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Student Abstracts

Feed processing affects palatability of ventenata-infested grass hay

D.E. McCurdy*, C.J. Watts, G.E. Chibisa, T. Prather, and A.H. Laarman

OmniGen-AF[®] supplementation on superovulation response in donor beef cows

A.P. Snider, M.R. Gellings, S.A. Armstrong, D.J. McLean, A.R. Menino Jr.

Use of Herbal Feed Additives in Poultry Feeding

K. Nix, G. Cherian, and F. Vercese

Dual-Purpose Winter Canola: Forage, Silage, and Grain Production

E. Walker, D. Llewellyn, and S. Fransen

Rumen-protected histidine supplementation; nutrient driven beef improvement

B.N. Sandberg, C.W. Hunt, M.E. Doumit, R. Richard, and G. K. Murdoch

Dietary ergovaline exposure induces fescue toxicosis-like response in Coturnix quail chicks

H. Roberts, J. Hermes, J. Durringer, M. Craig, M. West, G. Cherian

Effects of Serum Concentration of Beta-Carotene at Artificial Insemination on Productive and Reproductive Parameters in Lactating Holstein Cows

A.M.L. Madureira, T.G. Guida, R.L.A. Cerri, and J.L.M. Vasconcelos

Effect of rumen protected vitamin B complex on metabolic parameters, milk production and d 15 conceptus and endometrial outcomes

M. Kaur, I. Hartling, T.A. Burnett, L. Polsky, C. Donnan, H. Leclerc, and R.L.A. Cerri

Feed processing affects palatability of ventenata-infested grass hay

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Ventenata is an invasive grass species that infested rangelands in the inland Northwest, causing significant economic damage through declines in forage production. Despite its nutritional similarity to other forages such as cheatgrass in terms of crude protein content and NDF digestibility, its palatability for livestock is poor. The objective of this study was to investigate the role of texture and surface-bound microbes in determining palatability of ventenata-infested hay. Thirty-five weaned Charolais calves were separated into five treatments according to a taste-preference study that lasted for seven days. Each animal had access to two feedbunks: one with a reference diet (mixed grass hay), and one with a treatment diet. The five treatments were: Control – Mixed grass hay used as the reference diet (CTRL); ventenata-infested hay (VENT); autoclaved mixed grass hay (AUTO-M); autoclaved ventenata-infested hay (AUTO-V); and pelleted ventenata-infested hay (PELT). Preference between mixed-grass hay and ventenata-infested hay was calculated such that: 0% preference implies a total preference against the treatment diet; 50% preference implies an equal preference between mixed grass hay and ventenata-infested hay; and 100% preference implies a total preference for the treatment diet. Body weight gain was measured at the start and end of the experiment. Daily, intake of the reference diet and treatment diet were measured and preference was calculated. Among the five treatments, there was no difference in body weight gain during the 7 days on treatment. The CTRL treatment showed no difference from 50% preference, indicating that our feed preference test worked. Calves on the VENT treatment had a preference of 19%, highlighting the poor palatability of ventenata-infested hay. While autoclaving ventenata-infested hay made no difference to palatability, the PELT treatment increased preference to 50%, completely erasing the negative palatability of the ventenata-infested hay. Together, these results show the poor palatability of ventenata-infested hay may be due to texture of the hay, and ventenata's palatability can be improved through feed processing.

OmniGen-AF® supplementation on superovulation response in donor beef cows.

