

633 Effect of feeding Ca salts of palm oil (PO) or a blend of linoleic and monoenoic trans fatty acids (LTFA) on uterine involution and reproductive performance in Holstein cows. S. O. Juchem^{*1}, R. L. A. Cerri¹, R. Bruno¹, K. N. Galvao¹, E. W. Lemos¹, M. Villasenor¹, A. C. Coscioni¹, H. M. Rutigliano¹, W. W. Thatcher², D. Luchini³, and J. E. P. Santos¹, ¹University of California Davis, ²University of Florida, Gainesville, ³Bioproducts, Inc.

Objectives were to evaluate the effects of Ca salts differing in fatty acid profile on uterine involution and reproduction of dairy cows. After blocking according to parity, BCS at dry off and previous lactation milk production, 397 Holstein cows were randomly assigned to one of the two treatments consisting of Ca salts (2% diet DM) of either PO or LTFA from 23 d prepartum to 70 DIM. Body condition of all cows was scored at -43, -23, calving, and at 40, 70, 100 and 140 DIM. Blood was sampled during the first 21d postpartum four times weekly from a subset of 60 cows and plasma was analyzed for PGF metabolite. Ultrasound evaluation was performed weekly from 14 to 42 DIM to determine uterine diameter, thickness of the uterine wall, presence of fluid and interval to first ovulation. Cows were timed inseminated following the Ovsynch protocol at 72 DIM. Continuous and binomial data were analyzed by the MIXED and LOGISTIC procedures of the SAS (2001) program. Source of fatty acids had no effect on BCS either pre- or postpartum ($P < 0.40$). Incidence of retained placenta (6.5 vs 6.7%) and interval from calving to first postpartum CL (27.9 vs 28.3 d) did not differ ($P > 0.15$) between PO and LTFA, respectively. Interval from calving to disappearance of uterine fluid was reduced in cows fed LTFA compared to PO (27.6 vs 25.8 d; $P = 0.04$). Pregnancy rate after first postpartum AI tended to be higher for LTFA than PO at 27 (36.1 vs 28.1%; $P = 0.09$) and 41 (33.5 vs 25.6%; $P = 0.09$) d after AI, but pregnancy losses were similar ($P = 0.74$) and averaged 7.9%. Ca salts differing in fatty acid profile affected reproduction of dairy cows.

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Key Words: Reproduction, Fatty Acids, Dairy Cows

634 Responses of milk fat composition to dietary non-fiber carbohydrates in Sarda dairy sheep. A. Nudda^{*}, S. Fancellu, F. Porcu, F. Boe, and A. Cannas, *Dipartimento di Scienze Zootecniche, University of Sassari, Italy.*

Diets with high concentration of non-fiber carbohydrates (NFC) often induce milk fat depression (MFD) and changes in the fatty acid (FA) composition of milk in cows. In sheep MFD is less common, even when high NFC diets are fed at very high levels of intake or when they are supplemented with unsaturated oil. However, there are very few studies on sheep milk fatty acid composition for these diets. For this reason, an experiment was carried out to study the effect of diets with high (43% of DM) and low (28% of DM) NFC concentration on fat content and FA composition in sheep milk. Ten Sarda dairy sheep in midlactation were individually fed ad libitum diets that contained 56% of finely chopped alfalfa hay and 44% concentrate. The concentrate was mainly corn and barley in the high NFC diet (H-NFC), while soybean hulls were used in the low NFC diet (L-NFC). Both diets had similar fat content but the H-NFC diet contained higher concentration of C18:1 (+28%) and C18:2 (+25%) than L-NFC diet. DMI was affected by dietary treatments (H-NFC = 2501 g/d; L-NFC = 2891 g/d; $P < 0.005$). The ewes fed the

