

515 Effect of an enzyme mixture on dairy cow performance. S. Ghasemi* and A. A. Naserian, *Ferdowsi University, Mashhad, Khorasan, Iran.*

The use of enzymes as additives in ruminant diets has received considerable research interest recently following positive responses observed in feeding trials. The objective of present study was to determine the effects of an enzyme mixture (Natzzyme, Bioproton, PTY. LTD.), on dairy cow performance. Nine lactating Holstein cows, in early lactation, were randomly assigned to treatments in a 3 × 3 Latin squares design. Treatments were, 1) no enzyme 2) enzyme was added to concentrate portion of the TMR (0.5 kg/ton) 3) enzyme was added to concentrate portion of the TMR (1 kg/ton). Cows averaged 53.88 ± 8.19 days in milk. The cows were given ad libitum a TMR composed of 34% forage (20% alfalfa, 14% corn silage) and 66% concentrate (25% barley, 8% corn, 7% cotton seed, 6% soybean meal, 9% cotton seed meal, 5% beet pulp, 4.3% bran, 0.2% urea, 0.5% lime, 0.2% premix, 0.2% salt, 0.6% fat meal). Data were analyzed using General Linear Models procedure of SAS V6.12 for ANOVA to evaluate differences among experimental groups, means compared with Duncan test. Milk production, protein, lactose and digestibility of dry matter, were higher in cows fed enzyme compared to those fed control diets, but it was not significant. Dry matter intake was significantly higher in control group ($P \leq$

0.05), feed efficiency was significantly higher in treatment groups ($P \leq 0.05$). Milk production increased 4.5% in cows received enzymes in comparison with control group. So, data showed that the enzyme can improve dairy cow performance.

Effect of enzyme on cow performance

Treatment	1	2	3	SEM
Dry matter intake(kg/d)	25.56 ^a	24.02 ^c	24.76 ^b	0.17
Milk production(kg/d)	32.86	33.2	34.34	0.65
Protein(%)	3.34	3.37	3.35	0.01
Lactose(%)	4.64	4.65	4.66	0.05
Fat(%)	3.59	3.4	3.64	0.14
Digestibility of dry matter(%)	78.22	80.4	79.03	0.01
Feed efficiency	1.29 ^b	1.38 ^a	1.38 ^a	0.02

Key Words: Enzyme, Dairy Cow, Nutrition

Sheep Species

516 Analysis of probability distribution of some serum and hematological variables of dairy sheep. C. Dimauro¹, P. Bonelli², N.P.P. Macciotta¹, P. Nicolussi², C. Patta², and G. Pulina^{*1}, ¹Università di Sassari, Italia, ²Istituto Zooprofilattico per la Sardegna, Italia.

Serum and hematological parameters are widely used in nutrition and in health diagnosis of farm animals. They are also used to check the metabolic and health status of animals involved in scientific trials. Usually these variables are analyzed by standard ANOVA methods and statistical inference is based on the assumptions of normal distribution and of homoscedasticity of variance. Because of the strict metabolic control, it is not logical that these parameters should adapt to a normal distribution. To check this hypothesis, a set of about 700 observations for serum and about 1000 observations for hematological parameters have been analyzed for direct or transformed normality, for agreement to the Central Limit Theorem (CLT) and for the nearest distribution shape. The variables taken into account are listed in table 1. Results show that few variables are normally distributed and in general, they can not be normalized by using the usual transformate ($\ln x$, $1/x$, \sqrt{x}), but most of them follow the CLT.

	Direct Normality	Transformed Normality	Nearest CLT	Distribution Shape
Serum Parameters				
Alkaline phosphatase	No	No	No	Lognormal
Creatine phosphokinase	No	No	Yes	Lognormal
Glucose	No	No	Yes	Normal
Urea nitrogen	No	No	Yes	Gamma
Cholesterol	No	Yes ($\ln x$)	Yes	Lognormal
Hematological Parameters				
Hemoglobin	No	No	Yes	Lognormal
Hematocrit	Yes	No	Yes	Normal
Mean corpuscular volume	No	No	No	Loglogistic
Mean corpuscular hemoglobin	No	Yes ($1/x$)	Yes	Loglogistic
Platelets	No	Yes (\sqrt{x})	Yes	Weibull
Granulocytes	No	Yes (\sqrt{x})	Yes	Gamma

