

**PRODUCTION, MANAGEMENT, AND  
THE ENVIRONMENT: INFLUENCE OF  
DIET AND MANAGEMENT ON HEALTH  
AND PERFORMANCE**

**1456 (M217) A 6-yr study evaluating health, milk and milk quality in 427 dairy herds fed OmniGen-AF to dry and lactating cows.** O. Bewley<sup>1</sup>, T. Boyle<sup>1</sup>, M. Brady<sup>1</sup>, K. Brubaker<sup>1</sup>, J. D. Chapman<sup>\*1</sup>, T. Elliott<sup>1</sup>, L. O. Ely<sup>2</sup>, S. Fitzner<sup>1</sup>, A. E. Holland<sup>1</sup>, D. Larson<sup>1</sup>, R. Shaw<sup>1</sup>, and J. Ydstie<sup>1</sup>, <sup>1</sup>Prince Agri Products, Inc., Quincy, IL, <sup>2</sup>University of Georgia, Athens.

From 2007 through 2012, 427 U.S. dairy herds totaling 273,796 cows were enrolled in a study to evaluate health and production records collected from 90-d periods before and during the feeding of OmniGen-AF (Prince Agri Products, Inc., Quincy, IL). Herd sizes ranged from 68 to 6700 cows with dairies starting the studies throughout the year (January to March,  $n = 158$ , April to June,  $n = 98$ , July to September,  $n = 84$ , October to December,  $n = 87$ ). All dry and lactating cows were fed OmniGen-AF (OG) at 56 g/hd/d for 90 d. Health events, milk quality and milk yields were collected from DC305, DRMS and PCDART systems. Data were analyzed using paired  $t$  test (SAS, Statistical Analysis System) comparing number of health events and production recorded during the 90 d OG was fed (post-OG) to those occurring in the 90 d before feeding OG (Pre-OG). The resulting data were sorted and analyzed by all herds ( $n = 427$ ), herd size ( $< 100$  hd,  $n = 68$ ; 101–500 hd,  $n = 198$ ; 501–999 hd,  $n = 76$ ;  $> 1000$  hd,  $n = 85$ ), and pre-OG somatic cell count (SCC) cells/ml ( $< 200k$ ,  $n = 103$ ; 201k–300k,  $n = 127$ ; 301k–400k,  $n = 72$ ;  $> 401k$ ,  $n = 62$ ). Significance was declared at  $P < 0.05$ . Reductions in mastitis cases/mo. (-24.3%), late term abortions/mo. (-28.6%), hospital pen cows/d (-16.7%) and dead cows/mo. (-33%) expressed as a % of total herd cows differed ( $P < 0.001$ ) between the pre-OG to post-OG 90-d periods. Although incidence rates of health events varied across herd sizes and among herds grouped by SCC, common to all were significant differences detected in metritis and dead cows between pre-OG and post-OG. The average pre-OG SCC for all herds was 288,953 with an average of  $> 70\%$  of herds reporting a reduction in SCC. Changes in SCC from pre-OG to post-OG were proportional to the pre-OG SCC. Herds with a pre-OG SCC of between 201k to 300k and 301k to 400k or  $> 400k$  were observed to have post-OG SCC reductions of 23,102; 56,463 and 127,911 cells/ml, respectively ( $P < 0.001$ ). Milk production was reported in 208 herds with an average change from pre-OG to post-OG of 0.45kg/hd/d ( $P < 0.05$ ); however, only herds of  $< 100$  hd ( $P < 0.05$ ) and herds with a SCC of 201k to 300k ( $P < 0.001$ ) showed significant milk improvements. Results from this study suggest a nutritional strategy that includes feeding OG as part of a best-management practice program for dry and lactating cows can influence health, milk yield and milk quality in commercial dairies.

**Key Words:** health, milk quality, OmniGen-AF

**1457 (M218) Crude glycerin as a replacement for dry ground corn in finishing diets for beef cattle: Economic analysis.** P. Del Bianco Benedeti<sup>\*1,2</sup>, P. V. R. Paulino<sup>3</sup>, M. I. Marcondes<sup>1</sup>, A. Faciola<sup>2</sup>, I. França Smith Maciel<sup>1</sup>, and M. Custódio da Silva<sup>1</sup>, <sup>1</sup>Federal University of Viçosa, Brazil, <sup>2</sup>University of Nevada, Reno, <sup>3</sup>Nutron Alimentos Ltda., Campinas, Brazil.

The objective of this study was to evaluate the effects of replacing dry ground corn (DGC) with crude glycerin (CG) on production costs of finishing beef bulls. A complete randomized design experiment with 25 d for adaptation and 95 d for sampling collection was conducted, in which 3640 Nellore bulls ( $367 \pm 37$  kg) were blocked by BW and assigned to 20 pens. Animals were randomly assigned to one of four treatments: 0, 5, 10, and 15% (DM basis) CG in diet. All diets contained 15% roughage and 85% concentrate and were formulated to meet NRC (2000) recommendations. Diets were isoenergetic, isonitrogenous, and allowed 1.4 kg/d BWG. Initially, twenty animals were slaughtered to serve as reference to estimate initial empty BW, which allowed carcass gain calculation. Sensitivity analysis was performed according to Diniz et al., 2010 (Asian-Aust. J. Anim. Sci. 23:1308–1318) to determine which diet was more economical according to current CG prices as a function of DGC prices. Data presented in Table 1457 shows the cost of each diet tested in this work during the period of August to November 2012. Treatment without CG had the lowest diet cost, followed by treatments with 5, 15, and 10% of CG inclusion, respectively. Sensitivity analysis indicated that the treatment that provided the lowest cost per kg of carcass produced changes depending on the CG:DGC price relationship. When CG price was up to 110% of DGC price, the treatment that provided the lowest price per kg of carcass produced was 15% CG inclusion. When CG price was 120% or more of DGC price, the diet without CG was the most economical treatment. Data from this sensitive analysis indicates that CG may be an economical alternative to DGC for beef cattle feedlots in Brazil.

**Key Words:** economic analysis, feedlot, glycerin

**Table 1457.**

	Crude Glycerin (%)			
	0	5	10	15
Diet cost, \$/kg DM	0.21	0.22	0.23	0.24
DMI, kg/d	10.5	10.1	10.2	9.6
Diet cost, \$/animal/d	2.22	2.23	2.32	2.27
Carcass gain, kg/animal/d	0.89	0.85	0.84	0.83
Diet cost, \$/kg carcass	2.49	2.62	2.76	2.72
Crude Glycerin price, kg (% of price of DGC kg)	\$ / kg carcass			
90	2.49	2.51	2.54	2.41
100	2.49	2.52	2.56	2.44
110	2.49	2.54	2.59	2.48
120	2.49	2.55	2.62	2.52
130	2.49	2.56	2.64	2.55
140	2.49	2.58	2.67	2.59

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**1458 (M219) Inhibition of rumen methanogenesis induced by Bioflavex and its pure flavonoid components under in vitro fermentation using rumen fluid from steers fed high concentrate diets.** A. R. Seradj<sup>1</sup>, J. Crespo<sup>\*2</sup>, D. Villalba<sup>1</sup>, and J. Balcells<sup>1</sup>, <sup>1</sup>University of Lleida, Spain, <sup>2</sup>Interquim |S. A. (Ferrer Health Tech), Barcelona, Spain.