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Superovulation is a costly and biologically stressful procedure in cattle embryo transfer. High variation in ova recovery and fertilization rates and embryo quality result in inconsistent results and prevent full optimization of the procedure for genetic improvement. Inflammation and immune system dysregulation have been suggested to contribute to this variability. The objective of this study was to evaluate OmniGen-AF® (OG) supplementation, a product reported to support immune system function and animal health, on superovulatory response and serum cortisol and progesterone concentrations in beef cattle embryo donors treated with a 200 or 400 mg dose of follicle stimulating hormone (FSH). Twenty-four cross-bred beef cows were split into four groups and superovulated with 200 or 400 mg FSH and fed 0 or 56 g OG/hd/d for 49 d (d 0 = start of the feeding period). The superovulation protocol was started on d 28 and ova were nonsurgically recovered on d 49. Recovered ova were evaluated for fertilization and embryos were graded for quality and morphology. Good to excellent quality morulae and blastocysts were cultured to evaluate *in vitro* embryo development and plasminogen activator (PA) production. Blood samples were collected for cortisol and progesterone analyses on d 0, 10, 14, 21, 28, 38, 40, 42, and 49. Dose of FSH and OG exerted no significant effects on cow body weights during the feeding period. However, for cows superovulated with 400 mg FSH, feeding 56 g OG reduced ($P = 0.08$) the percent degenerate embryos recovered compared to feeding 0 g OG. Embryos recovered from cows superovulated with 400 mg FSH and fed 56 g OG produced more total PA, with a trend for peak PA production to be higher at 72 h of culture ($P = 0.08$), compared to all other groups. Serum cortisol was lower ($P = 0.049$) at the last breeding of the superovulation protocol (d 43) in donor cows fed 56 vs. 0 g OG. Serum progesterone was greater ($P = 0.05$) in cows fed 56 compared to 0 g OG on d 49, the day of embryo collection. In summary, feeding OG may ameliorate some of the undesirable effects associated with the higher FSH dose commonly used in superovulation protocols resulting in more transferable and fewer degenerate embryos. Based on PA production, there is also the potential for healthier embryos with a greater likelihood of developing beyond hatching following an embryo transfer.

Key words: embryos, cattle, cortisol, progesterone, reproduction

Use of Herbal Feed Additives in Poultry Feeding

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The use of an antibiotic as a growth promoter (AGP) began in the 1940's with the discovery of growth responses from *Streptomyces aureofaciens* in the monogastric diet. Resistance and residue problems have increased negative consumer perception of AGP use in animal diets. Although no direct link between antibiotic resistance in animals and succeeding antibiotic resistance in humans, there has been increased interest to find alternatives to AGPs. Phytogetic compounds have a wide variety of properties that allow them to be effective feed additives and are being studied as AGP alternatives.

To test the efficacy of an herbal feed additive, a total of 96 brown layers, age 27 weeks, were kept in individual cages for a four month feeding trial. Birds were weighed and randomly assigned to one of the four dietary treatments. There were a total of 24 birds per each diet, with 12 experimental units per diet (two hens per replicate). The experimental diets contained varying levels of AV/HLP/16 herbal supplement added to the commercially formulated diet. The diets consisted of a 0% AV/HLP/16 supplementation (Control), a 0.1% supplementation (Diet 1), a 0.15% supplementation (Diet 2) and a 0.2% supplementation (Diet 3). The proprietary herbal supplement, (AV/HLP/16 Ayurved Ltd.™, India) contained herbs like *Allium sativum* (garlic), *Commiphora mukul* (Indian bdellium), *Ocimum sanctum* (Holy basil), *Phyllanthus embilica* (Indian gooseberry), and *Trigonella foenum graceum* (Fenugreek).

Production performance, egg quality, egg and liver fatty acid composition, lipid stability, and hen serum lipids were analyzed in laying hens fed varying levels of AV/HLP/16 herbal supplement.

Egg mass and egg production was highest in hens receiving Diet 3 ($p < 0.001$, 0.004). Feed consumption did not differ significantly among the treatments. Feed conversion ratio was lowest for Diet 3 ($p = 0.065$). Shell, yolk and albumen weight (%) did not significantly differ between diets. Numerically, shell weight (g) and shell thickness (mm) values were highest for Diet 3 eggs ($p = 0.001$, 0.0004). Haugh unit and yolk index values were highest in birds fed Diet 3 ($p = 0.0003$, $< .001$). There was a significant effect of hen age on every quality characteristic measured. There was no interaction between the hen age and diet, except for the shell weight percentage.

Total liver lipids (%) was lowest in Diet 2 and Diet 3 ($p = 0.001$). There was no difference in yolk total lipids (%) but there were differences in individual yolk fatty acids. There was a significant decrease in stearic acid and arachidonic acid in eggs from Diet 3 ($p = 0.002$, 0.001). Linoleic acid was significantly reduced in supplemented diets ($p = 0.01$). Egg total lipid content decreased as the hen aged ($p = 0.0003$). No effect of diet on egg cholesterol or hen serum triglycerides was observed. Egg lipid oxidation products were highest in Diet 2 ($p = 0.0003$). Lipid oxidation products in liver were highest for Diet 1 and Diet 3 ($p = 0.051$).