H-NFC diet consumed more C18:1 and C18:2 and less C18:3. Milk yield was not affected by the treatments (H-NFC = 1674 g/d; L-NFC = 1765 g/d). Milk fat content (7.1% vs. 7.0%) and milk fat yield (116 vs. 122 g/d) did not differ between H-NFC and L-NFC diets. Sheep fed H-NFC diets had higher milk C6 to C12 FA and lower C18:0 and cis-C18:1 FA. All trans-C18:1 positional isomers were significantly higher for sheep fed H-NFC diet. The t10 C18:1 content was more than doubled in H-NFC ($P < 0.01$). Total trans-C18:1 acids and individual isomers did not affect milk fat content. The c9,t11 CLA isomer was significantly higher for sheep fed H-NFC. The desaturase index, calculated as c9,t11 CLA/(t11-C18:1 + c9,t11 CLA), was lower in H-NFC group ($P < 0.01$). Overall, the higher trans-C18:1 and CLA and lower C18:0 and desaturase index in milk fat of sheep fed H-NFC diets suggest that rumen biohydrogenation of unsaturated FA is slower and thus more unsaturated FA escapes from rumen. The high NFC diet used in this study did not decrease fat synthesis in sheep milk. (Research supported by MiPAF).

Key Words: Dairy Sheep, Non-Fiber Carbohydrates, Milk Fatty Acids

635 Nutritional properties and use of rumen protected oilseed /conjugated linoleic acid (CLA) supplements. S. K. Gulati^{*1}, S. W. McGregor², and T. W. Scott², ¹Sydney University, ²Rumentek Pty Ltd.

FDA (2003) has recently approved the use of formaldehyde as a feed additive for dairy and beef dietary supplements derived from oilseeds/meals. The practical significance of this is that the same diet containing rumen undegraded protein (RUP), rumen undegraded fat (RUF) and designer n-3, n-6 fatty acids can be included in the rations of lactating and non-lactating ruminants. The proportions of RUP and RUF in the supplements made by emulsification and formaldehyde treatment of soybean/canola oilseeds are approximately 90% and 80% respectively; the intestinal digestibility of the C18 unsaturated fatty acids and essential amino acids is 90% and 82%. Oilseeds supplements can be designed in terms of fat content and composition for specific production goals eg, improving reproductive performance, enhancing the physical and nutritional properties of milk and meat. In the current experiment our aim was to determine if the CLA induced suppression of milk fat could be reversed by feeding rumen protected (RP) oilseed supplements. Five Holstein cows in mid-lactation, grazing a predominantly kikuyu based pasture, were fed RP-CLA alone (61.5g/d equivalent to 10.3g/d trans10, cis12 and 10.2g/d of cis9, trans11) for 4 days followed by a combination of RP-CLA and RP-soybean/canola oilseed, the latter providing 656g of additional fat per day. RP-CLA alone reduced milk fat by 30% (from 3.4% to 2.4%; $P < 0.001$) and fat yield by 28% (from 826g/d to 594g/d; $P < 0.001$). In combination with RP-soybean/canola oilseed, milk fat increased from 2.4% to 3.4% ($P < 0.001$) and fat secretion was enhanced from 594g/d to 858g/d ($P < 0.001$). This result indicates that the mechanism of CLA induced milk fat depression occurs primarily in the lipogenic pathways within the mammary gland and not on the uptake and transfer of circulating fatty acids. From a dairy industry perspective, it is now practical to design and feed RP fat/protein supplements that produce beneficial effects on performance and product quality.

Key Words: Rumen Protected Oilseeds, CLA

Sheep Species

636 Effect of GnRH in conjunction with ram introduction on the induction of fertile estrus during the non-breeding season. K.M. Jordan^{*}, A.K. Wurst, E.K. Inskeep, and M. Knights, *Division of Animal and Veterinary Sciences, West Virginia University, Morgantown.*

Introduction of novel rams to anestrus ewes, the ram effect, can be used as a tool for out-of-season breeding but produces a variable response. A single injection of progesterone at ram introduction (RI) and treatment with PG on d 12-16 improved the proportion of pregnant ewes. Maintenance of the ram-induced corpus luteum (CL) up to PG treatment is probably crucial to success of this procedure. Therefore, the effect of a GnRH injection in conjunction with RI was evaluated in anestrus ewes. In addition, the effect of presence of a CL prior to PG injection on fertility of anestrus ewes was tested. In early July, ewes ($n = 28$ -