Key Words: Probability Distribution

517 Comparison of East Friesian and Lacaune sheep breeds for dairy production. D. L. Thomas*, Y. M. Berger, R. G. Gottfredson, and T. A. Taylor, *University of Wisconsin, Madison.*

East Friesian (EF) and Lacaune (LA) dairy sheep germplasm (semen, embryos and sheep) was imported into North America (NA) in recent years to improve

milk production of dairy sheep flocks. No studies have been reported on comparative performance of these two breeds in NA, and few studies are available from other countries. Progeny of 14 EF and 6 LA rams, representing all EF and LA lines in NA, were compared from 1999 through 2004 for growth, reproduction, and milk production at the Spooner Agric. Res. Sta. F1 lambs were produced by mating EF or LA rams to Dorset-cross, Rambouillet and Polypay ewes. EF- and LA-sired F1 ewes, and subsequent generations of crossbred ewes, were mated to both EF and LA sires to produce animals of a higher % dairy breeding with various combinations of EF and LA breeding. Growth, reproduction, and milk production data were available on 1794, 942 and 402 animals, respectively. Data were analyzed with PROC MIXED of SAS with sire breed and other appropriate effects fitted as fixed effects and ewe and sire fitted as random effects. EF-sired lambs had heavier ($P < 0.05$) birth and 30-d weights than LA-sired lambs (5.05 vs. 4.64 and 14.3 vs. 13.3 kg, resp.). 150-d weights were not significantly different between the two breeds but were slightly greater for LA-sired lambs. Breeds did not differ for ewe fertility, but EF-sired ewes had larger ($P < 0.05$) litter sizes than LA-sired ewes (1.85 vs. 1.69 lambs/ewe, resp.). EF-sired ewes lactated for 4% more days and produced 7.5% more milk than LA-sired ewes, but these differences were not significant. LA-sired ewes produced milk with a higher ($P < 0.05$) % fat and % protein than EF-sired ewes (6.3 vs. 5.8% and 5.2 and 4.8%, resp.). There were no significant differences between breeds for kg of milk fat and milk protein. EF-sired ewes would be expected to be more profitable than LA-sired ewes, due to their greater lamb production. However, the advantage of EF-sired ewes would be lessened, although not eliminated, if payments for milk were based on fat and protein content.

Key Words: Dairy Sheep, East Friesian, Lacaune

518 Reproductive performance and milk yield in Awassi and its crosses with either Charollais or Romanov breeds. R. Kridli^{*1}, A. Abdullah¹, N. AL-Smadi¹, and M. Momani-Shaker², ¹Jordan University of Science and Technology, Irbid, Jordan, ²Czech University of Agriculture, Prague, Czech Republic.

The objective of this study was to evaluate the effect of Awassi or Awassi crossbred breed types on reproductive performance, milk production and composition and udder measurements. One hundred, 2- to 6-year-old multiparous ewes of three genotypes [Awassi (A; n = 30), F₁ Romanov-Awassi (RA; n = 36) and F₁ Charollais-Awassi (CA; n = 34)] were used in the study. Upon lambing, ewes and their offspring were placed in a large pen in which they remained until the end of the experiment. Body weights (BW) and body condition scores (BCS) of all experimental ewes and BW of their lambs were recorded at the beginning of the study (one wk postpartum) and weekly thereafter, until the end of the ex-

periment (weaning of lambs at 70 d of age). Udder dimensions were recorded on the first milking day following parturition (one wk postpartum). Milk production was estimated weekly from parturition to weaning. Lambing rates were not influenced by genotype. The number of multiple births tended to be greater ($P = 0.10$) in RA compared with CA ewes. Similarly, the number of lambs born per lambing ewe was greater ($P < 0.05$) in RA than CA ewes while A ewes were intermediate. Milk production was greater ($P < 0.05$) in A than RA and CA ewes. The CA ewes, however, had greater BW ($P < 0.01$), BCS ($P < 0.01$) and milk ash percentage ($P < 0.05$) than the other genotypes. Lamb body weights from birth to weaning, udder dimensions, and milk crude protein and dry matter percentages were similar ($P < 0.05$) among the different genotypes. These results indicate that crossing Awassi ewes with Charollais and Romanov breeds lowered milk production without affecting lamb growth rate. Crossing Awassi with Charollais improved ewe BW and BCS while crossing Awassi with Romanov improved reproductive performance.