The study provided evidence that the use of AV/HLP/16, a more natural alternative functional feed ingredient, was beneficial to layer production performance at a level of 0.2% of the total diet without negatively impacting the yolk lipid stability or overall fatty acid composition. AV/HLP/16 herbal supplementation is a strong prospect for a more natural alternative to the AGPs that are being used in today's layer diets.

Dual-Purpose Winter Canola: Forage, Silage, and Grain Production

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Canola is an oilseed crop often used in cereal grain rotations in the Pacific Northwest (PNW). Canola offers many agronomic benefits such as breaking weed, disease, and pest cycles, increasing water infiltration, and increasing wheat yields in subsequent years. Vegetative canola has been shown to be a low fiber, high protein forage. The objective of this study was to determine the feasibility of growing and ensiling dual-purpose winter canola in the PNW. Roundup-Ready® winter canola (HyCLASS 154RR) was sown at a rate of 8lbs/ac in mid-August of 2014 and 2015. Plots received one of eight fertilizer combinations. Nitrogen (N) and sulfur (S) were applied at different rates with or without Agrotain® (a nitrogen stabilizer), used in 5:1 (N:S) ratio treatments (100N+0S, 100N+20S, 100N+20S+Agrotain®, 100N+40S, 200N+0S, 200N+20S, 200N+40S, 200N+40S+Agrotain®). Fertilizer was applied in split applications, 1/3 applied preplant and disked into the soil and 2/3 topdressed in the spring at bolting. Plots were split in half with a dual-purpose treatment (DPWC; winter canola harvested for forage in the fall and grain the following summer) and a grain-only treatment (GOWC; winter canola grown for grain without a fall forage crop taken). Canola forage was harvested in mid-October, approximately 60 days after planting. At that time most plants had developed around 8 true leaves. At harvest field weights were recorded, and a sample was oven dried to determine forage dry matter (DM) content and DM yield per plot. Forage was combined per fertilizer treatment (excluding Agrotain® treatments) and ensiled in experimental tube silos at WSU IAREC, Prosser, WA. Forage from each fertilizer treatment was ensiled with alfalfa cubes (CA) and without alfalfa cubes (CO) and replicated 4 times. Because canola is a high moisture crop, alfalfa cubes were used as an absorbent in hopes of reducing silage effluent losses. After approximately 45 days, CO and CA silages were removed from the silos. Samples were taken for fermentation analysis. Forage yields averaged 0.92 and 0.99 t DM/ac in 2014 and 2015, respectively. Forage yields were not different between fertilizer treatments in 2014 and 2015. Forage DM was expectedly low, ranging from 9-13% DM in 2014 and 15-21% DM in 2015. Grain yields did not differ between fertilizer treatments but, grain yields were significantly ($p<0.05$) reduced in the second year of the study. In the 2014 crop year, grain yields for GOWC were significantly ($p<0.05$) higher than DPWC, however in the 2015 crop year grain yields did not differ between GOWC and DPWC. Canola generally ensiled well both with and without alfalfa cubes. Silage pH ranged between 4.2-4.7 across all treatments, similar to grass/legume type silages evaluated in our laboratory. Silage pH was not different (excluding the 200N0S fertilizer treatment) between CA and CO silages, although numerically, CO silage tended to have a lower pH. There were significant year by fertilizer by alfalfa cube treatment interactions for both lactic and acetic acids. Lactic acid concentrations ranged from 4.5 to 14.3% of DM across all treatments. Canola (CO) silage had significantly ($p<0.05$) higher lactic acid concentrations than CA silage across all fertilizer treatments in 2014 and all but two fertilizer (100N20S, 100N40S) treatments in 2015. Acetic acid content averaged 2.4% across all treatments. Alfalfa cubes significantly ($p<0.05$) reduced effluent losses by 28-40 gal./t of silage, within fertilizer treatments. Dual-purpose winter canola yielded almost 1 t DM/ac of forage after only 60 days of growth. Absorbents greatly reduced effluent losses from our experimental silos, keeping valuable nutrients and minerals in the silage, rather than creating an environmental hazard. With the proper management DPWC can provide fall forage and recover to produce a significant grain crop the following summer.

Rumen-protected histidine supplementation; nutrient driven beef improvement

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The objective of this study was to determine the effect of supplementation with rumen-protected (RP) histidine in finishing cattle on growth, feed to gain ratio, and carcass traits/product quality. This project tested three levels of daily RP-histidine (control, low dose, and high dose) over a 55-d finishing period and implemented an aggressive 120 d implant (Revalor-XS). Crossbred beef steers were vaccinated, dewormed, blocked by body weight, and randomized into pens of six (eight pens total). The cattle were fed using Calan gates from an average starting BW of 355kg to a finishing LW of 615kg. Cattle were fed twice daily and the morning feed was top-dressed with the RP histidine according to treatment group: control (no RP-histidine), low dose (50g/hd each d), or high dose (100g/hd each d). Each steer received A,D&E injectable vitamin supplementation 80 d prior to initiation of treatments. Individual intakes were recorded, and feed samples and orts were analyzed every 5 d. On d 56, the steers were harvested at a USDA inspected facility, chilled, carcass data recorded at 24 h post-mortem, and fabricated 48 h post-mortem. One *longissimus lumborum* (Striploin: LL) and one *gluteus medius* (Top Sirloin: GM) was obtained from each animal, aged under vacuum (LL: 21 d, GM: 14 d), and cut into 2.54 cm steaks. One steak was used for retail display (9 d) for which subjective color scores as well as objective color scores (using Hunter Mini-Scan: L*, a*, and b*) were recorded on d 0,1,3,5,7, and 9. All samples were analyzed on d 0 and 9 using T-BARs to quantify lipid oxidation. Another steak was weighed and cooked to evaluate purge and cooking loss, and then tenderness was assessed using Warner-Bratzler Shear Force (WBSF). Consumer taste panels were conducted (1 panel for each muscle, 2 total) to determine consumer acceptability.

RP-histidine supplementation improved the lean color, uniformity, and brightness of the product throughout retail display, and decreased surface discoloration, browning, and purge compared with control. Consumers preferred RP treated product over control based upon improved juiciness, increased overall satisfaction and willingness to purchase the product. A trend for increased growth and improved feed to gain was observed in the treated animals. There were no negative effects of RP-treatment in terms of carcass quality (quality grade and yield grade), tenderness, cook loss, texture, flavor, incidence of off-flavor, or pH. Overall, 55 d of pre-harvest RP-histidine treatment positively impacts consumer perception and may optimize product quality and marketability.

Dietary ergovaline exposure induces fescue toxicosis-like response in Coturnix quail chicks.

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Much of Oregon's >100,000 acres of tall fescue is infected with a fungal symbiont, *Epichloë coenophiala*, which can produce high levels of ergovaline, the causative agent in fescue toxicosis in mammals. As pastured poultry production continues to gain favor, increased numbers of domestic poultry and waterfowl may be raised with tall fescue, or insects consuming tall fescue, as a major component of their diets; however research on the pathophysiological sequelae of ergovaline consumption on birds is limited. The aim of this study was to investigate the effects of dietary inclusion of ergovaline (1267 ppb) through fescue grass seed consumption on growth and development of Coturnix quails. Forty-five chicks were assigned by body weight to one of three nutritionally balanced diets at day three post-hatch (n = 15/diet): a corn/soy control (0ppb ergovaline), 20% endophyte negative seed (E-, 0 ppb ergovaline), and a 20% endophyte positive seed (E+, 1267 ppb ergovaline). Feed intake of each colony brooder pen was measured daily, while body weight measurements were measured weekly. At one and two weeks of age, wing chord measurements were also taken on each chick. Core and skin body temperature were measured on six chicks per diet during the second week of the trial. Feed consumption was negatively affected by inclusion of either E- or E+ fescue seed ($p = 0.010$ and $p < 0.001$, respectively) but feed efficiency was not ($p > 0.10$). No other significant differences in chick performance ($p > 0.05$) were observed between E- and control groups. Ergovaline inclusion in the diet increased core body temperature by an average of 0.9°C ($p = 0.011$), resulted in decreased wing chord measurements at one ($p = 0.010$) and two weeks of age ($p = 0.001$), and negatively affected chick body weight and average daily gain ($p < 0.001$ and $p = 0.038$, respectively). These data show that Coturnix quail consuming fescue grass at levels typical of pastured poultry production systems may experience fescue toxicosis.

Effects of Serum Concentration of Beta-Carotene at Artificial Insemination on Productive and Reproductive Parameters in Lactating Holstein Cows.

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The objective of this study was to determine the effects of beta-carotene concentration in serum at the moment of artificial insemination (AI) on Holstein cows. A total of 497 lactating dairy cows were enrolled. All animals were assigned to a timed AI protocol (CIDR+estradiol benzoate+GnRH-7d-PGF-2d-CIDR-out+PGF+ECP-2d-timed AI). Blood samples and body condition score (BCS) were collected at the moment of AI. Serum beta-carotene was quantified in a single step denaturation and extraction into a solvent, followed by measurement using a portable spectrophotometer (iCheck; BioAnalyt, GmbH, Teltow, Germany). Milk production and herd health records were collected for the entire experimental period, and pregnancy diagnosis was performed by ultrasound 31 d post-AI. Data was analyzed using the MIXED and GLIMMIX procedures of SAS. Animals with BCS ≤ 2.75 had lower ($P < 0.01$) concentration of beta-carotene compared with cows with BCS ≥ 3.0 ($3.82 \pm 0.09 \mu\text{g/ml}$ and $4.16 \pm 0.06\mu\text{g/ml}$, respectively). Multiparous cows had greater concentrations of beta-carotene compared with primiparous cows ($P < 0.01$). There was no correlation between milk production and concentration of beta-carotene ($r < 0.01$; $P > 0.10$), but a quadratic correlation between pregnancy per AI and concentration of beta-carotene ($P = 0.03$) was found. When serum beta-carotene was categorized as low ($\leq 3.21\mu\text{g/ml}$), intermediate (> 3.21 and $\leq 4.82 \mu\text{g/ml}$) and high ($> 4.82\mu\text{g/ml}$), cows with intermediate and high concentrations had higher pregnancy per AI (21.6%, 32.4% and 31.6%, respectively; $P = 0.05$). In conclusion, the concentration of beta-carotene was affected by BCS and parity. Animals with higher concentrations of serum beta-carotene had greater pregnancy per AI, suggesting it may be possible to use beta-carotene as a marker for fertility in lactating dairy cows.

Effect of rumen protected vitamin B complex on metabolic parameters, milk production and day 15 conceptus and endometrial outcomes

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Keywords: dairy, cow, reproduction, embryo, vitamin B complex, rumen protection, milk production, BHBA, endometrial gene expression

The aim of this project was to determine the effects of a rumen-protected vitamin B complex supplementation (VIT B) compared with a control diet containing no supplement (CON) on: milk production and components, concentrations of BHBA, haptoglobin and progesterone in plasma, ovarian dynamics and day 15 conceptus and endometrial outcomes. Fifty-one multiparous Holstein cows from the herd at the UBC Dairy Education and Research Centre were enrolled into the study 3 weeks prior to parturition and were randomly assigned to one of the two treatments. Blood samples (2/week), weekly milk samples and daily feed intake were collected. Cows were enrolled onto a double-ovsynch protocol at 33±3 days post-partum and inseminated by timed Artificial Insemination (AI). Ovarian structures were monitored and measured using *per rectum* ultra-sonography. The uterus was flushed on day 15 post AI for conceptus collection and endometrial samples were collected at the same time. Data was analyzed by ANOVA using the GLM procedure of SAS. Overall, 42 cows were flushed and 13 embryos were collected (recovery rate = 31%). Vitamin B supplementation had no effect on the size of the embryo ($P=0.49$), ovulatory follicle size ($P=0.51$) or CL size at embryo collection ($P=0.51$). However, cows with third or higher parity had significantly larger embryos compared to second parity cows (9.39 ± 1.44 vs. 1.73 ± 1.76 , $P<0.05$). Milk production ($P=0.33$) and milk fat ($P=0.81$) values were also similar between the two groups. BHBA and haptoglobin levels between the two groups were also identical. Analysis of transcripts related to embryo development, immune system, adhesion and regulation of Vitamin B molecules showed that *OXTR* ($P=0.04$), *MUC5B* ($P=0.05$), *MUC1* ($P=0.02$), *IL1B* ($P=0.05$), *SPP1* ($P=0.03$), *TRD* ($P=0.03$), *FZD8* ($P=0.05$) and *FOLR1* ($P=0.05$) genes were significantly upregulated in the VIT B group. *SELL* ($P=0.10$), *PLAU* ($P=0.10$) and *MYH9* ($P=0.10$) genes showed a tendency to be more upregulated in the endometrium of VIT B group compared to CON group. In conclusion, strategic dietary vitamin B supplementation during the transition and early lactation did not affect major outcomes of production and reproduction in lactating dairy cows. However, benefits of vitamin B in fertility might potentially be linked to endometrial and conceptus gene expression.