Four separated incubation series were performed in a complete randomized blocks design to determine the effect of a citrus extract rich in flavonoids (Bioflavex) and its main components on methane mitigation under in vitro condition. Rumen liquor from four rumen cannulated growing steers fed a high concentrate diet (90:10 commercial concentrate:barley straw) was used as inoculum. Bottles of 120 mL were prepared under the CO<sub>2</sub> stream and filled with incubation solution and a mixture of concentrate:barley straw (600:60 mg/bottle) was used as substrate. Bioflavex (BF) was added to the incubation media and its effect compared against its pure flavonoid components (Hesperidine [HS]; Isonaringine [IN]; Naringine [NG]; Neohesperidine [NE]; Neohesperidine [NH] and Poncirine [PC]) at 200µg/g dry matter (DM), and the substrate without flavonoids was also included as a control (CTR). Bottles were sealed and incubated at 39 ± 1°C for 72 h. The head space pressure was measured at intervals of 2 h, started from 2 to 12 h then 24, 48, and 72 h. Values (mbar) converted to volume (ml) by a linear regression. Since 12 h post incubation, a sample (0.1 mL) from head space gas was analyzed for methane concentration using GC. The pattern of cumulative gas production ( $y$ ) was fitted to the model:  $y = a(1 - e^{-b(t-c)})$ , being  $a$  the potential cumulative gas production (ml);  $b$  the production rate (ml/h) and  $c$  is the lag time (h). The addition of BF or any of its components reduced the cumulative gas ( $P < 0.01$ ) and methane production (mmol/g DM) ( $P < 0.01$ ) except for NE and PC, that did not differ from the CTR values. However, reduction in CH<sub>4</sub> production was more pronounced than it was in gas production ( $P < 0.01$ ). No changes were observed in the gas (ml/h) and methane production rate (mmol/h) in relation to CTR. The addition of flavonoids in the in vitro culture media reduced gas production and it would reflect the activity of bioflavex and its main components against the fermentative activity of the rumen liquor although our result also showed specific activity against methanogenic archaea.

**Key Words:** in vitro incubation, methanogenesis, pure flavonoids

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**1459 (M220) Effects of trace mineral-fortified, limit-fed creep supplements on performance of beef calves (pre-weaning).** A. Saran Neto<sup>1</sup>, L. S. Caramalac<sup>2</sup>, P. G. M. D. A. Martins<sup>2</sup>, P. Moriel<sup>2</sup>, H. J. Fernandes<sup>3</sup>, and J. D. Arthington<sup>\*2</sup>, <sup>1</sup>University of São Paulo, Pirassununga, Brazil, <sup>2</sup>UF/IFAS Range Cattle Research and Education Center, Ona, FL, <sup>3</sup>State University of Mato Grosso do Sul, Aquidauana, Brazil.

To assess the effects of limit-fed creep supplements, with or without trace mineral (TM) fortification, 30 cow/calf pairs were stratified by birth date and randomly allocated to 1 of 15 bahiagrass pastures (1 heifer and 1 steer cow-calf pair/pasture). Calves were approximately 5 mo of age at the start of the study. Four treatments were randomly assigned to pastures, including, (1) limit-fed creep fortified with hydroxy-Cu, Zn, and Mn, (2) limit-fed creep fortified with Cu- and Zn-sulfate and Mn-oxide (sulfate/oxide), (3) limit-fed creep without TM fortification, and (4) no limit-fed creep ( $n = 3, 3, 4,$  and 5 pastures, respectively). Creep supplements for treatments 1 and 2 were also fortified with Co carbonate, Na selenite, and I (via EDDI). All pastures were provided free-choice access to salt with no mineral fortification. Supplements were offered 3 times weekly for 89 d (265 g/calf on Monday, Wednesday, and Friday) which targeted a maximum intake of 114 g/d. Calf BW was measured on d 0, 45 and 89 (weaning). Calf TM status was assessed in liver biopsy samples collected at weaning. Limit-creep intake increased over time ( $P < 0.001$ ) and total limit-creep intake tended to be greater ( $P = 0.10$ ) for hydroxy- vs. sulfate/oxide-formulated supplements (7.6 and 5.1 kg; SEM = 0.97). Limit-creep had no effect ( $P = 0.22$ ) on pre-weaning BW gain (80.0 and 73.5 kg for limit-creep and no limit-creep, respectively; SEM = 5.44); however, BW gain tended ( $P = 0.09$ ) to be greater for calves consuming hydroxy- vs. sulfate/oxide-formulated supplements (87.1 and 74.4 kg, respectively; SEM = 5.44). Efficiency of added BW gain did not differ ( $P \geq 0.13$ ) among treatments (G:F = 1.94, 0.64, and 1.60 kg/kg for hydroxy, sulfate/oxide, and no TM fortification limit-creep feed, respectively; SEM = 0.850). The cost of added calf gain was \$0.27, \$1.98, and \$0.60/kg for hydroxy-, sulfate/oxide-, and no-TM fortification limit-creep, respectively. Calves consuming TM-fortified, limit-creep, irrespective of source, had greater ( $P \leq 0.02$ ) liver concentrations of Co, Cu, and Se compared to calves consuming no limit-creep or limit-creep without TM fortification. These results imply that the consumption of TM-fortified limit-creep increases the mineral status of calves and the use of hydroxy sources of Cu, Zn, and Mn may result in greater intake acceptability with a favorable cost of gain compared to sulfate/oxide alternatives.

**Key Words:** calves, creep feeding, trace minerals

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**1460 (M221) The effect of a maternal dietary yeast cell wall supplement during gestation on cow performance and calf growth and immunity.**

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The objective of this study was to determine if feeding of yeast cell wall (YCW) to pregnant cows influences cow performance as well as postnatal calf growth and immunity. Multiparous cows were assigned by predicted calving date into either the control (C;  $n = 24$ ) or supplemented (Y;  $n = 24$ ) groups. The Y cows were fed 4 g of YCW in 230 g of ground corn top-dressed on 1.81 kg of corn gluten and soybean meal (4:1) from approximately 90 d prepartum through 28 d postpartum. Weight and body condition score (BCS) were taken at 28-d intervals prepartum and postpartum. Within 24 h of parturition, the BW and BCS of cows and BW of calves were recorded, and blood samples from calves were obtained to determine white blood cell numbers. These procedures were repeated on d 14 and 28 postpartum, and continued at 28-d intervals through weaning. Weaning weights were adjusted to 180 d of age. Cows were observed for estrus twice daily starting d 28 postpartum through first estrus. Data were analyzed using the PROC MIXED in SAS. Yeast supplementation did not affect cow prepartum BW ( $P = 0.39$ ) or BCS ( $P = 0.14$ ), postpartum BW ( $P = 0.97$ ) or BCS ( $P = 0.89$ ), or the postpartum interval ( $P = 0.98$ ; C =  $56.2 \pm 3.3$ , Y =  $56.3 \pm 3.2$  d). Calf weight was not different at birth; however, on d 14 and at weaning, C males tended to be heavier than Y group males as well as females from the C and Y groups ( $P = 0.08$ ,  $0.07$ , respectively). At d 28 C males were heavier than Y males or females ( $P = 0.02$ ). There was a tendency for 180-d adjusted weaning weight to be heavier for C males than either Y males or C and Y females ( $P = 0.0563$ ). There was also a treatment by day interaction in which C calves were heavier than Y calves ( $P = 0.01$ ) and a calf sex by day interaction with males being heavier than females preweaning ( $P = 0.01$ ). Treatment did not affect the white blood cell profile of calves on d 0 or 28 as C and Y calves had similar percentages ( $P > 0.2$ ) of lymphocytes, monocytes, segmented neutrophils, banded neutrophils and eosinophils. The C males demonstrated a greater growth rate than prenatally supplemented calves in the neonatal and preweaning periods. These data suggest that prenatal YCW supplementation to healthy mature cows in a low stress environment does not benefit cow or calf performance.