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Key Words: Sheep, Reproduction, Milk Yield

519 The use of Dorper crossbred ewes in an accelerated lambing and extensive management system in the tropics. R. E. Dodson* and R. W. Godfrey, *University of the Virgin Islands, St. Croix, US Virgin Islands.*

Dorper sheep are being used in the US Virgin Islands for crossbreeding with the local hair sheep. The objective of this study was to evaluate the production traits of St. Croix White X Dorper (DPRX) ewes in an extensive management and accelerated lambing system. The DPRX ewes ($n = 14$; 9.6 mo of age) were compared to an established flock of Barbados Blackbelly (BB; $n = 22$; 38.2 mo of age) and St. Croix White (STX; $n = 21$; 50.8 mo of age) ewes managed on guinea grass pastures. Breeding occurred in October 2003 (BRD1) and June 2004 (BRD2) using DRPX, BB and STX rams for 35 d. Ovulation rate was determined by laparoscopy on d 7 to 9 after mating. Lambs were born in March 2004 (LMB1) and November 2004 (LMB2). On 7, 21, 35, 49 and 63 d of lactation 24-h milk production was measured. Lambs were weaned at 63 d of age in May 2004 (WEAN1) and January 2005 (WEAN2). Ovulation rate at BRD1 and BRD2 was lower ($P < 0.003$) in DRPX than in BB or STX ewes (1.1 ± 0.1 vs. 1.6 ± 0.1 vs. $1.9 \pm 0.1\%$, respectively). Number of lambs born at LMB1 was higher ($P < 0.03$) for STX than for BB or DRPX ewes (2.1 ± 0.1 vs. 1.7 ± 0.1 vs. 1.2 ± 0.2 , respectively) but there was no difference at LMB2 (1.6 ± 0.1). The DRPX ewes had fewer ($P < 0.01$) multiple births at LMB1 than BB or STX ewes (18.2 vs. 63.6 vs. 90.5%, respectively) but not at LMB2. Litter birth weight was lower ($P < 0.003$) for DRPX than for BB or STX ewes at LMB1 (3.4 ± 0.4 vs. 4.9 ± 0.3 vs. 6.2 ± 0.3 kg, respectively) but not at LMB2. There was no difference ($P > 0.10$) in litter weaning weight at WEAN1 but at WEAN2 it was greater ($P < 0.05$) in DRPX than in BB or STX ewes (20.9 ± 1.7 vs. 14.8 ± 1.4 vs. 16.3 ± 1.5 kg, respectively). Milk production, reported as area under the lactation curve, was similar ($P > 0.10$) among breeds during both lactations (51034.7 \pm 2319.7 units). These results show that it is possible to incorporate DRPX ewes into an accelerated lambing and extensive management system and achieve production levels that are similar to those of local hair sheep under tropical conditions.

Key Words: Sheep, Crossbreeding, Accelerated Lambing

520 Change in ultrasound loin and fat measurements in growing lambs of different breeds. C. Hiemke*, D. Thomas, T. Taylor, and R. Gottfredson, *University of Wisconsin, Madison.*

The objective of this trial was to estimate rates of fat thickness (FT), loin muscle area (LMA), and loin depth (LD) change in growing Hampshire (H, $n = 121$), Polypay (P, $n = 78$), Rambouillet (R, $n = 45$) and Targhee (T, $n = 18$) ram and ewe lambs by repeated ultrasound measurements. Loin width (LW) growth was estimated on 45 H and 39 P lambs. Linear and quadratic regressions of ultrasound measurements on weight were calculated by the PROC MIXED proce-

dures in SAS. All linear FT coefficients were positive and different ($P < 0.05$) from zero, except for T rams and R ewes and rams. Quadratic FT coefficients were negative and different ($P < 0.05$) from zero for P rams and T ewes. All linear LMA coefficients were positive and different ($P < 0.05$) from zero, except for the T ewes and rams. Quadratic LMA coefficients were negative and different ($P < 0.05$) from zero for the H and R ewes. All linear LD coefficients were positive and different ($P < 0.05$) from zero, except for T rams and ewes. Quadratic LD coefficients were different ($P < 0.05$) from zero for H and P ewes and R rams and ewes. Linear and quadratic LW coefficients for H rams and ewes were different ($P < 0.05$) from zero. P rams had a positive linear LW coefficient different ($P < 0.05$) from zero. All 19 of the 28 significant linear regressions were positive and all 10 of the 28 significant quadratic regressions were negative; indicating that FT, LMA, and LD increased at a slower rate as lambs grew in some breeds and sexes and that changes in these measurements continued at a constant positive rate in other breeds and sexes. Seven of the 10 significant negative quadratic regressions were in ewe lambs. Significant quadratic regressions were more common with LD than with other measurements. These data suggest that a linear adjustment of ultrasound measurements for body weight generally is adequate for ram lambs, whereas both a linear and quadratic adjustment may be more appropriate for ewe lambs. A few regression plots did not follow expected biological growth and may be explained by some other environmental effects.

Key Words: Lamb, Loin Growth, Fat Growth

521 Postweaning growth and internal parasite tolerance of lambs differing in percentage hair sheep breeding and raised on pasture. D. K. Aaron*, R. A. Zinner, D. G. Ely, W. P. Deweese, and E. Fink, *University of Kentucky, Lexington.*

The objective of this study was to compare postweaning growth and internal parasite tolerance of lambs differing in percentage Dorper (D) breeding and raised on pasture under conditions of natural *Haemonchus contortus* infection. A random sample ($n = 44$) was obtained from 197 Polypay (PP), 1/2 D x 1/2 PP (1/2 D), 3/4 D x 1/4 PP (3/4 D), and 7/8 D x 1/8 PP (7/8 D) lambs born in April, 2004. Lamb body weights (BW, kg), egg counts/g feces (FEC), and packed cell volumes (PCV, %) were measured at weaning (d 70) and at 3-wk intervals postweaning. Lambs were treated with anthelmintic at weaning and at each collection date thereafter (d 91, 112, 133, 154, and 175) according to routine flock management procedures. Data were analyzed as repeated measures using mixed model procedures. Distribution of FEC was not normal, so data were transformed as $\ln(\text{FEC} + 100)$ prior to statistical analysis. Lamb genetic type and collection date influenced ($P < 0.05$) all traits. Lamb genetic type x collection date interaction was present ($P = 0.005$) for BW. On most collection dates, 1/2 D lambs had highest FEC but were better able to tolerate parasite infection as evidenced by higher PCV ($P < 0.05$) and similar or heavier BW. Lambs with higher percentage D breeding had similar FEC and PCV but grew slower ($P < 0.05$) compared with PP lambs. Final (d 175) BW (kg), back-transformed FEC (eggs/g feces), and PCV (%) for PP, 1/2 D, 3/4 D, and 7/8 D were: 46, 830, and 33.4; 46, 1525, and 34.2; 42, 1250, and 31.8; and 40, 1100 and 32.9, respectively. Residual correlations between BW, FEC, and PCV, obtained via multivariate analysis of variance, revealed an inverse relationship between FEC and PCV (-0.21 ; $P = 0.003$). All other correlations were small and nonsignificant. In conclusion, performance of 1/2 D lambs was equal to or superior to PP lambs. Higher percentage D lambs grew slower; however, this was likely the result of a loss of heterosis rather than decreased tolerance to parasite infection.

Key Words: Lambs, Growth, Parasites

522 Interaction of copper oxide wire particles and molybdenum sulfate in lambs. J. Burke*¹, J. Miller², and D. Pote¹, ¹USDA, Agricultural Research Service, Booneville, AR, ²Louisiana State University, Baton Rouge.

Copper oxide wire particles (COWP) have been used in lambs to reduce *Haemonchus contortus* infection. However, COWP use may lead to copper toxicity.

The objective was to determine the effectiveness of dietary molybdenum/sulfur (MS) in returning lambs to a normocupremic state after COWP use and whether MS inhibited anthelmintic properties of COWP. Male hair breed lambs that were naturally infected with *H. contortus* were administered 0 or 2 g COWP on D 0 and 49 and fed a TMR (DM: 37% corn, 16% wheat midds, 14% soybean meal, 13% cottonseed hulls, 10% alfalfa pellets, 4% molasses, 4% soybean hulls, 1% calcium carbonate, 0.5% salt, 0.5% ammonium chloride, 0.15% vitamin premix, and 27.5 mg/kg lasalocid) with additional calcium carbonate (0.25%; C) or MS mineral (74.9 mg/kg sodium molybdate, 0.21% sodium sulfate, and 0.25% calcium carbonate). Lambs were randomly assigned to one of four treatments (2 × 2 factorial; n = 7/treatment). Fecal egg counts (FEC) and packed cell volume (PCV) were determined every 7 d between D 0 and 70. