W335 Variation in chemical composition among breeding lines of novel oat varieties as ruminant feeds. J. M. Moorby,* A. A. Cowan, and A. H. Marshall, *Institute of Biological, Environmental and Rural Sciences, Aberystwyth University, Aberystwyth, UK.*

Previous work has shown the nutritional benefits of naked oat varieties compared with husked oats, particularly for pigs and poultry, but also for ruminants. However, crop yields of naked oats are significantly lower than those of husked oats, leading to a more expensive crop which has limited its appeal to feed compounders in least-cost ration formulations. To improve the digestibility of husked oats, a breeding program aimed at producing low-lignin oats with a high oil content has generated several new breeding lines. The chemical composition of modern oat varieties is likely to be different from previous varieties, and therefore standard 'book' values. Samples of the whole grain (including husk if present) of 4 commercial varieties of winter naked (WN) oats, together with several novel low-lignin breeding lines of spring husked (SLLH; n = 5) and winter husked (WLLH; n = 8) oats, were analyzed for standard chemical composition. Data were analyzed by ANOVA, with multiple comparisons when the effect of treatment (SN, SLLH and WLLH) was significant ($P < 0.05$). Grain oil and CP concentrations were significantly lower in the novel husked oats than the conventional naked oat varieties (Table 1), while fiber concentrations were higher, leading to lower ME densities in the husked oats than the naked oats, as expected. In conclusion, although the apparent feeding value of the novel husked oats was not as good as naked oats in some areas, some values of novel spring varieties in particular were similar to naked oats and show promise as ruminant feeds. Oat breeding work is ongoing, and these results highlight breeding targets for future lines of high yielding husked oats.

Table 1. Mean chemical composition of oat varieties; values in % DM unless otherwise indicated

	WN	WLLH	SLLH	SEM	*P*-value
DM, %	89.4	90.9	90.9	0.49	0.053
OM	97.7[a]	97.4[a]	97.0[b]	0.09	<0.001
Oil	13.8[a]	7.5[b]	6.3[b]	0.74	<0.001
CP	12.7[a]	8.3[b]	11.1[a]	0.49	<0.001
ADF	3.8[a]	16.0[b]	13.3[b]	1.06	<0.001
NDF	8.2[a]	29.7[b]	27.5[b]	1.30	<0.001
ME, MJ/kg DM	16.7[a]	12.4[b]	13.0[b]	0.30	<0.001
Starch	54.6[a]	47.7[b]	48.4[b]	1.40	0.004
ADL	1.2[a]	2.9[b]	1.8[ab]	0.49	0.027

[a,b]Values in rows with different letters indicate significant differences ($P < 0.05$).

Key Words: chemical composition, oats, plant breeding

W336 Ruminal metabolism in continuous culture fermentation when administrating high concentration of inorganic selenium in mixed cultures of ruminal microorganisms. **J. M. Vera[1], T. Z. Davis[2], D. N. Miller[3], K. E. Panter[2], D. R. ZoBell[1], and J.-S. Eun*[1],** *[1]Department of Animal, Dairy, and Veterinary Sciences, Utah State University, Logan, [2]Poisonous Plant Research Laboratory, USDA-ARS, Logan, UT, [3]Agroecosystem Management Research Unit, USDA-ARS, Lincoln, NE.*

The current literature lacks information on ruminal microbial metabolism in response to high selenium (Se) concentration in the diet. We investigated changes in ruminal fermentation when high concentration of Se was administered in mixed ruminal cultures in fermentors. Two mature beef cows, fitted with a ruminal cannula, grazed on tall fescue pasture and were used as donor animals for ruminal contents. Filtered ruminal contents were allowed 11 d of adaptation to diets followed by 3 d of data collection. A dual-flow continuous culture system was used in a completely randomized design (n = 4) to test 2 dietary treatments: control (no Se addition) and 50 ppm Se addition. Grass hay (20 g DM/d) containing 0.12 ppm Se was added to the fermentors in 2 equal portions at 0800 and 1700 h. Selenium (sodium selenate) was added to the Se addition treatment by gradually increasing the concentration from 2 to 50 ppm over the 11 d in adaptation period. Culture pH averaged 6.04 and was not affected by treatment. Total volatile fatty acid (VFA) concentration averaged 52.2 and 55.5 m*M* in the control and Se treatment, respectively, and addition of Se did not affect the VFA concentration. Molar proportions of acetate and propionate did not differ due to Se addition, resulting in a similar acetate-to-propionate ratio. However, addition of Se tended to increase ($P = 0.09$) ammonia-N concentration. Additionally, Se addition increased methane production ($P = 0.01$). Selenate-respiring microorganisms were detected by the most probable number enumeration technique in 3 of the 4 replications receiving Se. Addition of 50 ppm Se in grass hay diet had no negative effects on ruminal fermentation, as was observed in similar culture pH and VFA concentration. However, addition of Se affected microbial N metabolism by increasing ammonia-N concentration. Overall data in this study suggest that the addition of Se up to 50 ppm would not interfere with in vitro ruminal metabolism by microbiota.

Key Words: continuous cultures, ruminal metabolism, selenium

W337 Effects of algae on ruminal fermentation and digestion in continuous culture fermenters. A. M. Gehman,* G. A. Harrison, and B. Jacobs, *Alltech Biotechnology Inc, Nicholasville, KY.*

The objectives of this experiment were to observe the effects on ruminal fermentation and digestibility when algae were included in a total mixed ration fed to continuous culture fermenters. Algae were *Schizochytrium* sp. and had a composition of 15.2% crude protein, 1.5% neutral detergent fiber (NDF), 3.9% ash, 30.9% non-structural carbohydrate, and 41.9% total fatty acids. Twelve single-flow continuous culture fermenters were used in a single-factor design with 6 dietary treatments with 2 replications per treatment. Diets were formulated to be isonitrogenous (17% crude protein) and to include algae at 0, 1, 2, 3, 4, and 5% dry matter (DM) or 0, 232, 465, 697, 930, and 1162 g equivalent for 22.7 kg DM intake. Diets were primarily comprised of corn silage, alfalfa hay, and corn grain. Cultures were fed 25 g twice daily for 6 d. Rates of flow and dilution were kept constant at 44 mL/h and 0.04/h for the duration of the study. Fermentation samples were collected from cultures before morning feeding during the last 3 d of the experiment to measure pH, ammonia, and volatile fatty acids (VFA). Composite effluent samples from each fermenter were used for DM and NDF digestibility. Data were analyzed for effects of treatment using PROC GLM of SAS. Culture pH and ammonia before morning feeding did not differ among treatments, averaging 6.21 ± 0.42 and 7.93 ± 0.32 mg/dL respectively. Molar proportions of acetate increased ($P < 0.01$) and propionate decreased ($P < 0.01$) similarly in all treatments containing algae compared with control (48.5 vs. 46.5 ± 0.5 and 26.0 vs. 29.4 ± 0.8 mol/100 mol). Butyrate, isobutyrate, isovalerate, valerate, and total VFA were not affected by treatment, averaging 18.2 ± 0.9, 1.81 ± 0.04, 1.73 ± 0.07, 2.32 ± 0.08,

and 46.5 ± 2.1 mol/100 mol, respectively. Dry matter and NDF digestibility were not affected by treatment, averaging 43.4 ± 2.6 and 38.4 ± 6.4% respectively. Inclusion of algae affected the VFA profile but did not affect DM or NDF digestibility, indicating that algae modifies rumen fermentation in a manner that may not affect forage utilization.

Key Words: algae, continuous culture fermenter, rumen fermentation

W338 Digestion response of dairy heifers to the supplementation of autolyzed yeast. D. R. Gomide[3], R. F. Lima[1], N. M. Lopes[1], R. C. Oliveira[1], A. Ganner[2], R. A. N. Pereira[3], and M. N. Pereira*[1], *[1]Universidade Federal de Lavras, Lavras, Brazil, [2]Biomin Research Center, Tulln, Austria, [3]Empresa de Pesquisa Agropecuaria de Minas Gerais, Lavras, Brazil.*

Response to autolyzed *S. cerevisiae* supplementation (Levabon Rumen, Biomin) was evaluated. Nine ruminally cannulated heifers (510kg) received a sequence of treatments in 35-d period, 3x3 Latin Squares. Treatments were 0, 10 or 30g/d, given twice daily via cannula. A TMR was individually fed twice a day: 51.8% corn silage, 48.2% concentrate, 15% CP, 34% NDF, 39% NFC. Low ruminal pH was induced by feed removal at 12h post-morning feeding on d 34 and ad libitum feeding on d 35. Ruminal pH was evaluated on d 28 and 35 at 0, 3, 6, 9, 12, 18 and 24h post-feeding, and ruminal ammonia and PUN simultaneously on d 28. Tifton was incubated in situ over time on d 30 to 33. Total tract digestibility of DM was done by total collection of feces on d 31 to 33, simultaneously to urine sampling to estimate the relative rumen microbial yield by allantoin excretion. Statistical models had the effects of heifer, period and treatment; some had time and time by treatment interaction. Preplanned contrasts were: T0 vs. T10 and T0 vs. T30. Ruminal pH did not respond to treatments ($P > 0.20$), neither protozoa count ($P > 0.24$). Mean and minimum pH were 6.45 and 6.01 on d 28, and 6.16 and 5.38 on d 35, respectively, nadir was at 12h post-feeding. Urinary allantoin excretion was (mmoles/d): 53.3 on T0, 60.5 on T10 ($P = 0.50$), 77.6 on T30 ($P = 0.04$). There were trends for increased kd of Tifton B fraction on T30 for DM ($P = 0.07$) and NDF ($P = 0.06$). Total tract DM digestibility was (% of intake): 67.3 on T0, 68.4 on T10, 69.5 on T30 ($P > 0.28$). Days 28 to 33 DMI was increased from 11.7kg/d to 12.5 on T10 ($P = 0.04$), but T30 induced no response ($P = 0.88$). Day 35 DMI was: 17.0 on T0, 17.2 on T10, 16.4 on T30 ($P > 0.43$). Ruminal ammonia concentration did not differ ($P > 0.58$), but PUN was (mg/dL): 17.5 on T0, 18.5 on T10 ($P = 0.14$), 19.1 on T30 ($P = 0.03$). T10 induced a flattened PUN curve along the day. Ruminal ammonia peaks posterior to the morning feeding induced PUN peaks, while the evening ammonia peak was associated to decreasing PUN concentration. Autolyzed yeast supplementation induced positive dose dependent responses in rumen microbial yield, digestion and DMI. Ruminal pH regulation by yeast was not a plausible mechanism for the response.

Key Words: rumen microbial yield, *Saccharomyces cerevisiae*, yeast

W339 The effect of several sodium and potassium salts on rumen pH. R. Garcia-Gonzalez,* C. Yunta, and H. van Laar, *Nutreco R&D, Boxmeer, the Netherlands.*

”Buffers” are broadly used in practice to counteract low rumen pH, but their mode of action is still open to question. Our work aimed to examine the rumen pH response to several Na and K salts, supplied at equivalent amounts of the cation. Two separate experiments (exp.) were conducted with Na and K salts, respectively. Each exp. was designed as a Latin square involving 5 rumen-fistulated cows in 5 periods of 2 d each. The cows were housed in a tie-stall barn, submitted to a fixed daily management schedule and fed a customary diet, but free of any mineral supplement, offered in 2 daily meals. The first day of each period, 1 of 5 possible treatments was supplied directly in the rumen, 2 h after the morning meal. Treatments were, for the Na exp.: $NaHCO_3$, Na_2CO_3, Na_2HPO_4, NaCl and none (control); and for the K exp.: $KHCO_3$, K_2HPO_4, K_2HPO_4 at double dose, KCl and none. Salts were supplied to provide 2 mol of the corresponding cation. Cows were fitted with indwelling rumen pH loggers set to record pH every 2 min for the whole duration of the exp. Every exp. was separately analyzed. First, pH data was averaged (avg.) for 3 time intervals post-administration of treatments, namely: 0 to 1 h, 1 to 3 h, and 3 to 6 h. Avg. pH were then analyzed with the mixed procedure of SAS, according to a model that included treatment, time (repeated measure), their interaction, and the pH at time 0 (covariable) as fixed effects; and cow and period as random effects. Any effects ($P < 0.05$) of these salts on pH were noticeable in the first 3 h, mostly in the first 1 h. In the Na experiment, NaCl did not cause any change in pH whereas all the other salts raised the pH. Similarly, in the K experiment KCl failed to cause any change in pH, while $KHCO_3$ rose, and the double dose of K_2HPO_4 tended to raise, pH. These results support that a positive strong cation to anion difference may be a determining factor for the salts tested to increase rumen pH.

Key Words: rumen pH, sodium, potassium

W340 Effect of polyethylene glycol on in vitro fermentation kinetics and digestibility of native tree fruits. F. Aviles-Nova*[1], J. G. Estrada-F[2], O. Castelan-Ortega[3], B. Albarran-P[1], and A. Ramirez-O[1], *[1]Centro Universitario UAEM-Temascaltepec. Universidad Autonoma del Estado de Mexico, Temascaltepec, Edo. de Mexico, Mexico, [2]Instituto de Ciencias Agropecuarias y Rurales (ICAR) de la UAEM, Toluca, Edo. de Mexico, Mexico, [3]Facultad de Medicina Veterinaria y Zootecnia de la UAEM, Toluca, Edo. de Mexico, Mexico.*

This study evaluated the effect of polyethylene glycol on in vitro ruminal fermentation kinetics, in vitro organic matter digestibility (IVOMD), in vitro neutral detergent fiber digestibility (IVNDFD) and metabolizable energy (ME) in the fruit of native trees *Quercus hintonii* and *Quercus glaucoides* from the Mexican Central Plateau. Samples were collected in 4 sites where 3 trees were randomly selected. Three subsamples of 200g of ripe fruit were taken from each tree. They were dried at 40°C, ground in a Wiley mill with a 1mm sieve, and analyzed in triplicate. Fermentation kinetics, IVOMD and IVNDFD were evaluated with the in vitro gas production technique (GP) with and without polyethylene glycol (PEG 6000). In the former, 500 mg of substrate were added to each glass syringe plus 50 mL of buffered ruminal fluid (10 mL of ruminal fluid from forage-fed cattle: with a concentration of 80:20) and 40 mL of culture media. The syringes with PEG contained 500 mg of substrate, 1000 mg of PEG, plus 50 mL of ruminal fluid and 40 mL of culture media. All syringes were incubated at 39°C for 96 h. Gas volume was recorded from 1 to 8,12,16,20,24,36,48,72, and 96 h and was adjusted to mathematical model $Y = b(1\text{-exp-}^{c(t\text{-lag})})$. IVOMD and ME were determined with equations: IVOMD = 16.49+0.9042*GP+0.0492*RP+0.0587*EE, ME = 3.16+0.0695*GP+0.000730 *GP2 +0.00732*RP+0.02052*EE [RP = raw protein; EE = ether extract]. A completely randomized design was used with a 2x2 factorial arrangement. *Q. glaucoides* presented higher IVNDFD (52.7%) ($P < 0.001$), IVOMD (68.8%)($P < 0.001$) and ME (10.4 MJ/kgMS)($P < 0.010$). PEG addition between the species had a positive effect on IVNDFD, IVOMD and ME ($P < 0.02$). *Q. glaucoides* with PEG presented higher GP (200.1 mL/200mg) compared with *Q. glaucoides* without PEG (176.8 mL/200 mg)($P < 0.0001$). *Q. hintonii* presented a similar behavior with PEG (150.1mL/200mg) and without PEG (126.4mL/200mg) ($P < 0.018$). Adding PEG to the fruit had a

positive effect, improving nutritional value. *Q. glaucoides* presented higher digestibility and better fermentation parameters.

Key Words: in vitro digestibility, native trees, polyethylene glycol

W341 Chemical composition and in vitro digestibility of foliage trees, and their use in feeding lambs in the dry tropics of central highlands of Mexico. S. Rojas-Hernandez[1], D. Castelan-Ortega[3], A. Garciâ-Martinez[2], J. Olivares-Perez[1], J. G. Estrada-F[4], and F. Aviles-Nova*[2], *[1]U. A. Medicina Veterinaria y Zootecnia, Universidad Autonoma de Guerrero, Ciudad Altamirano, Guerrero, Mexico, [2]CU - Temascaltepec, Universidad Autonoma del Estado de Mexico, Temascaltepec, Edo. de Mexico, Mexico, [3]Facultad de Medicina Veterinaria y Zootecnia - Universidad Autonoma del Estado de Mexico, Toluca, Edo. de Mexico, Mexico, [4]Instituto de Ciencias Agropecuarias y Rurales, Toluca, Edo. de Mexico, Mexico.*

The objective of this study was to evaluate the chemical composition and in vitro digestibility of *C. alata* and *G. ulmifolia*, and the productive response of lambs fed diets with different levels of foliage included, in terms of dry matter intake (DMI), total weight gain (TWG), daily weight gain (DWG), feed conversion (FC) and feed efficiency (FE). Twenty lambs at 3.5 mo of age and 22.9 ± 0.88kg were randomly distributed (n = 4) in 5 treatments: T0 = control diet, T1 = diet with 15% *C. alata*, T2 = diet with 30% *C. alata*, T3 = diet with 15% *G. ulmifolia*, and T4 = diet with 30% *G. ulmifolia*. A totally random design was used, the Tukey test was applied ($P < 005$). The *G. ulmifolia* foliage had greater crude protein, IVDOM, total phenols and condensed tannins content ($P < 0.01$), with 167.2, 491.0, 41.5, and 38.2 g/kg DM, respectively, and 2.08 Mcal/kg DM of metabolizable energy. The *C. alata* foliage had greater neutral detergent fiber and acid detergent fiber content ($P < 0.001$), with 502.0 and 315.0 g/kg DM, respectively; the *C. alata* foliage, at 24, 48 and 96 h of incubation, had greater gas production ($P < 0.001$) with 66.1, 170.9 and 210.6 mL/g DM, respectively. Asymptotic gas production (b) was greater ($P < 0.05$) in T0 (293 mL g^{-1} DM). DMI was less in lambs in T0 (1061.4 g/animal/day) ($P < 0.025$). The DWG of the control diet was similar to that of diets with the different levels of inclusion of each species ($P > 0.05$), however the DWG of the diet with 15% *C. alata* (T1) was greater (295.6 g/d) ($P < 0.05$) than that of the diet with 30% *G. ulmifolia* (T4) (227.8 g/day) and was similar to T2 (30% *C. alata*) (286.7 g/d) and T3 (15% *G. ulmifolia*) (267.8 g/d). The native, non-leguminous tree foliages, *C. alata* and *G. ulmifolia*, have potential as forage for lamb production in the dry tropics. Including foliage from these species may substitute 15 and 30% of the conventional ingredients in lambs diets, since they improve dry matter intake and productive response.

Key Words: kinetics of degradation, lambs, non-leguminous tree

W342 Effect of replacing barley grain with wheat dry distillers grains with solubles on *in situ* degradation kinetics, growth, and fatty acid profiles of lambs. J. S. Avila[1], S. J. Meale*[1], A. S. O'Hara[1], A. Horadogoda[1], D. Palmer[1], T. A. McAllister[2], and A. V. Chaves[1], *[1]Faculty of Veterinary Science, University of Sydney, Sydney, NSW, Australia, [2]Lethbridge Research Center, Agriculture and Agri-Food Canada, Lethbridge, Alberta, Canada.*

The aim of the study was to assess the effects of replacing barley grain with increasing concentrations of wheat dry distillers grains with solubles (WDDGS) in lambs diets. The control diet contained (DM basis) 62.9% barley grain, 30% alfalfa hay, 2.5% molasses, 1% canola oil and 3.6% mineral-vitamin mix. Increasing concentrations (20, 40% of DM) of WDDGS was achieved by replacing barley grain with WDDGS. Digestion kinetics of DM, CP, and NDF of diets were measured by in situ incubations using 2 rumen cannulated cows. Additionally, 39 weaned Dorper/Merino lambs were used in a trial to determine the effects of WDDGS on growth performance, feeding behavior, subcutaneous fat fatty acid (FA) profiles and wool growth. Lambs were blocked by weight and randomly assigned to one of the 3 dietary treatments (Control, 20% WDDGS and 40%WDDGS). Lambs were fed ad libitum using 3 automatic feeders per treatment and had free access to water. Lambs were slaughtered at a BW of ≈44 kg. Data were analyzed using the mixed model procedure of SAS. In the in situ study, WDDGS did not affect ($P = 0.61$) DM or NDF degradation rates (k, h^{-1}), but reduced CP degradation rate ($P = 0.02$). Effective rumen degradable protein and ruminal undegradable protein (g/kg DM) were higher ($P < 0.001$) in the WDDGS diets compared with control. In the growth trial, increasing WDDGS in the diet did not affect ($P = 0.48$) eating time (min/d), but quadratically increased ($P = 0.02$) eating rate (g/min), intake ($P = 0.02$) and daily gain ($P = 0.05$). Final bodyweights were linearly increased ($P = 0.02$) by WDDGS addition and hot carcass weight was higher ($P = 0.04$) in the 40% WDDGS group compared with other treatments. Inclusion of WDDGS did not affect feed efficiency ($P = 0.62$), wool staple length ($P = 0.32$), total SFA ($P = 0.29$), MUFA ($P = 0.32$) or PUFA ($P = 0.11$) profiles of subcutaneous fat, but increased C18:3 ($P = 0.02$). This study suggested that WDDGS included up to 40% of dietary DM as replacement of barley grain increases RDP, RUP, and lamb growth performance.

Key Words: digestion kinetics, ethanol by-products, wool yield

W343 Could essential oils of thyme (*Zataria multiflora*) and peppermint (*Mentha piperita*) improve calf growth performance? M. Ebrahimi, M. Ganjkhanlou, and M. Dehghan-Banadaky,* *University of Tehran, Karaj, Tehran, Iran.*

This experiment was conducted to investigate the effect of feeding thyme and peppermint essence to calf starter on preweaning and postweaning calf growth performance, feed intake and blood metabolites. Following 3 d of colostrum and transition milk feeding 36 Holstein calves were assigned in a completely randomized block design with 3 dietary treatment with 12 calves (6 females and 6 males) per treatment including: 1) starter without essence (Control), 2) starter including 0.2% peppermint essence, and 3) starter including 0.2% thyme essence. Calves were housed in individual hutches, and fed whole milk at 10% of the initial body weight daily and had free access to starter and water. The weaning process defined when the calves had consumed 1 kg of starter for 2 d, consecutively. The experiment was ended 2 weeks after weaning the calves. Feed intake was measured daily. Body weight was measured at birth, at monthly throughout the study, at weaning and at the end of study. Blood samples were obtained 2 d before weaning and at the end of study. Plasma samples analyzed for glucose, urea nitrogen and β-hydroxybutyrate (BHBA) determination. Average daily feed intake and body weight gain was greater for calves fed peppermint compared with other calves (624.3 ± 43.5 vs. 526.2 ± 42.4 and 432.7 ± 44.7 g daily feed intake and 0.94 ± 0.03 vs. 0.88 ± 0.02 and 0.82 ± 0.04 g daily gain respectively for treatments 2, 3 and 1, $P < 0.05$). There were no differences between treatments for postweaning gain and feed consumption after weaning ($P > 0.05$). Plasma urea nitrogen and BHBA concentration decreased in calves fed thyme compared with other calves ($P < 0.5$). No significant difference showed in blood metabolites between calves after weaning ($P > 0.05$).The results of this study demonstrated that supplementation of peppermint essence to calf starter increased feed intake and body weight during suckling period,

but after weaning the supplementing of essence had no effect on calf growth performance. Also we concluded that supplementing of thyme essence to starter causes a decrease in blood urea nitrogen and BHBA concentrations in suckling calves.

Key Words: calf performance, essential oil, starter

W344 In vitro investigation of various adsorbents to adsorb aflatoxin B1. M. Savari, M. Dehghan-Banadaky,* K. Rezayazdi, and M. Javan-Nikkhah, *University of Tehran, Karaj, Tehran, Iran.*

Aflatoxin B1 (AfB1) is the most important of a group of naturally occurring secondary metabolites produced mainly by *Aspergillus parasiticus* and *Aspergillus flavus* primarily in agricultural products from tropical and subtropical regions. A common way to counteract aflatoxicosis is the utilization of adsorbents added to AfB1 contaminated feed to bind the toxin in the gastro-intestinal tract before its resorption. Therefore, the aim of this study was to comparison of various adsorbents including bentonite (natural mineral), zeolite (synthetic mineral), Mycosorb (organic) and Biotox (mineral - organic) on their ability to adsorb aflatoxin B1. Hence, AFB1-contaminated rice was obtained after inoculation with the *Aspergillus parasiticus* type strain PTTC 5286 (Iranian Research Organization for Science and Technology). AFB1 was produced in 6 d at 28°C. Amounts of aflatoxin present in the contaminated rice were determined by HPLC. The result showed that the product obtained was containing aflatoxins in the following concentrations (μg/g of substrate): B1-B2-G1-G2, 13.5:0.5:0:0. AFB1 was extracted 3 times with chloroform by soaking rice in chloroform over night at room temperature and stirring rice. Adsorbents were individually mixed at 3 different ratios with AFB1 (1:1000, 1:5000 and 1:15000, w/w) in the McDougall buffer at pH 6.8 and shaken for 16 h at 39°C, centrifuged (at 3500 × g for 15min) and the supernatant evaluated for amount of aflatoxin B1 by aflatoxin B1 ELISA kit and then obtained data were analyzed using the general linear model procedure of the SAS in a 4 × 3 × 3 factorial arrangement of a completely randomized design. At the 1:15000 aflatoxin: adsorbent ratio, zeolite, Mycosorb and Biotox sequestered (adsorbed) over 0.8, 0.81 and 0.83 of the AFB1. This efficacy decreased when the amount of adsorbents was reduced. Bentonite had a lower sequestering efficacy in all of cases, with 0.38 being the maximum value obtained in the 1:15,000 aflatoxin: adsorbent ratio ($P > 0.05$). We concluded that there were significant differences between 3 ratios of aflatoxin: adsorbent and also between adsorbents for percentage of adsorption.

Key Words: aflatoxin B1, adsorbents, *Aspergillus parasiticus*

W345 Influence of *Yucca schidigera* on in vitro gas production and fermentation of rumen fluid. K. D. Boden* and C. A. Loest, *New Mexico State University, Las Cruces.*

Several factors, including excessive foam production, may inhibit eructation and contribute to bloat in cattle. We hypothesized that saponins of *Yucca schidigera* in a commercially available feed supplement (Ruma-Just, Nova Microbial Technologies) will alter anaerobic microbial fermentation and decrease both foam and gas production in vitro. Rumen fluid was collected from 2 ruminally cannulated cows fed an 83% dry-rolled corn-based diet. Anaerobic fermentations were conducted at 39°C in 250-mL Erlenmeyer flasks containing 40 mL rumen fluid, 60 mL McDougal's buffer, and 1 g ground corn grain with treatments. Treatments were 0.00 (control), 0.01, or 0.02% Ruma-Just mixed with the ground corn grain. Gas production was recorded from 7 flasks per treatment at 0, 2, 4, 6, 8, 10, 12, 18, and 24 h. Foam height, viscosity, pH, VFA, and NH_3 were measured in 6 flasks per treatment that were incubated for 0, 6, 12, or 24 h. Results showed that gas production, VFA, and NH_3 concentrations increased ($P < 0.05$), and pH decreased ($P < 0.05$) from 0 to 24 h regardless of treatment. Rumen fluid pH tended to be greater (quadratic, $P = 0.06$) for 0.01% Ruma-Just (6.18 ± 0.10) than control (6.03 ± 0.10) and intermediate for 0.02% Ruma-Just (6.13 ± 0.10). Gas production was lower (quadratic, $P < 0.05$) for 0.01% Ruma-Just (102 ± 3.8 mL) than control (116 ± 4.5 mL) and 0.02% Ruma-Just (121 ± 3.8 mL). Similarly, foam height was lower (quadratic, $P < 0.05$) for 0.01% Ruma-Just (4.63 ± 2.85 mL) than control (8.25 ± 2.85 mL) and 0.02% Ruma-Just (8.75 ± 2.85 mL). Viscosity was lower (quadratic, $P < 0.05$) for 0.01% Ruma-Just (2.13 ± 0.06 cP) and 0.02% Ruma-Just (2.18 ± 0.06 cP) than control (2.30 ± 0.06 cP). Treatments did not affect ($P > 0.10$) VFA and NH_3 concentrations. In summary, Yucca Schidigera altered gas and foam production, rumen fluid viscosity, and pH, but did not affect VFA and NH_3 concentrations in vitro. Decreasing gas production, foam production, and rumen fluid viscosity could reduce ruminal bloat. Authors acknowledge R. Goodall, Nova Microbial Technologies and MBRS RISE Program (grant # R25GM061222).

Key Words: *Yucca schidigera*, gas production, rumen

W346 Effects of inclusion of bioethanol co-product on changes in the metabolic characteristics of the proteins in oat grain in ruminants. D. Damiran, M. Yari, L. Yang,* Z. Niu, and P. Yu, *Department of Animal and Poultry Science, University of Saskatchewan, Saskatoon, SK, Canada.*

This research program aims to develop a strategy to more efficiently utilize oat grain by integration with bioethanol co-products (wheat dried distillers grains with solubles) in sustainable beef and dairy production and to assist the beef and dairy industry to develop low-cost and more efficiently feeding strategies by utilizing alternative feed resources. In this study, the objectives were to investigate the effects of inclusion of bioethanol co-product of wheat dried distillers grains with solubles into oat grain on changes in the metabolic characteristics of the proteins, total truly digested and absorbed protein supply and degraded protein balance, determined with the DVE/OEB system (non-TDN based model) and NRC-2001 model (TDN-based model). Oat grains with the co-products were mixed manually to combine in ratios of 4:0, 3:1, 2:2 and 1:3. Each combined feed had 2 replications with 2 sources of the co-products. The rumen degradation kinetics and intestinal digestion were determined using 2 Holstein Friesian dairy cows. The data were analyzed by mixed model procedure of SAS with a CRD model. A significant level was declared at $P < 0.05$ and a tendency was declared at $P < 0.10$. The results showed that by using the DVE/OEB system, when the co-products was included at the different ratios into oat grain, the total truly digested and absorbed protein supply tended to be linearly increased from 76 to 137 g/kg DM ($P = 0.06$) and degraded protein balance linearly increased from 6 to 133 g/kg DM ($P < 0.01$). By using the NRC-2001 model, when the co-product was included at the different ratios into oat grain, the metabolizable protein supply was numerically increased from 100 to 154 g/kg DM ($P = 0.20$) and degraded protein balance increased from −33 to 119 g/kg DM ($P < 0.01$). In conclusion, the inclusion of bioethanol co-product changed the metabolic characteristics of the proteins and improved nutrient supply from oat grain to cattle.

Key Words: metabolic characteristics of the protein, combined oat with bio-ethanol co-products, nutrient modeling

W347 Evaluation of forage indigestible NDF and relations with analytical parameters by principal component analysis. A. Gallo, S. Bruschi, G. Giuberti, M. Moschini, and F. Masoero,* *Università Cattolica del Sacro Cuore, Piacenza, Italy.*

The estimation of indigestible NDF (iNDF) is considered as an important parameter in dynamic nutritional models to predict energy and protein values of forages. Currently, the iNDF is predicted as 2.4 times ADL. However, recent observations suggested the use of a constant coefficient provides inaccurate estimations of the iNDF across forages. The aim of this experiment was to evaluate the iNDF of different forages and to study its relationships with chemical parameters. A set of 35 forages (10 alfalfa hays or AH, 10 grass hays or GH and 15 corn silages or CS; respectively) was randomly collected from the Po Valley of the Northern Italy. Forages were characterized for chemical composition and iNDF, the latter evaluated after 288h of in situ rumen incubation. Then, a principal component analysis (PCA) was used to study relationships between original variables and extracted principal components. Overall, the nutritive value of forages was in the ranges of those reported by the National Research Council database. The iNDF was lower in CS than GH and AH (13.4 versus 25.1 and 26.8 g/100 g DM, $P < 0.05$; respectively). The iNDF/ADL ratio was higher than 2.4 for all forage classes, being 6.2, 3.5 and 4.7 in GH, AH and CS, respectively. As a result of PCA, the first 3 principal components explained more than 85% of total variation (eigenvalues of 6.13, 3.30 and 0.78). The loading plot from PCA showed iNDF clustered with different chemical parameters. Particularly, iNDF was positively correlated ($P < 0.05$) to CP (r = 0.41), ash (r = 0.59), ADICP (r = 0.60), NDICP (r = 0.72), ADL (r = 0.73) and ADF (r = 0.81). Furthermore, ether extract and NSC clustered and were oriented in an inverse direction to iNDF. The iNDF/ADL ratio clustered with ether extract and NDF (r = 0.53 and r = 0.45, $P < 0.05$; respectively) and was negatively related ($P < 0.05$) to NSC (r = −0.72) and soluble CP (r = −0.55). Our data suggested the iNDF was related to different chemical parameters and the use of simply regression seems to be inadequate to universally predict iNDF across forages.

Key Words: indigestible NDF, forage, principal component analysis

W348 Utilization of *Yucca schidigera* to alter hydrogen sulfide gas production from rumen fluid in vitro. J. Browne-Silva* and C. A. Loest, *New Mexico State University, Las Cruces.*

This study evaluated the effects of an additive from *Yucca schidigera* (Ruma-Just, Nova Microbial Technologies) on in vitro fermentation of ground corn grain, total gas and H_2S production, and rumen fluid viscosity. Rumen fluid was collected from a ruminally-cannulated cow fed a corn-based diet. Anaerobic fermentations were conducted in 250-mL serum bottles containing 50 mL rumen fluid, 50 mL McDougal's buffer, and 1 g of ground corn grain that was thoroughly mixed with one of 6 treatments. Treatments, in a 3 × 2 factorial arrangement, were ground corn grain substrate mixed with 0%, 0.01%, or 0.02% Ruma-Just and 0% added sulfur, or 0%, 0.01%, or 0.02% Ruma-Just with 0.6% added sulfur as sodium sulfate. Total gas production was recorded, and a sample of gas for H_2S analysis was collected after incubating 9 replicate bottles per treatment for 24 h at 39°C. Contents from in vitro fermentations were frozen at −20°C, and later filtered for IVDMD and rumen fluid viscosity measurements. Gas production decreased in response to 0.01% Ruma-Just when no sulfur was added, and gas production decreased in response to 0.02% Ruma-Just when 0.6% sulfur was added (Ruma-Just × S interaction, $P < 0.01$). Ruma-Just at both 0.01% and 0.02% increased IVDMD when no sulfur was added, but Ruma-Just did not affect IVDMD when 0.6% sulfur was added (Ruma-Just × S interaction, $P = 0.07$). Production of H_2S per gram of substrate was not affected by Ruma-Just when 0% sulfur was added, but H_2S production decreased in response to 0.02% Ruma-Just with 0.6% added sulfur (Ruma-Just × S interaction, $P = 0.01$). By design, addition of 0.6% sulfur increased ($P < 0.01$) H_2S production. Rumen fluid viscosity tended to be lower ($P = 0.10$) for 0.02% Ruma-Just than 0% and 0.01% Ruma-Just. In conclusion, *Yucca schidigera* may decrease total gas and H_2S production in ruminants consuming diets high in sulfur. Authors acknowledge R. Goodall and Nova Microbial Technologies.

Key Words: *Yucca schidigera*, hydrogen sulfide, rumen

W349 Effect of monensin and bismuth subsalicylate on hydrogen sulfide in continuous culture fermenters. M. Ruiz-Moreno,* E. Binversie, and M. D. Stern, *Department of Animal Science, University of Minnesota, St. Paul.*

In ruminants, excess dietary S is associated with several conditions including a reduction in DM intake, negative effects on feedlot performance and carcass characteristics, and sulfur-associated polioencephalomalacia. Therefore, ruminant nutritionists are interested in methods to reduce negative effects of high S diets. Bismuth subsalicylate (BSS) has been shown to decrease fecal H_2S production in humans, while there are conflicting results about the effect of monensin (MON) on H_2S production in ruminants. Therefore, the objective of this experiment was to evaluate effects of these compounds on H_2S production by rumen microbes. Eight dual flow continuous culture fermenters were used during 2 consecutive 10-d periods with the first 7 d for stabilization followed by 3 d of sampling. The experimental design was a 2 × 2 factorial arrangement of treatments, with 2 levels of BSS (0 and 1% of DM) and 2 levels of MON (0 and 5 ppm in incubation fluid). Fermentation substrate consisted of 46% distillers dried grains, 41% ground corn, 8% hay, 2.5% $CaCO_3$, 1.5% molasses and 1% mineral premix and was provided at 75 g/fermenter/d. Addition of BSS to the diet increased ($P < 0.05$) digestion of OM, NDF and ADF but decreased ($P < 0.05$) NFC digestion and total VFA concentrations. Molar proportions of acetic and propionic acid increased ($P < 0.05$) with BSS, while butyric acid decreased ($P < 0.05$). Monensin decreased ($P < 0.05$) ADF digestion and A:P ratio, without affecting ($P > 0.05$) molar proportions of acetic, propionic and butyric acids. In regards to nitrogen metabolism, MON increased ($P < 0.05$) non NH_3-N outflow without affecting ($P > 0.05$) other parameters. BSS increased ($P < 0.05$) NH_3-N concentration, NH_3-N flow and tended to increase ($P < 0.1$) dietary-N flow, and decreased ($P < 0.05$) microbial-N outflow, CP digestion and efficiency of microbial protein synthesis. Headspace concentration of H_2S was reduced 99% ($P < 0.05$) with BSS. Conversely, a trend ($P < 0.1$) to increase H_2S headspace concentration was found following addition of MON. Only minor changes in fermentation pH were found with MON, but increases ($P < 0.05$) in mean, minimum and maximum fermentation pH were observed with addition of BSS. Results indicate that BSS can markedly decrease H_2S production in long-term in vitro rumen incubations.

Key Words: bismuth subsalicylate, hydrogen sulfide, rumen

W350 Alteration of fasting heat production during fescue toxicosis in Holstein steers. A. F. Koontz*[1], A. P. Foote[1], D. H. Kim[1], L. P. Bush[2], J. L. Klotz[3], K. R. McLeod[1], and D. L. Harmon[1], *[1]Department of Animal and Food Sciences, University of Kentucky, Lexington, [2]Department of Plant and Soil Sciences, University of Kentucky, Lexington, [3]USDA-ARS, Forage-Animal Production Research Unit, Lexington, KY.*

This study was designed to examine alteration of fasting heat production (FHP) during fescue toxicosis. Six ruminally cannulated Holstein

steers (BW = 348 ± 26 kg) were weight-matched into pairs and utilized in a 2-period crossover design experiment. Each period consisted of 2 temperature segments, one each at 22°C and 32°C. During each period, one steer per pair was ruminally dosed twice daily with 0.5 kg of ground endophyte-infected fescue seed (E+), the other with ground endophyte-free fescue seed (E-) for 7 d. Animals were pair-fed with E+ animals offered alfalfa cubes at 1.5 × NE_m. On d 8 of each segment, animals were moved to individual metabolism stalls fitted with indirect calorimetry head-boxes. Rumen contents were removed, weighed and subsampled for DM determinations. The reticulorumen was then washed and filled with a buffer (NaCl = 96; $NaHCO_3$ = 24; $KHCO_3$ = 30; K_2HPO_4 = 2; $CaCl_2$ = 1.5; $MgCl_2$ = 1.5 mmol/kg buffer) that was gassed with a 75% N_2 and 25% CO_2 mixture before rumen incubation. During buffer incubation, an E+ or E-fescue seed extract was added at 12 h intervals to maintain treatment presentation to the animal. After a 12-h wait, heart rate (HR), core temperature (CT), O_2 consumed, and CO_2 produced were recorded for 16 h. There was no difference ($P > 0.9$) in DMI or DMI/kg $BW^{0.75}$ between endophyte treatments by design; however, intake decreased ($P < 0.01$) at 32°C. CT was unaffected by fescue treatment or temperature. Rumen contents weight (kg/ kg $BW^{0.75}$) tended to be increased ($P < 0.15$) and DM of rumen contents as well as total rumen DM/kg $BW^{0.75}$ was increased ($P < 0.0001$) in E+ animals. Increased temperature had no effect on measurements with the exception of HR and respiratory quotient (RQ). HR increased ($P = 0.05$) at 32°C, but was unaltered by fescue treatment. RQ was elevated ($P = 0.02$) in E+ animals and tended to increase ($P = 0.1$) at 32°C. O_2 consumption decreased ($P = 0.04$) and CO_2 production tended to be reduced ($P = 0.07$) in E+ animals. FHP (kcal/kg $BW^{.75}$) was reduced ($P = 0.04$) in E+ animals. These data suggest that consumption of E+ tall fescue by cattle results in a reduction in basal metabolic rate.

Key Words: cattle, fescue, fasting heat production

W351 Influence of maternal nutrition and prenatal adenovirus-VEGF gene therapy on fetal visceral tissues and crypt cell proliferation at d 130 of gestation. N. M. Chapel*[1], R. D. Yunusova[1], R. P. Aitken[2], J. S. Milne[2], D. J. Carr[2,3], P. P. Borowicz[1], A. L. David[3], J. M. Wallace[2], and J. S. Caton[1], *[1]Center for Nutrition and Pregnancy, Department of Animal Sciences, North Dakota State University, Fargo, [2]Rowett Institute of Nutrition and Health, University of Aberdeen, Scotland, UK, [3]Prenatal Cell and Gene Therapy Group, UCL Institute for Women's Health, University College London, UK.*

Adenovirus VEGF (Ad.VEGF) gene therapy has been shown to increase pre- and early post-natal growth velocity in an ovine model of fetal growth restriction. Our objectives were to investigate the effects of Ad.VEGF on fetal visceral tissues and crypt cell proliferation at d 130 of gestation in this paradigm. First parity ewe lamb recipients were initially allocated to a control (CON; n = 12) or high (H; n = 45) quantity of the same diet at singleton embryo transfer. Control diets provided met requirements for specific age and stage of gestation and H ewes received approximately twice the dietary intake of CON. At 89 ± 1.5 d of gestation H ewes were randomly allocated to receive 1 of 3 injections into both uterine arteries: a) Ad.VEGF (5×10^{11} particles) gene; (n = 18), b) control Ad containing the β-galactosidase reporter gene, Ad.LacZ, same dose; (n = 14), and c) saline (n = 13). On d 130 of gestation ewes and fetuses were necropsied. Fetal visceral tissues were harvested, weighed, and perfusion fixed. At necropsy, H ewes had increased ($P \leq 0.001$) BW, condition, and perirenal fat compared with CON (81.0 vs. 65.7 ± 1.2 kg; 2.9 vs. 2.4 ± 0.03; 1,334 vs. 543 ± 91 g, respectively). Maternal measurements were not altered by any injection treatment. Fetal BW was lower ($P < 0.001$) in H compared with CON (4,186 vs. 5,084 ± 214 g). Total fetal stomach, small intestine, and large intestine weights tended ($P \leq 0.07$) to be lower in H compared with CON. Fetal liver weight was less ($P \leq 0.01$) in H compared with CON. Fetal stomach (g/kg BW) was greater ($P < 0.01$) in H compared with CON. Fetal small intestine (g/kg BW) was less ($P = 0.016$) in Ad.VEGF vs. Ad.LacZ + saline. Small intestinal crypt cell proliferation was not altered by maternal nutrition or adenovirus-VEGF gene therapy. Adenovirus-VEGF gene therapy, while having some effects on proportional fetal visceral tissue mass, does not appear to alter intestinal crypt cell proliferation at d 130 of gestation. However, intestinal vascular responses to gene therapy treatment are unknown at this time.

Key Words: intestine, maternal nutrition, VEGF

W352 Effect of dried fermentation biomass on microbial fermentation in continuous culture. A. Carpenter*[1], E. Binversie[1], M. Ruiz-Moreno[1], J. Usry[2], I. Shinzato[2], and M. D. Stern[1], *[1]Department of Animal Science, University of Minnesota, St. Paul, [2]Ajinomoto Heartland Inc., Chicago, IL.*

Fermentation biomass (FB) is a dried bacterial co-product derived from lysine production (Ajinomoto Heartland Inc.). The objective of this study was to determine if FB can be used as a protein source in ruminant diets. The study consisted of one experimental period where 8 dual-flow continuous culture fermenters were inoculated with rumen fluid. The experimental period consisted of a 7-d adaptation followed by 3 sampling days. Substrate for the microbes was provided by one of 2 isonitrogenous diets, CON or DFB. In CON diet, soybean meal (SBM) provided 55% of total CP, and in DFB diet, SBM and FB provided 12 and 45% of total CP, respectively. CON contained 3% molasses, 16% ground corn, 13% grass hay, 48% corn silage, and 20% SBM on a DM basis. DFB contained 3% molasses, 18.4% ground corn, 13% grass hay, 50% corn silage, 8.5% SBM, and 6.7% FB. Fermenters were fed 75 g/d of DM divided into 8 equal portions. Anaerobic conditions were maintained by infusion of N_2; pH was maintained between 5.8 and 6.8; and temperature was set at 38.6°C. On sampling days, liquid and solid effluent outflows were collected, combined, and homogenized to be used for chemical analysis. Both treatments had an average pH of 5.9. There was no effect ($P > 0.1$) of treatment on apparent or true OM digestibility (%). Nitrogen source had no effect ($P > 0.1$) on total-N, dietary-N, and bacterial-N flows. Addition of FB decreased ($P < 0.05$) ammonia-N flow from 0.41 to 0.23 g/d and tended to decrease ($P = 0.06$) effluent ammonia concentration from 17.1 to 9.7 mg/100 mL. Histidine and methionine flows increased ($P < 0.05$) from 0.48 to 0.53 and 0.18 to 0.20 g/d, respectively, when FB partially replaced SBM in the diet, but there were no effects ($P > 0.1$) on other AA or total AA. There was a trend ($P = 0.08$) in percent change from essential AA input (CON = 68.9% versus DFB = 63.74%) and from non-essential AA input (CON = 73.62% versus DFB = 82.22%); however, there was no effect ($P > 0.1$) on percent change of total AA. Results indicate that FB elicited a similar response in N metabolism and AA flows to SBM and may be used as a protein source in ruminant diets.

Key Words: continuous culture, fermentation biomass, protein

W353 Plasma metabolites and rumen ammonia concentration in steers fed high-forage diets and supplemented non-protein nitrogen. C. L. Cox*[1], R. H. Pritchard[1], B. P. Holland[1], and J. S. Jennings[2], *[1]South Dakota State University, Brookings, [2]Alltech Inc., Brookings, SD.*

The objectives were to determine if Optigen, a slow-release NPN source, has a slower N release than urea and whether pelleting affects Optigen

N release. Treatments (TRT) were 1) control non-urea pellet, 11.0% CP; 2) ruminally pulse dosed Optigen, 12.4% CP; 3) Optigen incorporated into a pellet, 11.3% CP or 4) urea ruminally pulse dosed, 12.8% CP. Diets were 50% forage (oat hay; 5.5% CP, 66% NDF) and 50% pelleted feed (beet pulp, corn, soybean meal). NPN as a percent of dietary CP (36 ± 0.5%) did not vary among TRT 2, 3, and 4. Diets were fed to 4 ruminally fistulated steers (BW 387 ± 28.9 kg), fitted with indwelling jugular catheters, in a 4x4 Latin square designed experiment. Pellet was fed at 0800 (t 0) and consumed within 20 min. Pulse doses of Optigen or Urea occurred at t 0. Blood samples were collected in 10 min intervals (0800 to 1130), 1 h intervals (1300 to 1600), and 2 h intervals (1600 to 2000). Rumen fluid samples were taken at 1 h pre-feeding and at 0, 1, 4, 8, 12 and 16 h post feeding. TRT 2 and 4 resulted in higher dietary CP than TRT 1 and 3 (12.6 v 11.2%; $P < 0.01$).Diet did not affect DMI (6.5 ± 0.2 kg). At t 0, rumen ammonia-N (RAN; 4.4 ± 5.8 mg/dl), plasma urea-N (PUN; 10.0 ± 0.9 mg/dl) and blood ammonia-N (BAN; 0.8 ± 0.03 mg/dl) were similar across TRT. RAN was greatest for TRT 4 (28.1 ± 4.6 mg/dl) and similar between TRT 1, 2, and 3 (6.4 ± 5.3, 10.8 ± 4.6, 8.5 ± 5.3, respectively; $P < 0.05$). A TRT by time interaction occurred because of 60 min post feeding RAN concentrations of 8.6 ± 12.4, 34.6 ± 10.7, 25.3 ± 12.4 and 138.9 ± 10.7 mg/dl, for TRT 1 through 4, respectively ($P < 0.001$). PUN concentrations of 11.6, 11.5, 10.9 and 14.58 mg/dl, respectively, were not affected ($P > 0.05$) by time or TRT. BAN concentrations were highest for TRT 4 ($P < 0.05$) and peaked during 50 to 80 min post feeding. TRT 3 caused lower BAN concentrations compared with TRT 2 ($P < 0.05$) which was consistent with decrease in RAN at 60 min post feeding. Optigen had a slower rate of N release than urea, and was not adversely affected by pelleting.

Key Words: beef cattle, blood ammonia, non-protein nitrogen

W354 Gossypol and total phenols of eleven varieties of whole cottonseed (*Gossypium hirsutum*) in the north of Argentina. M. García*[1], C. Berton[1], E. Casenave[1], M. Nazareno[1,2], and J. I. Arroquy[3], *[1]FAyA, UNSE, Santiago del Estero, Argentina, [2]INQUINOA-CONICET, Santiago del Estero, Argentina, [3]INTA - EEA Santiago del Estero, Santiago del Estero, Argentina.*

Whole cottonseed (WCS, *Gossypium hirsutum*) is a feedstuff usually fed in beef and dairy cattle rations. Gossypol is a polyphenol pigment in WCS and cotton byproducts, and its concentrations depend on several factors such as genotype, temperature, and rainfall. This pigment is considered as an antiquality factor that might affect animal performance and ruminal metabolism. The objective of this study was to quantify gossypol concentration and nutritional profile of WCS from 11 varieties cultivated in Northern Argentina, and usually fed to cattle. Varieties studied were: Guazuncho 3, Pora, Poraite, New opal BT, Guazuncho 2000 RR, BT604, BT404, Cacique, Chaco 530, Oro blanco, and an experimental cultvirar. Samples were collected in 2004, 2006, 2007, 2008, 2009 and 2011 were analyzed for total soluble protein, ash, total fat, total phenolic compounds (TF; Folin-Ciocalteu), and free gossypol. Gossypol was analyzed by HPLC-DAS with external standard using a purified gossypol. Total phenolic compounds concentration in the varieties oscillates from 0.54 to 1.16% (Tannic acid equivalent). Gossypol content in WCS was 0.06–1.36%. Soluble protein varied from 0.53 to 2.24%. Total fat was 17.59–25.65%. Results from this preliminary study indicate small variation in gossypol and TF levels among 11 varieties grown in the north of Argentina.

Key Words: antiquality, cotton varieties, gossypol

W355 Influence of nitrogen fertilization and fibrolytic enzymes on digestibility and utilization of the nutrients of ryegrass (*Lolium multiflorum* var. Jumbo) hay fed to Holstein steers. J. A. Villarreal,* J. E. Camargo, E. G. Alvarez, J. Rodriguez, E. Vazquez, B. H. Gutierrez, M. F. Montano, and V. M. Gonzalez, *Universidad Autonoma de Baja California, Mexicali, BC, Mexico.*

To evaluate the influence of fibrolytic enzyme addition × N fertilization (100, 200 or 300 kg of N/ha) on digestive function of ryegrass hay offered as basal diet, 6 Holstein steers (143 ± 5 kg LBW) equipped with cannulas in rumen and duodenum proximal were distributed in a split plot design. Orthogonal contrasts were used to test for linear, quadratic, and cubic effects of increasing N fertilization. Daily enzyme levels tested were 0 vs. 15 g/d and N fertilization levels applied to ryegrass were 100, 200, and 300 kg N/ha. Chromic oxide (0.3% as daily DMI basis) was added as digestive internal marker to basal diet. There was no interaction ($P \geq 0.05$) between enzyme and N fertilization. Enzyme addition increased N ($P \leq 0.05$; 76.6 vs. 77.4 g/d ±5.7) and microbial N flow ($P \leq 0.05$; 54.5 vs. 57.9 g/d ± 5.0) to the duodenum, N efficiency ($P \leq 0.05$; 1.34 vs. 1.42 ±0.1), microbial efficiency ($P \leq 0.01$; 24.6 vs. 26.5 ± 2.7) and postruminal OM digestion ($P \leq 0.10$; 42.1 vs. 45.5± 5.1). Nitrogen fertilization increased (linear component, $P \leq 0.01$) feed N leaving the abomasum and the OM rumen digestion ($P \leq 0.05$). Passage and digestion rates were not influenced ($P \geq 0.05$) by treatments. Fibrolytic enzymes had more influence on N metabolism in the rumen and total tract than for N fertilization.

Key Words: fibrolytic enzyme, N fertilization, rye grass