**Key Words:** yeast cell wall, calf performance, cow performance

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**1461 (M222) Effect of restricted feeding on body weight, some hematological and biochemical parameters in sheep and goats raised under semiarid conditions.**

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A total of 10 Barki sheep and 10 Baladi goats were used in 4-mo experiment to investigate to what degree local sheep and goats can tolerate feed shortage under semiarid conditions and to compare sheep and goats for their ability to withstand these harsh conditions. Animals were divided into two groups according to feeding level (50 and 100% of maintenance energy requirements). Changes in live body weight and some biweekly hematological and blood biochemical parameters were examined. Restricted feeding level did not affect ( $P > 0.05$ ) live body weight. In both sheep and goats, restricted diets showed a significant ( $P < 0.05$ ) decrease in hemoglobin (Hb) and packed cell volume (PCV %). Reduction was shown in erythrocytes cell counts (RBCs) especially in goats ( $P < 0.05$ ). Restricted feeding showed a significant decrease in white blood cells (WBCs) in both species, but the reduction was much greater in goats than in sheep (17.15 and 7.75%). Animals fed restricted diets show a significant decrease ( $P < 0.05$ ) in total protein, globulin, and triglyceride, and a non-significant increase in albumin, albumin/globulin ratio, and total lipids in both species. While glucose and cholesterol increased in sheep, both parameters decreased in goats. Alanine transferase (ALT), aspartate transferase (AST), and  $\gamma$  glutamyl transferase (GGT) were increased in both species that received restricted diet. The increase in the three enzymes was significant only in sheep, and the GGT was only significant in goats. While alkaline phosphatase was significantly decreased in sheep, it was significantly increased in goats. Restricted feeding resulted in a significant increase in blood urea and a significant decrease in creatinine concentration in both species. In conclusion, results revealed that both sheep and goats are adapted to feed shortage with higher tolerance in sheep than in goats under semiarid conditions.

**Key Words:** sheep, goats, restricted feeding

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**1462 (M223) Effects of trace mineral-fortified, limit-fed creep supplements on performance of beef calves (post-weaning).**

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The effects of limit-fed creep supplements, with or without trace mineral (TM) fortification, on measures of performance

and stress in heifers following weaning were evaluated. Heifers were derived from an experiment involving 30 cow/calf pairs, stratified by birth date and randomly allocated to 1 of 15 pastures (2/pasture). Calves were approximately 5 mo of age at the start of the study. Four treatments were randomly assigned to pastures, including, (1) limit-fed creep fortified with hydroxy-Cu, Zn, and Mn, (2) limit-fed creep fortified with Cu- and Zn-sulfate and Mn-oxide, (3) limit-fed creep without TM fortification, and (4) no limit-fed creep ( $n = 3, 3, 4,$  and  $5$  pastures, respectively). Creep supplements for treatments 1 and 2 were also fortified with Co carbonate, Na selenite, and I (via EDDI). All cattle were provided access to salt with no TM fortification. Supplements were offered Monday, Wednesday, and Friday (265 g/calf) for 89 d prior to weaning, targeting a maximum intake of 114 g/d. At weaning, heifers consuming TM-fortified creep, irrespective of source, had greater ( $P \leq 0.02$ ) liver Cu concentrations compared to heifers consuming no limit-creep or limit-creep without TM fortification. Following weaning, 15 heifers were individually provided free-choice access to a soybean hull-based feed and ground grass hay for 16 d. The acute phase protein response (APR) was assessed via plasma concentrations of the Cu-dependent protein, ceruloplasmin, on d 0, 2, 5, 9, and 16. Shrunken BW was measured on d 0 and d 17. Total DMI of calves provided TM-fortified, limit-creep supplements, irrespective of TM source, was less ( $P = 0.03$ ) than calves not provided limit-creep or calves provided limit-creep without TM fortification (1.21 vs. 1.80% BW; SEM = 0.262). This response was mostly the result of less ( $P = 0.056$ ) grain DMI among heifers provided TM-fortified, limit-creep vs. no limit-creep or limit-creep without TM-fortification (0.45 vs. 0.86% BW, respectively; SEM = 0.320). Heifers provided TM-fortified limit-creep had a greater ( $P = 0.05$ ) increase in post-weaning plasma ceruloplasmin (8.02 and 5.04 mg/dL, respectively; SEM; 2.354) and less ( $P = 0.03$ ) BW gain (7.9 vs. 17.6 kg; SEM = 9.26) compared to calves provided no limit-creep or limit-creep without TM-fortification. These results imply that TM-fortified limit-fed creep feed results in increased Cu status of weaned calves which corresponded to a heightened Cu-dependent APR and less post-weaning DMI and BW gain.

**Key Words:** calves, creep feeding, trace minerals

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#### 1463 (M224) Young beef calves preferentially consume supplements fortified with hydroxy vs. organic and sulfate sources of Cu, Zn, and Mn.

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Our objective was to evaluate the preferential intake of supplements fortified with Cu, Zn, and Mn from; (1) hydroxy, (2) organic, and (3) sulfate-sources. This was achieved in 4 individual feeding studies involving 8 pens of early-weaned

calves (2 calves/pen; average age = 120 d; average BW = 115 kg). Each pen was provided free-choice access to a mixed concentrate ration and ground grass hay. On each study day at 10:00, all feed was withdrawn and calves were offered 3 different mineral fortified supplements, for a 4 h period, provided in three separate feeding containers. Supplements were created using a base mixture containing 52, 46, and 2% cottonseed meal, ground corn, and salt. Supplements were fortified with 2,000 mg/kg Zn (Exp. 1), 750 mg/kg Cu (Exp. 2), 3,000 mg/kg Mn (Exp. 3), and all 3 elements (Exp. 4). Preferential intake was measured over 7- (Exp. 1, 2, and 3) and 14-d (Exp. 4) evaluation periods. In Exp. 1 and 2, calves consumed more ( $P < 0.001$ ) of the supplement offer containing hydroxy Cu (Exp. 1) and hydroxy Zn (Exp. 2) then sulfate and organic sources, while consumption of sulfate sources was greater ( $P \leq 0.04$ ) than organic sources (81.9, 72.2, and 45.5%, and 48.1, 35.1, and 9.5% consumption of supplement offer for hydroxy, sulfate, and organic sources of Cu and Zn, respectively; SEM = 3.94 and 7.93). In Exp. 3, calves consumed more ( $P < 0.001$ ) of the supplement offer containing hydroxy Mn than sulfate and organic sources, while there were no differences ( $P = 0.97$ ) in preferential intake of supplements containing Mn sulfate or organic Mn. In Exp. 4, when all 3 elements were combined within a single supplement, calves almost exclusively selected ( $P < 0.001$ ) the supplements containing hydroxy-source elements vs. supplements containing sulfate or organic sources (70.0, 12.5, and 8.0% consumption of supplement offer for hydroxy, sulfate, and organic sources, respectively; SEM = 3.16). When offered to young calves, these results reveal a lesser preferential intake of trace mineral concentrated supplements fortified with organic and sulfate sources of Cu, Zn, and Mn compared to the same supplements fortified with hydroxy sources of these elements.

**Key Words:** trace minerals, supplementation, calves

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#### 1464 (M225) Predicting dry matter intake of steers and heifers in the feedlot by using categorical and continuous variables.

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Close-out information, submitted by Iowa cattle producers to the Iowa State University Feedlot Performance and Cost Monitoring Program, was used to develop dry matter intake prediction model for steers and heifers by considering categorical and continuous variables. Close-out information consisting of 1651 pens of steers and 601 pens of heifers included information on start and end dates, cattle per pen, sex, housing type, days on feed, initial and sale weight, feed conversion (FC), proportion of concentrate, average daily gain (ADG), percent death loss, feed cost and total cost per 45.35 kg gain, break-even sale price, non-feed variable cost, non-feed fixed cost and corn price. Dry matter intake (DMI) was not provided but

was calculated as  $DMI = ADG \times FC$ . In predicting DMI, categorical regression analysis (optimal scaling) was applied for steers and heifers separately. Independent variables used were starting date on feed (season) (1 = winter: December through February; 2 = spring: March through May; 3 = summer: June through August, and 4 = fall: September through November), number of cattle per pen (head), housing type (housing) (1 = confinement, 2 = partially open lot, 3 = open lot), days on feed (dof), initial weight (iw), proportion of concentrate (concentrate). When the model was applied separately for steers and heifers, DMI prediction for steers was found as  $DMI = 0.540 \cdot iw + 0.017 \cdot season + 0.143 \cdot housing - 0.062 \cdot head - 0.096 \cdot concentrate - 0.186 \cdot dof$  ( $R^2 = 0.433$ ), whereas DMI prediction for heifers was found as  $DMI = 0.706 \cdot iw + 0.086 \cdot season + 0.085 \cdot housing + 0.186 \cdot dof - 0.099 \cdot head - 0.084 \cdot concentrate$  ( $R^2 = 0.468$ ). With this model, categorical variables such as housing type and season are included in the regression model and this may help professionals predict the DMI of their steers and heifers in the feedlot.

**Key Words:** dry matter intake prediction, categorical regression, feedlot

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**1465 (M226) Comparison of high-performance dairy cows fed concentrates vs. those fed no concentrates over a period of 10 yr.** P. L. Kunz<sup>1</sup>, M. Buergisser<sup>1</sup>, and M. Furger<sup>2</sup>, <sup>1</sup>Bern University of Applied Sciences, Zollikofen, Switzerland, <sup>2</sup>Agricultural Education and Advisory Centre Plantahof, Landquart, Switzerland.

Milk prices in Switzerland have been falling for years. As a result, farmers seek to reduce production costs by feeding lower amounts of the most expensive feed component, i.e., concentrates, or cease feeding concentrates altogether. To clarify how high-performance dairy cows respond to a lack of concentrates in their rations, the high-performance herd (75 Brown Swiss cows) at the experimental farm of the Plantahof Agricultural Centre was divided into two groups: one herd (forage herd = FH, 37 cows) has not received concentrates since 2003, while the other herd (concentrate herd = CH, 38 cows) received the same roughage feed components as the FH and an additional 1500 kg concentrates per cow and lactation. The ration was composed of hay, dried grass and maize silage in winter, and hay, grass and maize silage in summer. Both herds were of equal genetic value, as the same bulls were used to sire progeny. Cows which left the herds were replaced by daughters originate from the same herd. Because not all results have been analysed up to now, the results shown are based on different times. The two feeding regimes resulted in differences between the two trial herds: Over the past 6 yr, feed intake in CH cows was higher ( $25.6 \pm 3.3$  kg DM/day) than in FH cows ( $21.5 \pm 2.3$  kg DM/day). Similarly, over the past 9 yr, milk yields of CH cows ( $10,323 \pm 731$  kg/Lactation) exceeded that of FH cows ( $8279 \pm 341$  kg/Lactation). There was no difference in milk fat and milk protein content. The

CH cows suffered higher incidences of milk fever, acetonemia and ovarian cysts over a 4-yr period than the FH cows. None of these results were statistically significant. A total of 48 of the CH cows and only 27 of the FH cows had to be sent to slaughter due to infertility or illness over a 4-yr period. The economic analysis shows that in the Swiss cost environment the forage herd (FH) yielded a higher agricultural income than the concentrate herd (CH). This was primarily due to the higher feed costs for and inferior health of the CH.

**Key Words:** dairy cows, concentrates, costs of production

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**1466 (M227) Effect of *Leukonostoc citreum* SK2556 fermented korean aged garlic extract (KAGE) on feed intake, production performance, egg quality, odor gas emission from feces, excreta microbiota and hematological profiles in laying hens.** D. Jung\*, J. H. Cho, and I. H. Kim, *Dep. of Animal Science, Dankook University, Cheonan, South Korea.*

The goal of this study was to investigate the impacts of dietary supplementation with Dorean aged garlic extract (KAGE) fermented by *Leukonostoc citreum* SK2556 on feed intake, production performance, egg quality, odor gas emission from feces, excreta microbiota and hematological profiles in laying hen. A total of 384, 54-wk (ISA- brown) laying hens were randomly assigned to 1 of 4 treatments with 8 replications per treatment and 12 adjacent cages as a replication (hens were caged individually). The experimental treatments were: 1) CON (Basal diet), 2) KAGE1 (CON + 0.05% Fermented Aged Garlic Feed Additive), 3) KAGE2 (CON + 0.1% Fermented Aged Garlic Feed Additive), and 4) KAGE3 (CON + 0.2% Fermented Aged Garlic Feed Additive). KAGE compounds were analysed by HPLC methods, IgG in the serum were then analysed using an automatic biochemistry blood analyser (HITACHI747, Tokyo, Japan), WBC, RBC and lymphocyte concentrations using an automatic blood analyser (ADVIA120, Bayer, Tarrytown, NY, USA) and fecal *Lactobacillus* and *E. coli* shedding were measured by using MacConkey agar plates and *lactobacilli* medium III agar plates. At 3 wk, laying hen fed with KAGE showed higher yolk height than CON (9.38, 9.47, 9.48 vs. 9.17 mm;  $P < 0.05$ ). In the next week, KAGE3 proved better yolk height along with egg shell thickness compared to CON (9.47mm,  $41.75\text{mm}^2$  vs. 9.18mm,  $40.26\text{mm}^2$ ;  $P < 0.05$ ). Likewise, 0.1 and 0.2% KAGE had meaningful higher value (96.23, 96.08 vs. 93.99;  $P < 0.05$ ) on haugh unit than CON diets. In the last week of experiment, results showed that KAGE2 and KAGE3 treatment improved yolk height and egg shell thickness compared with basal diet (9.52, 9.52 vs. 9.25 mm; 41.89, 41.93 vs.  $40.26\text{mm}^2$ ;  $P < 0.05$ ). Haugh unit was influenced by the 0.2% KAGE over CON (96.42 vs. 94.49;  $P < 0.05$ ). However, laying hen feed with KAGE showed no significant result on feed intake, production performance, excreta gas production and microbiota

and blood composes in any level of experiment. In a nut shell, our findings demonstrated that the administration of KAGE at a level of 0.1% and/or 0.2% can improve yolk height, haugh unit and egg shell thickness in laying hen.

**Key Words:** aged garlic extract, laying hens, *Leukonostoc citreum* SK2556, haugh unit, gas emission

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**1467 (M228) Effects of probiotics supplementation on growth performance, nutrient digestibility, carcass characteristics, meat quality, intestinal microflora and fecal noxious gas emission in broilers.** I. H. Kim\*, Y. Lei, and S. Kim, *Dep. of Animal Science, Dankook University, Cheonan, South Korea.*

A total of 765 broilers (BW  $36.77 \pm 0.33$  g; 1 d old) were used in a 35-d feeding trial to evaluate the effect of fermented plants on performance, carcass traits, blood profiles, nutrient digestibility, intestine microbial population and fecal noxious gas emission of broiler chicks. Broilers were randomly distributed into 1 of 5 treatments on the basis of BW (9 replicate pens per treatment with 17 broilers per pen). Dietary treatments were: 1) NC (basal diet); 2) PC (NC + 5ppm enramycin); 3) P1 (NC with 0.5% of CP reduced + 150ppm phytochemicals); 4) P2 (NC + 0.1% probiotics); 5) P3 (NC + 0.2% probiotics). All nutrients in diets were formulated to meet or exceed the recommendation of NRC (1994) for broilers. The broilers were weighed and feed intake were recorded on d 1, 14, 28, and 35 for calculating BW gain (BWG), feed intake (FI), and feed conversion ratio (FCR). At d 35, fresh excreta samples were collected from each pen for the measurement of nutrient digestibility according to the procedures of AOAC (2003). All data were subjected to GLM procedures of SAS (1996) as a randomized complete block design, with pen as the experimental unit. Differences among treatments were separated by Duncan's multiple range test;  $P < 0.05$  was considered statistically significant. Overall, broilers fed P3 diet had greater (1770 vs. 1681 g;  $P < 0.05$ ) body weight gain (BWG), and lower (1.555 vs. 1.625;  $P < 0.05$ ) feed conversion ratio (FCR) than those fed NC diet. The nutrient digestibility of dry matter (DM) and nitrogen (N) was increased (76.30 vs. 73.26%; 65.32 vs. 62.71%;  $P < 0.05$ ) in P3 compared with NC. There was no difference ( $P > 0.05$ ) in meat quality, relative organ weight and blood profiles. Addition of 0.2% probiotic enhanced the growth of *Lactobacillus*, but inhibited *Escherichia coli* in the small intestinal and large intestinal. Also, addition of 0.1% probiotic showed same result with P3 on the large intestinal microflora but no change in the number of *Lactobacillus* and *Escherichia coli* in small intestine. A significant increase in the rate of ammonia was observed in 1.0 g/kg and 2.0 g/kg probiotic-treated birds versus controls.

**Key Words:** broilers, growth performance, gas emission, nutrient digestibility, probiotic

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**1468 (M229) Effects of a synbiotic feed additive on milk quality and calving interval in Brazilian dairy herds.** R. D. Sainz<sup>1</sup>, E. A. Filgueiras<sup>2,3,4</sup>, C. U. Magnabosco<sup>5</sup>, P. H. Medes<sup>3</sup>, and K. S. Mendanha<sup>2</sup>, <sup>1</sup>University of California- Davis, Davis, CA, <sup>2</sup>Universidade Federal de Goiás, Goiânia-GO, Brazil, <sup>3</sup>Biofórmula Ltda, Goiânia-GO, Brazil, <sup>4</sup>CAPES, Brasília-DF, Brazil, <sup>5</sup>Embrapa Cerrados, Brasília, Brazil.

Data on milk quality and reproduction were collected from 22 dairy herds in the Brazilian states of Paraná, Rio Grande do Sul, Minas Gerais and Goiás. These herds were selected because each one had used the synbiotic Biofórmula Leite (Biofórmula, Goiânia-GO, Brazil) at the minimum dose of 2 g·animal<sup>-1</sup>·d<sup>-1</sup> for a minimum of 1 yr and had records of milk yield and quality and herd reproduction for at least 1 yr before and 1 yr after the start of treatment. The synbiotic contained a mixture of probiotic microorganisms, prebiotics and fibrolytic enzymes. After data tabulation and verification, seven herds (total 189 cows) had sufficient information to study treatment effects on milk quality and three (total 115 cows) had enough for reproductive performance, all primarily Holsteins. The data for the 12 mo preceding treatment were considered as the control, and those for 12 mo following initiation of treatment as treated. Somatic cell count (SCC) data were log-transformed before analysis. These data were subjected to a meta-analysis using a mixed model considering herd as a random variable and treatment as a fixed effect nested within herd. There were no significant differences between treatments in milk yields and the concentrations of fat, protein and total milk solids in milk, but there were reductions in SCC (-41%, 654,963 vs. 386,473 SC/mL,  $P < 0.001$ ) and in calving interval (-73 d, 446.3 vs. 373.4 d,  $P < 0.01$ ) following initiation of treatment with the synbiotic. The synbiotic feed additive used in this study proved to be an effective tool in the reduction of somatic cells in milk as well as in improving the fertility of cows in commercial dairy herds, confirming results obtained under research conditions.

**Key Words:** dairy, somatic cells, reproduction

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**1469 (M230) Effects of injectable trace minerals at the start of the breeding season on attainment of pregnancy in commercial beef cows.** J. D. Arthington<sup>1</sup>, P. G. M. D. A. Martins<sup>1</sup>, P. Moriel<sup>\*1</sup>, and L. Havenga<sup>2</sup>, <sup>1</sup>UF/IFAS Range Cattle Research and Education Center, Ona, FL, <sup>2</sup>MultiMin USA, Ft. Collins, CO.

Our objective was to evaluate the effects of a single application of injectable trace minerals (ITM; MultiMin 90, MultiMin USA, Inc., Fort Collins, CO) on pregnancy attainment of lactating beef cows. Mature Brahman x British crossbred beef cows ( $n = 3750$ ) were enrolled from 14 separate commercial cow/calf operations in central and southern Florida. Ranch breeding season ranged from 90 to 120 d with study

enrollment < 30 d after the start of the breeding season. During enrollment, cows were administered 5 mL of ITM or sterile saline subcutaneously in alternating order. The ITM contained 60, 10, 15, and 5 mg/mL of Zn, Mn, Cu, and Se, respectively. At the time of treatment administration, cow body condition score (BCS) was recorded and assigned a BCS category group (1 = low; 2 = moderate; 3 = high). In addition, samples of pasture forage and trace mineral supplement were collected. To estimate ranch trace mineral status, liver biopsy samples were collected from 10% (maximum of 16) of the enrolled cows. Treatment assignment was identified by an individual number and color coded ear tag. Tags were removed during pregnancy diagnosis. Overall tag loss was low and equally distributed between treatments (96.3 and 95.5% tag recovery for ITM and Saline, respectively) resulting in a total of 3597 collected tags for pregnancy analysis. Average Se and Cu were highly variable among ranches (Se, range = 0.39 to 4.36 and average =  $1.14 \pm 1.04$  mg/kg DM; Cu, range = 65 to 307 and average =  $158 \pm 78$  mg/kg DM). There were 5 and 3 ranches classified as Se and Cu deficient (liver concentrations < 0.60 and 100 mg/kg DM, respectively). There was no ranch x treatment interaction ( $P = 0.50$ ) or overall treatment effect ( $P = 0.19$ ) for pregnancy attainment (88.8 and 87.2% pregnant for ITM and Saline, respectively; SEM = 0.88). Attainment of pregnancy increased ( $P < 0.001$ ) with increasing BCS category (83.9, 86.7, and 91.0 for low, medium and high BCS categories, respectively). Interestingly, although not statistically significant ( $P = 0.62$ ), the numeric difference between the percentage pregnancy attainment due to ITM increased as cow BCS decreased (3.1, 1.8, and 0.1% for low, medium, and high BCS categories, respectively). Provided at the start of the breeding season, ITM injection did not significantly improve pregnancy outcome in the commercial cow/calf ranches enrolled in this study.

**Key Words:** injectable trace minerals, cow, pregnancy

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#### 1470 [Withdrawn]

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**1471 (M232) Cost analysis of feeding bermudagrass (*Cynodon dactylon*) or ryegrass (*Lolium multiflorum*) plus rye (*Secale cereale*) baleage based on nutrient composition and forage refusal of weaned crossbred beef calves.** R. M. Martin<sup>\*1</sup>, R. J. Pruitt<sup>2</sup>, B. Buttrey<sup>3</sup>, and R. Walker<sup>3</sup>, <sup>1</sup>Louisiana State University AgCenter, School of Animal Sciences, Baton Rouge, <sup>2</sup>Louisiana State University AgCenter, Agricultural Economics and Agribusiness, Baton Rouge, <sup>3</sup>Louisiana State University AgCenter, Hill Farm Research Station, Homer.

In the Gulf Coast region, supplementation can be costly for weaned beef calves during the fall backgrounding period due to limited forage production and quality. A study was conducted evaluating performance of weaned Angus crossbred calves fed

bermudagrass (*Cynodon dactylon*) or ryegrass (*Lolium multiflorum*) and rye (*Secale cereale*) baleage in hay rings during a 60-d fall backgrounding period. Four forage treatment comparisons included: early boot stage bermudagrass harvested for hay (BERH), early boot stage bermudagrass harvested for baleage (BERB), early boot stage ryegrass and rye harvested for baleage (ERRG), and bloom stage ryegrass and rye harvested for baleage (LRRG). Both BERH and BERB were harvested from the same hay field at the same time. Nutrient composition of forage treatments included 8.2% CP, 59.9% TDN, and 88.8% DM (BERH); 9.2% CP, 57.4% TDN, and 49.1% DM (BERB); 12.8% CP, 64.5% TDN, and 37.2% DM (ERRG); and 9.2% CP, 62.7% TDN, and 55.7% DM (LRRG). Forage refusal on a DM basis was estimated as amount of (kg) and percent of bale weight fed based on forage remaining outside of the hay ring. Cost estimates for each treatment were performed based on nutrient composition and forage refusal and were derived using standard performance assumptions associated with the tractor and implements used during harvesting of the forage and adjusted for the time needed to harvest forages for this study. Total costs of production were \$293.92/ton DM (ERRG), \$209.18/ton DM (LRRG), \$128.33/ton DM (BERB), and \$117.87/ton DM (BERH). On a cost per nutrient basis, ERRG had the greatest cost/lb of CP and TDN (\$1.15 and \$0.23) followed by LRRG (\$1.14 and \$0.17), BERB (\$0.70 and \$0.11), and BERH (\$0.72 and \$0.10), respectively. Forage refusal was greater ( $P = 0.01$ ) for the BERH (115 kg and 10.0%) compared with BERB (27 kg and 3.4%), ERRG (26 kg and 5.0%), and LRRG (29kg and 3.7%) treatments, but similar among BERB, ERRG, and LRRG, respectively. Value associated with hay refusal measured outside the hay ring was \$14.73/ton DM (ERRG), \$7.66/ton DM (LRRG), \$4.39/ton DM (BERB), and \$11.74/ton DM (BERH). Production costs were lower for bermudagrass harvested as dry hay or baleage. While hay refusal was less outside the hay ring for all baleage treatments, the high value of hay refusal and production cost of the ERRB treatment was greatly associated with the high moisture content of the bales.

**Key Words:** baleage, economics, weaned beef calves

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**1472 (M233) Evaluation of three copper sources on measures of forage utilization and copper status in beef cattle.** P. G. M. D. A. Martins<sup>1</sup>, O. F. R. Cunha<sup>1</sup>, G. P. Caputti<sup>1</sup>, A. Saran Neto<sup>2</sup>, J. M. B. Vendramini<sup>\*1</sup>, and J. D. Arthington<sup>1</sup>, <sup>1</sup>UF/IFAS Range Cattle Research and Education Center, Ona, FL, <sup>2</sup>University of São Paulo, Pirassununga, Brazil.

We investigated the effect of Cu source on measures of subtropical forage utilization and Cu status in beef cattle. In Exp. 1, 24, 2-year old heifers ( $371 \pm 48.1$  kg) were individually fed limpgrass hay and 2.1 kg/d of a molasses-based supplement (8.3 and 3.0 mg Cu/kg DM, respectively). Treatments were assigned to heifers consisting of, (1) no Cu, and 100 mg Cu/d

from (2) hydroxy Cu, (3) organic Cu, or (4) Cu sulfate. Forage DMI and liver Cu change was assessed over 33 d. In Exp. 2, forage DMI and DM, N, and NDF in situ ruminal disappearance was evaluated in 4 ruminally-fistulated steers using a 4 x 4 Latin square design with 4, 20-d periods with the same treatments as Exp. 1. Periods consisted of 10 d of no Cu, 7 d adaptation, and 5 d in situ bag incubation. Dried and ground bermudagrass (4 g) was placed into polyester bags and duplicate samples were incubated for 0, 3, 6, 9, 12, 24, 48, and 72 h. The non-linear model used was  $P=A+B [1-\exp(-c \times t)]$ . In Exp. 1, supplemental Cu had no effect ( $P = 0.40$ ) on voluntary forage DMI; however, heifers provided hydroxy Cu tended ( $P = 0.07$ ) to consume less hay than heifers consuming organic Cu (1.31 vs. 1.46% BW). All heifers experienced a decrease ( $P < 0.001$ ) in liver Cu; however, heifers consuming no Cu tended ( $P = 0.12$ ) to have a greater decrease vs. all other treatments, and heifers provided hydroxy Cu tended ( $P = 0.14$ ) to have a lesser decrease than heifers consuming organic Cu (-94, -80, -64, and -44 mg/kg DM for no Cu, organic Cu, Cu sulfate, and hydroxy Cu, respectively). In Exp. 2, the DM, N, and NDF fractions were described as A, rapidly degradable; B, potentially degradable; and C, undegradable. There was no effect ( $P \geq 0.15$ ) of treatment on forage DMI and in situ DM disappearance. Fraction A NDF and N did not differ among treatments; however, NDF fraction B tended ( $P < 0.06$ ) to be greater for steers provided organic Cu vs. all other treatments (48.7 vs. 41.2%). Similarly, N fraction B was greater ( $P = 0.03$ ) for steers receiving organic Cu vs. hydroxy Cu and No Cu (29.2 vs. 19.0%). These results imply that the organic Cu source utilized in these studies may positively influence the digestibility of subtropical forages.

**Key Words:** copper, digestibility, cattle

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**1473 (M234) Comparison of camelina meal and DDGS in the diet of replacement beef heifers.** E. E. Grings, A. Sackey\*, and G. A. Perry, *South Dakota State University, Brookings.*

The objective of this study was to evaluate the effect of supplementing beef heifers with either cold-pressed camelina meal or dried distillers grains with solubles (DDGS) for 75-d before breeding on weight gain and pregnancy rates. Heifers ( $n = 110$ ) were blocked by weight (BW =  $300 \pm 1.1$  kg) into five pens per treatment and assigned to one of two dietary treatments. Heifers fed camelina meal consumed an average of 5.3 kg/d millet hay, 0.7 kg/d camelina meal and 1.3 kg/d corn, whereas heifers fed DDGS consumed an average of 5.3 kg/d millet hay, 1.1 kg/d DDGS and 0.9 kg/d corn. Average nutrient composition of diets was 9.3% CP, 52.6% NDF and 29.5% ADF for the camelina diet and 9.6% CP, 54.7% NDF and 29.3% ADF for the DDGS diet. Supplements were placed in bunks each morning and millet hay fed after supplements had been consumed. Heifers were bred following a 5-d CO-synch + CIDR fixed time AI protocol and transported to pasture the next day. Four-

teen d later, three clean-up bulls were placed in the pasture for 46 d. Pregnancy was determined by transrectal ultrasonography 96 d after AI. Weight and pregnancy data were analyzed using the GLM and GLIMMIX procedures of SAS, respectively. ADG ( $0.45 \pm 0.08$  kg/d;  $P = 0.2$ ) and final BW ( $339 \pm 1.26$  kg;  $P = 0.97$ ) did not differ between treatments during the 75-d treatment period. Similarly, no difference ( $P = 0.35$ ) was detected for BCS ( $5.2 \pm 0.04$ ) at breeding between treatments. We noted no differences between treatments in conception to timed AI ( $P = 0.57$ ) or in total pregnancy rate ( $P = 0.35$ ). Our data suggests that camelina meal has the potential to serve as a feed resource for replacement heifers with no adverse effect on weight gain or pregnancy rates.

**Key Words:** beef heifers, protein supplement, reproduction

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**1474 (M235) Effects of prepartum evaporative cooling and vitamin E supplementation on immune function of Holstein cows during summer in Florida.** G. C. Gomes\*, J. E. Zuniga<sup>1</sup>, E. Karakaya<sup>1</sup>, L. F. Greco<sup>1</sup>, L. D. P. Sinedino<sup>1</sup>, N. Martinez<sup>1</sup>, R. S. Bisinotto<sup>1</sup>, E. S. Ribeiro<sup>1</sup>, P. M. Leopoldo Junior<sup>1</sup>, M. A. Engstrom<sup>2</sup>, J. P. Driver<sup>1</sup>, J. E. P. Santos<sup>1</sup>, and C. R. Staples<sup>1</sup>, <sup>1</sup>*Dep. of Animal Sciences, University of Florida, Gainesville,* <sup>2</sup>*DSM, Eden Prairie, MN.*

Objective was to evaluate the relationship of vitamin E (VitE) supplementation and prepartum environment on immunity of Holstein cows. Animals ( $n = 70$ ) were blocked at 30 d prepartum by parity, milk yield, and body weight, and randomly assigned to treatments arranged in a  $2 \times 2$  factorial. Cows were housed until parturition in either a free-stall barn equipped with fans and sprinklers (Cooling- C) or in an open lot providing only shade (No cooling- NC). After parturition, all cows were housed in a free-stall barn equipped with fans and sprinklers. All-rac- $\alpha$ -tocopherol (DSM, Parsippany, NJ) was top dressed daily at 1000 IU prepartum and 500 IU postpartum per cow for moderate VitE (M) or 3000 IU prepartum and 2000 IU postpartum per cow for high VitE (H). Blood samples were collected in the prepartum at d -30, and -14 relative to parturition. After calving, blood samples were obtained at d 3, 7, 14, 21, 28, 35, and 42. Analyses included phagocytosis and oxidative burst by neutrophils, percentage of lymphocytes positive for IL-10 and IFN- $\gamma$  production after PMA/ionomycin stimulation, percentage of total, CD4(+), CD8(+), and  $\gamma\delta$  subtypes of T lymphocytes, concentrations of serum IgG against ovalbumin challenge at d -30, -14, and 3, and acute phase proteins. Data were analyzed by ANOVA for repeated measures with PROC GLIMMIX of SAS. Non-normally distributed data was appropriately transformed. Results from cytokines and neutrophil function analyses are presented as fold increase in percentage of positive cells or mean fluorescence intensity (MFI) relative to unstimulated



controls. Feeding more VitE increased ( $P < 0.05$ ) the percentage of lymphocytes producing IFN- $\gamma$  (10.0 vs. 5.4). Parturition cooling tended ( $P < 0.10$ ) to increase the percentage of T lymphocytes (31.0 vs. 23.4%) relative to total lymphocytes, CD4(+) subtype (12.4 vs. 7.4%), and IgG against ovalbumin (0.552 vs. 0.480 O.D.). Providing H vitE to NC cows tended to increase phagocytic activity (MFI) by neutrophils (4.83 vs. 4.25) whereas the reverse occurred when cows were cooled prepartum (4.52 vs. 5.20). Oxidative burst activity (MFI) of neutrophils from multiparous cows was enhanced when cows were cooled (8.72 vs. 6.59) whereas the opposite occurred for primiparous cows (4.84 vs. 5.84). VitE supplementation and parturition cooling caused changes in adaptive immunity patterns. Additionally, parturition cooling provided a conditional improvement of innate immunity depending on amount of vitE supplemented and parity, which might reflect differences in metabolic and oxidative stress status.

**Key Words:** cow, heat stress, vitamin E

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**1475 (M236) Forages used in high producing cow rations in CA.** Y. Trillo<sup>1</sup>, A. Lago<sup>2</sup>, and N. Silva-del-Rio<sup>1</sup>, <sup>1</sup>VMTRC, University of California, Tulare, <sup>2</sup>DairyExperts, Tulare, CA

The objective of this study was to describe the forages included in the high cow ration of 16 California dairies ranging in size from 1000 to 6000 lactating cows. Records from a consecutive 12-mo period, starting from January to June 2012, were extracted from the feeding management software FeedWatch 7.0 (FW). Records from 16 high cow (HC) recipe and 13 high cow premix (HCP) recipe were used. Two dairies did not prepare premix and one dairy had sporadic premix records and records were not included in the final data set. Descriptive statistics were conducted with SAS 9.3. Across dairies, three to seven forage types were available to fed high producing cows. Most forages were directly included into the HC recipe. But some dairies included straw in the HCP recipe ( $n = 5$ ). The median number of forages included daily in the HC recipe was two ( $n = 7$ ), three ( $n = 4$ ), four ( $n = 4$ ), or five ( $n = 1$ ). Throughout the 12-mo study period, the number of forages in the HC recipe varied within dairy in zero ( $n = 1$ ), one ( $n = 10$ ) or two ( $n = 5$ ) forages. All dairies fed alfalfa hay, either for a twelve ( $n = 14$ ) or seven ( $n = 2$ ) month period. When alfalfa hay was not fed ( $n = 2$ ), cows were fed green chop alfalfa. All dairies included corn silage in the HC recipe, but in some dairies it was only fed for 11 ( $n = 3$ ), 9 ( $n = 2$ ), 8 ( $n = 1$ ), or 5 ( $n = 1$ ) mo. BMR corn silage was fed ( $n = 3$ ) in combination with conventional corn silage for 3 to 9 mo. High moisture earlage ( $n = 5$ ) was fed for 2 to 6 mo in combination ( $n = 4$ ) or not ( $n = 1$ ) with corn silage. Other silages, such as wheat ( $n = 5$ ), alfalfa ( $n = 3$ ) or both ( $n = 4$ ) were also included for 3 to 12 mo or 1 to 10 mo, respectively. Other crops were fed occasionally [sorghum silage ( $n = 2$ ) and oat silage ( $n = 1$ )]. Some dairies fed straw for 6 to 12 mo ( $n = 6$ ) while others for less than 2 mo ( $n = 3$ ). Only

10 dairies had records of DM adjustments on FW. For corn silage, DM adjustments were made zero ( $n = 4$ ), six ( $n = 2$ ), eight ( $n = 1$ ), nine ( $n = 2$ ) or ten ( $n = 1$ ) times in a year. Although corn silage and alfalfa hay are the most common forages used in California dairies, wheat silage, alfalfa silage and straw are other common roughage sources for high producing cows.

**Key Words:** dairy cow, forages, feeding management software

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**1476 (M237) Evaluating on-farm methods for measuring dry matter content of potatoes.** R. J. Norell<sup>1</sup>, J. B. Glaze, Jr.<sup>2</sup>, M. Chahine<sup>2</sup>, and N. L. Olsen<sup>3</sup>, <sup>1</sup>University of Idaho, Idaho Falls, <sup>2</sup>University of Idaho, Twin Falls, <sup>3</sup>University of Idaho, Kimberly.

Measuring dry matter content is critical for pricing cull potatoes and for effectively managing potato feeding rates on livestock operations. In this study, dry matter determinations from three on-farm methods (microwave, dehydrator, and Koster Moisture tester) were compared with a laboratory oven. Twenty lots of potatoes were obtained for the study (1 blue, 3 red, 3 yellow, and 14 burbank varieties). Ten potatoes from each lot were cleaned then sliced horizontally into 7mm thick slices. Duplicate 100-g subsamples were run with each drying method. Lab (L) samples were dried for 24 h at 55 C. Equipment for the on-farm methods included two 1000-W microwaves (M), four 500-W Nesco FD60 food dehydrators (D) set at 68 C, and two Koster Moisture Testers (K). Samples were weighed at specified time intervals during the drying process with the on-farm methods and a run was deemed complete when two identical weights were obtained. Drying time and dry matter (DM) data were analyzed as a completely randomized block design. Drying time differed significantly between on-farm methods ( $P < 0.001$ ) and averaged 8.6, 248.5, and 428.6 min for M, K, and D, respectively. Mean DM was significantly higher ( $P < 0.05$ ) for M (23.4%) and D (23.5%) than K (22.6%) or L (22.7%). A Bland-Altman assessment for agreement was used to compare difference in DM between each on-farm method and L. A range of agreement was defined as mean bias + or- 2 SD. The 95% limits of agreement between the lab oven and M, K, and D were: -0.7% to 1.5%; -1.6% to 1.4%; -1.0% to 1.6%, respectively. Overall, the three on-farm methods provided closely corresponding DM to L. The trend lines between Bland-Altman differences and oven DM were not statistically significant ( $P > 0.75$ ) for D and K but was significant ( $P < 0.05$ ) for M with a negative slope across the range of DM in the study. Drying potatoes with all three on-farm methods did not create objectionable odors and can therefore be conducted indoors if desired. This study indicates that the three on-farm methods are effective tools for measuring DM content of potatoes.

**Key Words:** potatoes, dry matter, on-farm testing

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**1477 (M238) Optimizing drying time of potatoes by food dehydrator and Koster Moisture Tester.**

R. J. Norell<sup>1</sup>, J. B. Glaze Jr.<sup>2</sup>, M. Chahine<sup>2</sup>, and N. L. Olsen<sup>3</sup>, <sup>1</sup>University of Idaho, Idaho Falls, <sup>2</sup>University of Idaho, Twin Falls, <sup>3</sup>University of Idaho, Kimberly.

Cull potatoes lose moisture over time when stacked outdoors in a pile. Measuring dry matter content on a frequent basis is therefore important for effectively managing potato feeding rates for cattle. In this study, different sample processing methods were compared for drying potatoes. In trial 1, drying time (DT) and dry matter content (DM) were evaluated for four potato sample sizes in food dehydrators and a lab oven 7-mm-thick horizontal slices (THICK), 3.5-mm-thick horizontal slices (THIN), 7-mm-square fries (LFF), and 3.5-mm-square fries (SFF). The dehydrators were 500-W, Nesco brand FD-60 with four trays, and each tray had a plastic insert to prevent sample movement between trays. Operating temperature was set at 68°C for the dehydrator and the lab oven was set at 55°C. Four lots of potatoes were used with a single lot analyzed each test day. Forty potatoes per lot were cleaned, and 10 were randomly selected for each processing method. A 100-g subsample from each processing method was then randomly assigned to an individual tray within dehydrator. Drying time was significantly different between potato processing methods ( $P < 0.001$ ) with THICK requiring the longest time (459 min), LFF (264 min), SFF (225 min) and THIN (205 min). DM differed between processing methods with THICK slices having higher DM ( $P < 0.053$ ) than the other three processing methods. DM was 0.8% lower ( $P < 0.05$ ) in the lab oven than in dehydrator. In trial 2, DT and DM were evaluated for potatoes processed into THICK and LFF with two Koster Moisture Testers, lab oven, and eight potato lots. Twenty potatoes were cleaned from each lot, with 10 randomly assigned to each processing method. Three 100-g subsamples from each processed lot were randomly assigned to a Koster tester or lab oven. LFF reduced DT ( $P < 0.001$ ) by 101 min compared to THICK. DM did not differ between the two processing methods ( $P < 0.13$ ) nor between lab oven and Koster ( $P < 0.16$ ). This study indicates that drying time is optimized by reducing potato particle size for both the food dehydrator and Koster Moisture Tester without reducing accuracy in estimating potato dry matter.

**Key Words:** potatoes, drying methods, sample processing

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**1478 [Withdrawn]**

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**1479 (M240) Validating a refractometer to evaluate Immunoglobulin G concentration in Jersey colostrum and the impact of multiple freeze-thaw cycles on evaluating colostrum quality.**

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The objectives were: 1) validate an on farm method utilizing refractometry to rapidly and accurately determine immunoglobulin (IgG) concentration in Jersey colostrum and 2) evaluate the impact of freeze thaw (FT) cycles on radial immunodiffusion (RID) and refractometry to determine IgG concentration in bovine colostrum. Samples ( $n = 58$ ; 3 L) of first-milking colostrum were collected from a single dairy in northwestern Iowa. Samples were analyzed within 2 h of collection for IgG concentration by RID, %Brix and refractive index (nD) by refractometer and an estimate of IgG concentration by colostrometer. Samples were then frozen, placed on dry ice and transported to the laboratory at Iowa State University (Ames). All samples arrived frozen and were placed in a -20°C manual defrost freezer until further analysis. On d 7 (1FT), 14 (2FT) and 1 yr (3FT), all samples were thawed, re-analyzed by RID, % Brix, nD and colostrometer and re-frozen. Fresh colostrum, had a mean IgG concentration, as determined by RID, of 72.91 mg/mL (SD = 3.30), mean % Brix of 21.21 (SD = 0.34) and mean nD of 1.3669 (SD = 0.0074). Immunoglobulin G concentration as determined by RID and IgG as estimated by colostrometer were impacted by the number of FT cycles. The estimates for IgG concentration by RID were greater in fresh and 1FT samples as compared to 2FT and 3FT samples (72.91, 75.38, 67.20 and 67.31 mg IgG/mL, respectively). The colostrometer reading was lower in 1FT samples compared to fresh and 2FT samples. There was no impact of multiple FT cycles on nD, or %Brix reading. In fresh samples, IgG concentration was moderately correlated with nD ( $r = 0.79$ ), % Brix ( $r = 0.79$ ) and colostrometer reading ( $r = 0.79$ ). Diagnostic test characteristics utilizing the recommended cut-point of 1.34966 nD resulted in similar sensitivities for 1FT and 2FT samples (94.87 and 94.74%, respectively). Cut-points of 18, 19, 20, and 21% Brix were evaluated on Fresh samples. 18 and 19% Brix cut-points resulted in the greatest sensitivities (92.31 and 84.62%) and specificity (94.74 and 94.74%, respectively). Using the 18% cut-point resulted in 94.83% of the samples being correctly classified. This data supports the use of refractometry (nD and % Brix) to accurately and rapidly determine IgG concentration in fresh Jersey colostrum. Additionally the data suggests that IgG concentration as determined by RID is impacted by multiple FT cycles, whereas estimates obtained via refractometry are not impacted by multiple FT cycles.

**Key Words:** colostrum Jersey refractometer