32/group) were exposed to intact rams for 35d and given an ovulatory dose of GnRH (100 μ g) on d2, d7 or both days following RI. The presence of a CL was determined by transrectal ultrasonography on d7 and d14 at which time an injection of 20 mg PG (Lutalyse) was given. Pregnancy was diagnosed on d52 and d67 relative to RI. Mean estrous response (56%), pregnancy rate to the first (PR1; 29%) and second (PR2; 65%) service periods did not differ among groups. Because of potential for a CL induced by RI or GnRH to be short-lived, the effect of presence of a CL on d7 and/or d14 on fertility variables was examined. Ewes were reclassified as having: no CL on d7 or 14 (CL 0; $n = 14$), a CL on d7 only (CL 7; $n = 10$), a CL on d14 only (CL 14; $n = 16$), or a CL on both days (CL 7,14; $n = 16$). More ewes ($P < 0.01$) in CL 7 (70%), CL 14 (81%) and CL 7,14 (81%) were marked by rams than in CL 0 (14%). PR1 and PR2 were greater in ewes in CL 7,14 (53 and 81%) and CL 14 (38 and 93%) than in CL 0 (7 and 38%). PR1 tended to be higher ($P = 0.06$)

in ewes in CL 7,14 than in CL 7 (30%), which did not differ from CL 0. Percentages of ewes lambing to the first and both services were 7 and 14, 30 and 50, 25 and 81, and 47 and 76 for the four groups respectively. Percentage of ewes lambing to the first service was greater ($P = 0.01$) in CL 7,14 than in CL 0 and more total ewes lambed in groups with CL than in CL 0. Although one or two injections of GnRH after RI did not improve reproductive performance of anestrus ewes, the value of presence of a CL at PG treatment was confirmed.

Key Words: GnRH, Anestrus ewe, Fertility

637 The effect of metabolizable protein and machine milking on the periparturient relaxation of immunity against *Teladorsagia circumcincta* in dairy ewes. E. C. Partington*, J. Donaldson, L. A. Sinclair, and A. M. Mackenzie, Harper Adams University College, Newport, Shropshire, UK.

Increased anthelmintic resistance has led many to investigate alternative methods of parasite control. It is believed that most larval contamination of the pasture is derived mainly from the mature breeding ewe due to the periparturient relaxation of immunity (PPRI). Increasing the metabolizable protein (MP) supply of the ewe in late pregnancy may moderate the PPRI. Previous studies by the author investigating the effect of MP supply to dairy ewes on faecal nematode egg counts (FECs) have not shown significant differences. This study investigated the effects of MP supply and machine milking on the PPRI. Thirty-two pregnant dairy ewes were fed 1 of 2 diets and allocated to 1 of 4 groups: Low MP (0.98 x daily requirement) milked, Low MP, suckled, High MP (1.75 x daily req.) milked or High MP, suckled, in a 2 x 2 factorial design (n=8), from -6 to +7 weeks around parturition. From week -6 ewes were inoculated with 30,000 *Teladorsagia circumcincta* larvae/week. The lambs from the milked ewes were weaned at 72 hours old and the ewes machine milked 3 times/day (yields recorded and samples collected weekly). The remaining ewes suckled twins with milk yield estimated by lamb weight gain. The ewes were slaughtered in week +7 to determine worm burden (WB). FECs and WB were transformed according to $\text{Log}_{10}(n+1)$ prior to statistical analysis using GENSTAT. An increased MP supply lowered ($p < 0.001$) ewe FECs *pre-partum*. During lactation suckling increased ($p = 0.009$) ewe FECs. Ewes that were suckled had higher milk yields ($p = 0.001$) and higher WB ($p = 0.002$) than the milked ewes. An increased MP supply increased ($p < 0.001$) ewe weight gain up to parturition, while during lactation ewes that suckled lost more weight ($p = 0.003$) than the milking ewes. Conclusion increased MP supply reduced the PPRI in the dairy ewes, however it may not be advised to use solely machine milked animals to study the effects of the PPRI. More work on how increased MP supply lowers FECs is needed.

Key Words: Periparturient, Sheep, Nematodes

638 The effect of iodine supplementation to ewes in late pregnancy on lamb serum immunoglobulin level. T. M. Boland*, M. J. Guinan, M. A. Foley, P. J. Quinn, J. J. Callan, and T. F. Crosby, University College Dublin, Dublin, Ireland.

High levels of iodine, fed as part of a mineral premix, negatively impact on lamb serum immunoglobulin G (IgG) levels at 24h post partum. The objective of this study was to examine if this high level of iodine, when offered independently of other minerals, elicits a similar effect. Forty-four ewes of mixed breeds were used to examine the effect of dietary iodine supplementation in late pregnancy on lamb serum IgG values. The ewes were individually penned and offered grass silage ad-libitum, supplemented with 500g of 19% crude protein (CP) concentrate from day 105 of pregnancy. Ewes were allocated to one of four treatments: T1, control (C) no mineral supplement; T2, supplemented with Ca, P, Mg, Na, Mn, Co, I, Zn, Se and Vit. E (M); T3, as T2 but excluding iodine (-I); T4, supplementary iodine only (IO). Colostrum yield was measured following hand milking at 1, 10 and 18h after parturition. A blood sample was taken from the lambs at 24h post partum for IgG determination. IO ewes had higher DM and CP intakes than C or M ewes ($P < 0.05$). Treatment did not affect gestation length, lamb birth weight, colostrum yield at 1, 10 or 18h or total colostrum yield to 18h post partum. While lambs from the M treatment were fed more colostrum than the C lambs ($P = 0.02$) there was no difference when colostrum intake was expressed per kg lamb birth weight ($P > 0.05$). Treatment had a significant effect on lamb serum IgG level at 24h post partum ($P < 0.001$). Lambs from the -I treatment had the highest IgG level (19.2g/l) and this was higher than in the control (15.1g/l; $P = 0.02$), the M (1.5g/l;

$P < 0.001$) and the IO treatments (1.1g/l; $P < 0.001$). Lamb serum IgG values were higher in C than in the M and IO treatments ($P < 0.001$). We conclude that at the supplementation level applied in the current study that iodine offered on its own or as part of a mineral pre-mix, will equally and significantly lower the lamb's ability to absorb IgG from the colostrum.

Key Words: Iodine, Sheep, IgG

639 The effects of mineral block intake by ewes in late pregnancy on dietary intake and IgG absorption by the progeny. T. M. Boland*, D. Joyce, P. J. Quinn, J. J. Callan, and T. F. Crosby, University College Dublin, Dublin, Ireland.

Molassed mineral blocks are a free choice form of mineral supplementation that minimize both labor in the feeding of minerals and the disruption caused at feeding time. However, relatively little information is available on the intake of these blocks. Target intake guidelines in the range 20-30g/hd/day are commonly quoted. In an attempt to quantify the intake of mineral blocks when offered ad libitum in the last month of gestation, 158 ewes (114 single bearing (SB) and 18 twin bearing (TB)) were group housed, in addition to 26 individually housed TB ewes) were assigned to this study. Block intake was recorded daily in all treatments while food and water intake, colostrum yield, composition and the intake of colostrum by each lamb was measured at 1, 10 and 18h after parturition for the individually fed animals. A blood sample was taken from the progeny of the individually fed ewes at 24h post partum for IgG determination. Daily block intakes for the single bearing, twin bearing group fed and twin bearing individually fed ewes were 73g (range 40-95g), 117g (range 77-138g) and 206g (range 175-223g) per hd/day respectively. These intakes represent a 3-10 fold increase on commonly quoted guidelines. There was no effect of treatment on voluntary food intake. The daily water consumption (l/ewe/d) was higher when the ewes had access to mineral blocks (2.24 vs 0.77; $P < 0.05$). Treatment had no effect on colostrum yield, IgG concentration of the colostrum or total colostrum IgG yield. Although the intake of IgG to 18h was similar for lambs in both treatments (30.0 vs 30.5 g/lamb) the percentage of colostrum IgG absorbed was significantly lower when the ewes had access to mineral blocks (26.1 vs 6.5; $P < 0.05$). We conclude that the provision of ad libitum access to this mineral block to ewes in late pregnancy resulted in intakes that were both variable and excessively high, resulting in increased water intake and a reduction in lamb serum IgG values.

Key Words: Mineral, Sheep, IgG

640 Shear force and sensory attributes of lamb from hair sheep composite breeds. S. P. Greiner¹, D. R. Notter¹, and S. K. Duckett^{*2}, ¹Virginia Polytechnic Institute and State University, Blacksburg, ²University of Georgia, Athens.

One hundred fifty seven lambs from two locations (L1, L2) were evaluated over a three yr period to assess the effect of breed type on shear force and sensory panel attributes. Dorper (DP) and Dorset (DO) cross-breeds (out of $\frac{1}{2}$ -DO, -Rambouillet, -Finnsheep ewes) were produced in all three yr at L1, along with straightbred Katahdin (KT) and Barbados Blackbelly x St. Croix (HH) wethers in 2001 and 2002. At L2, DP and Suffolk (SU)-sired lambs (out of SU dams) were produced in 2001 and 2002. Lambs were weaned at 90 d of age, grazed, and then fed a high-concentrate diet prior to harvest at 8 mo of age. Loins from carcasses were aged at 4° C for 10 d and frozen at -20° C for subsequent Warner-Bratzler shear force (WBS) and sensory analysis. Two 2.54 cm chops from each loin were broiled to an internal temperature of 71° C, and rated by a trained sensory panel for overall tenderness (T), juiciness (J), lamb flavor (LF), and off-flavor (OF) using a 8-point scale (1 = extremely tough, dry, and bland; 8 = extremely tender, juicy, and intense). A model that fit year, location and breed type was used to evaluate DP vs non-DP (ND; DO and SU) breed types. No breed by location interactions were observed. WBS values were 0.25 kg lower ($P = 0.01$) for DP than ND (2.30 vs 2.65; SEM = 0.14). Similarly, panelists tended to rate DP more T ($P = 0.06$) than ND (5.62 vs 5.27; SEM = 0.19). Scores for J, LF, and OF were similar ($P > 0.13$) between DP and ND. At L1, a model that fit breed and year was used to assess differences among breed types. WBS values were 2.81, 2.50, 2.45, and 2.44 kg for DO, DP, KT, and HH, respectively ($P = 0.10$; SEM = 0.16). Breed types rated similarly for all sensory traits. Palatability characteristics

exhibited by hair breeds of sheep may contribute positively to genotypes developed for low input, easy care production systems.

Key Words: Lamb, Tenderness, Sensory Evaluation

641 Evaluation of ultrasound measurements to predict carcass ribeye area and fat thickness in lambs. C. J. Hiemke^{*1}, D. L. Thomas¹, T. A. Taylor¹, R. G. Gottfredson¹, and S. Pinnow², ¹*University of Wisconsin, Madison*, ²*Pinn-Oak Ridge Farm, Delavan, WI*.

The objective of this study was to evaluate ultrasound measurements to predict carcass ribeye area (REA) and fat thickness (FT). Lambs were measured once with an Aloka 500 ultrasound machine with a 3.5 MHz linear probe set over the loin between the 12th and 13th ribs. Lambs were in 8 different groups (n=174, 6 to 89/group) spread over a 13 mo period. Digital ultrasound images were saved to a PC and measured with ImageTool (www.ddsdx.uthscsa.edu/dig/itdesc.html). Carcass measurements on 89 lambs were obtained using a REA grid and ruler on the carcass. Measurements on 85 lambs were obtained by tracing the cross section of the loin and the subcutaneous fat layer onto acetate paper. Carcass REA was measured with a compensating planimeter, and carcass FT was measured with a ruler from the trace. All ultrasound measurements were collected by one operator who was a novice

at the start of the study. Pearson (Spearman rank) correlations between ultrasound and carcass measurements of all lambs were .70 (.71) for REA and .77 (.75) for FT ($P < .001$). Within group correlations increased from .40 to .93 for REA and from .59 to .96 for FT from the 1st to the 8th group of lambs. Ultrasound loin width and 3 loin depths were correlated ($P < .05$) with carcass REA (n=79), however, these correlations (.25 to .58) were lower than the correlation between ultrasound REA and carcass REA (.72). Prediction equations generated using stepwise regression (n=174) were: Carcass REA, $\text{cm}^2 = 3.66 + .85(\text{ultrasound REA})$, ($R^2 = .49$) Carcass FT, $\text{cm} = .071 + .88(\text{ultrasound FT})$, ($R^2 = .60$) Carcass FT, $\text{cm} = -.203 + .82(\text{ultrasound FT}) + .01(\text{carcass wt, kg})$, ($R^2 = .62$). Experience of the ultrasound operator is important. Using all data collected during the study while the operator was gaining experience, approx. 50 and 60% of the variation in carcass REA and FT was accounted for by ultrasound REA and FT, respectively. However, in the last two groups, variation in carcass REA and FT accounted for by ultrasound was approx. 80 and 75%, respectively.

Key Words: Lamb, Ultrasound