liquid passage rate. WCGF, SFC, and AH were ruminally incubated in Dacron bags and removed at 0, 3, 6, 12, and 48 h on d 12 and 13. Feeding 45% WCGF reduced ($P < 0.05$) total tract digestibility of OM and tended to increase ($P < 0.10$) ruminal pH. The undegradable fractions of AH, SFC, and WCGF were decreased ($P < 0.06$) by feeding 45% WCGF. Total VFA concentrations decreased ($P < 0.05$) quadratically, whereas NH3 and butyrate increased ($P < 0.05$) quadratically with increasing dietary AH. pH, acetate, and acetate: propionate increased ($P < 0.05$) linearly in response to additional AH, whereas propionate decreased ($P < 0.01$) linearly and the undegradable fraction of SFC *in situ* tended ($P < 0.10$) to decrease linearly as the level of AH increased. Rate of liquid passage tended ($P < 0.12$) to increase linearly with increasing dietary AH. A WCGF × AH interaction existed ($P < 0.05$) for turnover time (TT). For steers fed 25% WCGF, TT increased linearly as AH increased, but for steers fed 45% WCGF, TT decreased linearly with increasing amounts of AH. Few interactions existed between WCGF and AH. WCGF fed at 25% diet dry matter may provide sufficient roughage in steam-flaked corn finishing diets.

Key Words: Wet Corn Gluten Feed, Roughage Level, Digestibility

656 Feedlot performance of growing cattle fed four silages with a silage inoculant. M. H. O'Connor*[1], G. M. Hill[1], S. A. Martin[2], R. N. Gates[3], and J. K. Bernard[1], [1]*University of Georgia, Tifton, GA/USA,* [2]*University of Georgia, Athens, GA/USA,* [3]*USDA-ARS, Tifton, GA/USA.*

Corn (CS), pearl millet (PM), tropical corn (TC), and sorghum (S) silages with (I) or without (NI) Suncure™ inoculant added at ensiling were compared to determine effects on growing cattle performance. Silages were fed free-choice for 84-d. Dietary energy and CP were adjusted with supplements (SUP) containing rolled corn and soybean meal: SUP-A (27.9% CP, DM basis) fed at 1.25 kg/animal daily with all CS and TC silages; SUP-B (16.2% CP, DM basis) fed at 2.27 kg/animal daily with all PM and S silages. Each SUP delivered Vitamins A, D, and E (24,000, 8,000, and 400 IU/d, respectively), Se (2.0 mg/d) and lasalocid (150 mg/d). On d 1, steers were implanted with Synovex-S®, heifers with Synovex-H®. Means of consecutive daily full weights were used as initial and final BW. The 10-mo old steers (n=64; 282 kg BW) and heifers (n=64; 228 kg BW) were ranked by weight and randomly assigned to treatments in a 4 X 2 factorial arrangement. Silage (6 samples/treatment) DM, CP, ADF, NDF, and calculated TDN (%), respectively, were: CS=28.1, 9.3, 25.5, 42.4, 69.8; CSI=29.3, 8.8, 24.3, 41.3, 68.7; PM=21.0, 11.7, 40.0, 59.5, 55.3; PMI=20.8, 12.2, 40.8, 61.2, 56.3; TC=25.9, 8.2, 35.3, 56.8, 66.2; TCI=27.3, 8.2, 35.4, 58.0, 66.0; S=22.2, 7.8, 39.1, 61.4, 56.0; SI=23.6, 7.6, 38.4, 61.3, 55.8. The ADG and DMI (kg), and DM/gain, respectively, by main effects were: Silage=CS, 1.39, 6.97, 5.02; PM, .94, 5.93, 6.37; S=1.16, 6.50, 5.64; TC, 1.07, 6.10, 5.66; SE=ADG, .07, DMI, .05, DM/gain, .14; Inoculant=NI, 1.13, 6.33, 5.71; I, 1.16, 6.41, 5.6; SE=ADG, .05, DMI, .37, DM/gain, .20 . Kind of silage affected ADG and DM/gain ($P < 0.01$), and DMI ($P < 0.07$), with highest ADG on CS, lowest on PM, but adding the inoculant did not improve ($P > 0.10$) ADG, DMI or DM/gain in growing cattle.

Key Words: Cattle, Silage, Feedlot

657 Are bacterial direct-fed microbials effective against sub-clinical acidosis in feedlot cattle? G. R. Ghorbani*[1,2], D. P. Morgavi[1], K. A. Beauchemin[1], and J. A. Leedle[3], [1]*Agriculture and Agri-Food Canada, Lethbridge, AB, T1J 4B1, Canada,* [2]*Isfahan University of Technology, Isfahan, Iran,* [3]*Chr. Hansen BioSystems, Milwaukee, WI, 53214.*

Sub-clinical acidosis can result in significant economic losses to the feedlot cattle industry. A study was conducted to determine whether bacterial direct-fed microbials (DFM) can be used to minimize the risk of acidosis without compromising the high production levels achieved with high concentrate diets. Six ruminally cannulated steers were used in a double 3 x 3 Latin square to study the effects of DFM on feed intake, ruminal pH, and ruminal and blood characteristics. Steers were provided ad libitum access to a diet containing steam-rolled barley, barley silage, and a protein-mineral supplement; 87, 9, and 4% (DM basis), respectively. Treatments were A) *Propionibacterium* P15, B) *Propionibacterium* P15 and *Enterococcus faecium* EF212, and C) control. The bacterial treatments, 10^9 CFU/g whey powder carrier, or whey powder alone for C, were topdressed once daily at the time of feeding (10g/head/d). Periods consisted of 2 wk of adaptation and 1 wk of measurements, and ruminal pH was measured every 15 min for 6 d using indwelling electrodes. DMI, ruminal pH (mean, minimum, hours pH < 5.8) and blood pH were not affected by treatment ($P > 0.05$). However, treatment A increased ruminal NH_3 concentration ($P < 0.1$) and protozoal numbers ($P < 0.05$) with a concomitant reduction in the number of amylolytic bacteria ($P < 0.05$) compared with the control, while treatment B had no effect. However, it decreased *Streptococcus bovis* enumerated using a selective medium, although this effect was not significant. Although the bacterial DFM used in this study did not induce changes in DMI or ruminal pH, some rumen variables indicated that the propionic acid producing *Propionibacterium* might decrease the risk of acidosis in feedlot cattle.

Key Words: Sub-clinical acidosis, Bacterial direct-fed microbials, Feedlot diet

658 Effect of corn processing on ruminal starch digestion, microbial protein flow, and degradable intake protein requirements of finishing cattle. R. J. Cooper*, C. T. Milton, T. J. Klopfenstein, T. L. Scott, and D. J. Jordon, *University of Nebraska, Lincoln.*

Metabolism and finishing studies were conducted to evaluate the effect of corn processing on ruminal starch digestion, microbial protein flow, and degradable intake protein requirements of finishing cattle. In the metabolism study, six ruminally and duodenally-cannulated steers (523 kg) were used in a replicated 3 x 3 Latin square design experiment. Dietary treatments consisted of 90% concentrate diets that were dry-rolled (DRC), high-moisture (HMC), or steam-flaked corn-based (SFC). True ruminal OM digestibilities were increased ($P < .07$) by approximately 18 and 8% for HMC and SFC, respectively, compared with DRC. Ruminal starch digestibilities were similar between HMC and SFC, but were approximately 19% higher ($P < .05$) compared with DRC. Microbial N flow to the duodenum (g/d) was similar between DRC and SFC; whereas, microbial N flow to the duodenum was approximately 31% higher ($P < .05$) for HMC compared with the average of DRC and

SFC. Microbial N efficiencies were similar among treatments and averaged 25.9 g of microbial N flowing to the duodenum per kg OM truly fermented in the rumen, or 14.4 g of microbial CP per 100 g of total tract OM digestion. In the finishing study, 90 individually-fed steers were fed the same DRC, HMC, and SFC diets as in the metabolism study; however, urea was factored across diets at 0, 0.5, 1.0, or 2.0% of DM. For the dry-rolled corn-based diet, feed efficiency was not improved beyond the first increment of urea, suggesting that the DIP requirement was met at 6.3% of DM. For the high-moisture corn-based diet, nonlinear analysis predicted maximal feed efficiency at 1.14% urea which provided a dietary DIP value of 10.0% of DM. For the steam-flaked corn based diet, nonlinear analysis predicted maximal feed efficiency at 1.64% urea which provided a dietary DIP value of 9.5% of DM. We conclude that degradable intake protein requirements for finishing cattle are increased by corn processing methods that increase ruminal starch digestion compared with dry-rolled corn.

Key Words: Corn Processing, Degradable Intake Protein, Finishing Cattle

659 Factors affecting conjugated linoleic acid production by mixed ruminal bacteria.

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The objective of this study was to identify environmental factors that influence conjugated linoleic acid (CLA) production by mixed ruminal bacteria. Ruminal contents were collected from a 600-kg ruminally fistulated Hereford steer maintained on pasture. Mixed ruminal bacteria were obtained by differential centrifugation under anaerobic conditions and added to basal medium that contained a commercial emulsified preparation of soybean oil and a mixture of soluble carbohydrates (cellobiose, glucose, maltose, and xylose). Culture samples were collected from batch culture incubations at 0, 2, 4, 6, 8, 12, 24, 26, 28, 30, 32, and 48 h. Continuous culture incubations were conducted at dilution rates of 0.05 and 0.10 per h, extracellular pH values of 5.5 and 6.5, and 0.5 and 1.0 g/L of mixed soluble carbohydrates. Culture samples were obtained from the culture vessel once steady state conditions had been achieved. In batch culture, *trans*-$C_{18:1}$ concentrations increased over time and reached a maximum at 48 h. Little CLA was produced during the first 8 h, but *cis*-9, *trans*-11 CLA concentrations remained high between 24 and 30 h and *trans*-9, *trans*-11 CLA concentrations were high between 24 and 32 h. When mixed ruminal bacteria were maintained in continuous culture on 0.5 g/L of mixed soluble carbohydrates, concentrations of *trans*-$C_{18:1}$, *cis*-9, *trans*-11 CLA, and *trans*-9, *trans*-11 CLA were reduced ($P < 0.05$) at a dilution rate of 0.05 per h and extracellular pH of 5.5. Similar effects were also observed when 1.0 g/L of mixed soluble carbohydrates was used. When extracellular pH was lowered to 5.0, neither *trans*-$C_{18:1}$ or CLA isomers were detected. In conclusion, our results suggest that culture pH appears to have the greatest influence on the production of *trans*-$C_{18:1}$ and CLA isomers by mixed ruminal bacteria.

Key Words: conjugated linoleic acid, rumen, bacteria

660 Influence of diet on conjugated linoleic acid content of beef.

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Conjugated linoleic acid (CLA) has been shown to have health benefits in animal models. Increasing the CLA in beef would enhance its nutritive value. Twenty Angus crossbred steers (235 ± 18.8 kg BW) were used to study the effect of diet on the CLA content of beef. Steers were assigned to one of four treatments in a randomized block design, and were followed from weaning to slaughter. There were two feeding periods (backgrounding and finishing). During backgrounding: Trt 1, 2 and 3 received a diet consisting of a 60:40 forage to grain ratio. Trt 4 received alfalfa hay only. During finishing: Trt 1 and 2 received a diet consisting of a 15:85 forage to grain ratio. In addition to the basal diet Trt 2 received 84 g per head/d of a synthetic mixture of rumen protected CLA isomers. Trt 3 and 4 were finished on pasture containing predominantly Kentucky bluegrass and orchardgrass. Average live BW at slaughter was between 500 to 600 kg. Muscle tissue samples were collected at slaughter from the loin and round of each carcass and analyzed for fatty acid profile. Cattle finished on pasture (Trt 3 and 4) had 275 and 470% more $C_{18:1}$ *trans* fatty acids, respectively, compared with Trt 1 (Table below). $C_{18:1}$ *cis* fatty acids were not different among treatments. Beef from steers raised only on forages (Trt 4) had 550% more CLA (*cis*-9, *trans*-11), whereas steers receiving grain in backgrounding and grazed on pasture during finishing (Trt 3) had 300% more CLA compared with beef from steers fed typical high grain feedlot diet (Trt 1). Supplemental protected CLA (Trt 2) slightly increased CLA in the round, but not the loin. Raising cattle on forages and pasture with no grain supplementation can enhance the CLA content of beef.

Fatty acid*	Muscle	Trt 1	Trt 2	Trt 3	Trt 4	$P<$
$C_{18:1}$ *trans*	Loin	1.1^{d}	2.6^{c}	3.6^{b}	6.1^{a}	0.03
CLA *cis*-9, *trans*-11	Loin	0.19^{c}	0.33^{c}	0.63^{b}	1.06^{a}	0.01
CLA *trans*-10, *cis*-12	Loin	0.014	0.053	0.010	0.034	NS
$C_{18:1}$ *trans*	Round	0.74^{c}	1.54^{c}	3.09^{b}	4.12^{a}	0.02
CLA *cis*-9, *trans*-11	Round	0.20^{d}	0.42^{c}	0.97^{b}	1.57^{a}	0.03
CLA *trans*-10, *cis*-12	Round	0.012^{b}	0.063^{a}	0.033^{ab}	0.046^{ab}	0.0 4

*Mean values shown are as a % of total fatty acids.

Key Words: Beef, CLA, Pasture

661 Effect of corn silage and soybean oil on *in vitro* production of conjugated linoleic acid (CLA) and 18:1 fatty acids by beef finishing diets.

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A study was conducted to determine the effect of level of corn silage (CS) and soy oil (SO) on *in vitro* production of CLA with beef finishing diets. The experimental design was a 2x3x5 factorial randomized complete block with CS (20 vs. 40% of diet DM), SO (0, 4, or 8% of diet DM) and time (0, 6, 12, 24, and 48 h) as the factors. There four replicates per treatment, and the experiment was conducted twice. Following standard *in vitro* digestibility procedures, incubated samples were analyzed for NDF digestion and fatty acid composition. Fatty acid analysis was performed on fatty acid methyl esters (FAMEs) formed by direct acidic methylation. FAMEs were quantified by gas-liquid chromatography. The CLA isomers measured were cis-9, trans-11 (c9,t11), trans-9, trans-11 (t9,t11), and cis-10,trans-12 (c10,t12). Total CLA (TCLA) and total 18:1 fatty acids (18:1FA) were also measured. Fatty acid concentrations are reported as mg per g of DM contents. NDF digestion was significantly less when CS was increased from 20 to 40% of diet DM ($P<.05$), and when 8% SO was added compared with 0 or 4% added SO ($P<.05$). Level of SO significantly increased production of t9,t11, TCLA and 18:1FA ($P<.001$), and there was a trend for level to increase c10,t12 ($P=.0725$). Level of CS tended to increase c9,t11 production ($P=.0759$). There was a significant CS by SO interaction for t9,t11, TCLA and 18:1FA ($P<.02$). Time significantly affected c9,t11, t9,t11 and 18:1FA production ($P<.05$) with the greatest concentrations occurring at 12 h of incubation. There was a trend for TCLA concentrations to be affected by time ($P=.0883$) with the greatest concentrations occurring with the 24 h incubation. Both CS and SO can be used to alter CLA and 18:1 fatty acid production during *in vitro* fermentation.

Key Words: CLA, In Vitro, Rumen Biohydrogenation

662 Effects of flake density of high oil corn and typical corn on performance and carcass characteristics of feedlot steers.

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To determine if density of steam-flaked high oil corn (HO) or typical corn (T) affected feedlot performance and carcass composition of feedlot steers, 16 English x Continental crossbred steers (BW = 363 ± 10.6 kg) were fed diets containing corn steam-flaked at either .31 kg/L (24 lb/bu) or .36 kg/L (28 lb/bu) flake densities for 127 d. Prior to initiation of the study steers were fed T processed at .36 kg/L. On d 0, steers were randomly allotted to four dietary treatments: typical corn, .31 kg/L (T24); typical corn, .36 kg/L (T28); high oil corn, .31 kg/L (HO24); or high oil corn, .36 kg/L (HO28). Diets, designed to meet or exceed NRC (1996) requirements, were formulated to be isocaloric and isonitrogenous by including HO into the diet at 75% of DM while T was included at 72% of diet DM with 2.8% blended vegetable and animal fat added to produce diets equal in ether extract. Daily gain of steers was greater ($P = .07$) d 0 to 28 for steers fed HO24 than for steers fed

HO28 and was greater (P < .05) from d 0 to 56 for steers fed HO24 than steers fed T24. Neither corn type nor degree of processing affected (P > .10) DMI. Feed efficiency (FE) over the total trial was superior (P = .05) for HO24 as compared to T24 and HO28. From d 0 to 56, feeding HO24 produced greater (P < .01) FE than feeding T24, T28, or HO28. Carcass characteristics (hot carcass weight, internal fat, external fat, marbling score, longissimus muscle area) were unaffected (P > .10) by dietary treatments. Differences in carcass variables were not expected because diets were formulated to be isocaloric and isonitrogenous. High oil corn can effectively replace typical corn plus supplemental fat in feedlot diets, and more extensive processing of high oil corn will enhance its feeding value.

Key Words: High oil corn, Steam-flaked corn, Steers

663 Effect of Dry-Rolled High-Oil Corn or Added Corn Oil on Ruminal and Total Tract Digestibility of Beef Cattle Finishing Diets. L.R. Kennington*[1], C.W. Hunt[1], J.G. Andrae[1], G.T. Pritchard[1], and F.N. Owens[2], [1]*University of Idaho, Moscow,* [2]*Dupont Specialty Grains, Des Moines, IA.*

Three ruminally and duodenally cannulated Angus steers were used in a replicated 3 x 3 Latin square design to evaluate digestion characteristics of dry-rolled high-oil corn and its isogenic counterpart in finishing diets. Dietary treatments included: 1) isogenic typical corn (**TC**, 79.2% of diet DM), 2) a high-oil corn hybrid (**HOC**, 79.2% of diet DM), and 3) TC with 2.4% added corn oil (**OIL**, 76.9% typical corn). Ruminal OM and GE digestibilities were greater ($P<.05$) for HOC and OIL than for TC (66.2, 70.9 vs. 60.2%; 63.5, 67.2 vs. 54.9%, respectively). In contrast, total tract OM digestibility was greater ($P<.05$) for TC and OIL diets than for the HOC diet (88.4, 89.2 vs. 86.9%). Total tract GE digestibility was greater ($P<.05$) for OIL (88.1%) than HOC (85.8%) with GE digestibility of TYP being intermediate (87.2%). Ruminal starch digestibility was greater ($P<.05$) for OIL than TC or HOC (86.1 vs. 75.5 and 78.9%) while total tract starch digestibility was greater for OIL and TC ($P<.05$) than HOC (97.1, 96.3 vs. 94.8%). Total fatty acid digestibility was greater ($P<.05$) for HOC and OIL than TC (75.7, 75.2 vs. 68.8%). Due to higher fatty acid intake, steers fed HOC and OIL had greater ($P<.05$) daily intake of ME (DE*.82) than steers fed TC (32.1, 32.6 vs/ 30.6 Mcal/d). However, diet ME (Mcal/kg DM) was greater ($P<.05$) for OIL (3.07) than TC (2.95) with diet ME of HOC being intermediate (3.01). Despite the higher oil content of HOC and its 3.6% greater GE concentration, slightly greater fecal starch and fatty acid losses reduced its ME advantage to only 2.2% over the diet containing typical corn. Subtracting DE contributed by other diet components, ME content was not significantly greater (2.6% higher) for the rolled high-oil corn than typical corn. In contrast, adding 2.4% corn oil to the diet increased diet GE by 3% and diet ME by 4.2%, due to slight decreases in fecal starch and NDF concentrations.

Key Words: High-oil corn, Beef, Energy

664 Effects of high oil corn and shade on performance of Angus and Bonsmara x Beefmaster feedlot steers. T. C. Bramble*[1], C. R. Richardson[1], K. F. Wilson[1], G. V. Pollard[1], C. P. Bridge[1], F. N. Owens[2], and G. R. Chapman[3], [1]*Texas Tech University, Lubbock,* [2]*Du Pont Specialty Grains, Des Moines, IA,* [3]*Amarillo, TX.*

This experiment was designed to determine if corn source [high oil corn (HO) vs typical corn (T)] would alter performance of finishing steers with or without access to shade in partially slotted floor feedlot pens. Steers, of Angus (A) (n=59, BW = 322 ± 2.2 kg) and Bonsmara x Beefmaster (B) (n = 56, BW = 294 ± 2.1 kg) heritage, were fed for 150 d (July 17 to December 13, 2000). Breed was nested within pens and steers were blocked into pens by weight. Treatments included: NST (no shade, typical corn), NSHO (no shade, high oil corn), ST (shade, typical corn), and SHO (shade, high oil corn). Finishing diets, formulated to meet or exceed NRC (1996) requirements, consisted of 77.7% steam-flaked (.36 kg/L, 28 lb/bu) corn (either HO or T), 10% roughage, and protein, vitamin, mineral, and feed additive supplements. Shade structures, black, 80% light-occluding polypropylene cloth fixed 3 m above pens, covered 67% of pen area (9.8 m^2 of shade/steer). Supplemental shade increased DMI by 6.8% (P = .05) during the first 28 d, HO improved (P = .02) DMI by 3.2% from d 28 to 56, but neither shade nor diet impacted (P > .10) DMI for the total trial. Steers fed HO had greater (P = .07) ADG (1.62 vs 1.55 kg) than steers fed T for the total study, but shade had no effect on ADG. Daily gain was greater (P < .01) for A than B cattle over the total trial. Feed efficiency (FE) was improved (P = .04) by shades from d 28 to 56 but was not different (P > .10) for any other period during the trial. High oil corn improved (P < .01) FE by 5.8% from d 0 to 85 and improved (P = .06) overall FE by 3.0% (5.13 vs 5.29 kg feed/gain). Although Angus steers gained faster than Bonsmara x Beefmaster and substituting high oil corn for typical corn improved ADG and FE, shades failed to improve performance when averaged over the total trial. However, early in the trial or when ambient temperature increased, shade may improve DMI and FE of typical corn.

Key Words: High oil corn, Shade, Bonsmara

ASAS/ADSA Ruminant Nutrition: Protein Nutrition

665 An evaluation of feeding practices associated with milk production and milk composition. C.R. Richardson* and D.A. Christensen, *University of Saskatchewan.*

The objective of this study was to look for links between feeding management strategies and milk composition on dairy farms near Saskatoon, SK, Canada. Eleven dairy farms that fed a total mixed ration (TMR) and participated in Dairy Herd Improvement (DHI) testing were selected to participate in a 54 d, observational study. Nine farms completed the study. Data collected included dry matter intake (DMI), particle size variation of TMR, times fed per day, bulk tank milk production and weekly milk composition. Milk component production (Kg) and 3.5% fat corrected milk (FCM) were calculated. Analysis was done on TMR for moisture, CP, NDF, ADF, EE, moisture and ash. Herd size ranged from 37 to 197 cows. Milk protein content ranged from 3.10 % to 3.36 %, which differed between farms (P<0.05). Milk fat content ranged from 3.45% to 4.00% (P<0.05). Total milk production and milk per cow was significantly different between farms (P<0.05). DMI ranged from 19.0 to 31.5 Kg per day. Herds with the highest intakes did not always have the highest milk production. Pearson correlations for DMI and milk yield per cow ranged from -0.35 to 0.46. Herds differed in times fed per day and particle size of the TMR. Herds with the highest NDF and ADF were not necessarily the highest fat herds. Small ration particle size was not always highly correlated with milk fat percentage. Strength of correlations for feeding practices varied between farms. Milk production correlated strongly with milk protein yield (r2=0.988) and milk fat yield (r2=0.993). Fluctuations in daily DMI were significant between farms. There are many factors that influence milk production and composition. It appears that the amount each of these factors contributes varies from farm to farm and includes a combination of feeding management techniques

Key Words: milk composition, feeding management, nutrition

666 Effect of different levels of dietary protein on nitrogen metabolism of heifers. J.C. Marini* and M. E. Van Amburgh, *Cornell University, Ithaca NY 14853.*

Four Holstein heifers (with an initial weight of 204 kg ± 5 SD) were used in a Youden square design (5 periods and 5 treatments) in order to investigate the effect of dietary protein levels on nitrogen (N) metabolism. Five diets (D) calculated to be isocaloric on a ME basis (30% hay:70% concentrate) varied in CP levels from D1 to D5, 8.9, 12, 15.7, 18.6 and 21.4 %CP respectively, and were fed to the animals at 2x maintenance. Differences in CP were achieved by substituting citrus pulp for soybean meal. Plasma urea nitrogen (PUN) concentration and rumen ammonia concentration (RAN) for D1 and D2 were low and suggested that they were N deficient although only the lowest level of protein intake depressed total tract DM and NDF digestibilities (P < 0.01). Nitrogen balance increased with increasing levels of CP although D2 was not statistically different than D3, D4 and D5. Fecal N excretion and the non-urea fraction of urinary N did not differ among treatments. Lucas analysis showed that the true digestibility of the protein was 96% and metabolic fecal N excretion was 0.54 g N/MBW (R^2=0.99). Endogenous urinary N was 0.24 g/kg MBW and the N excreted in the urine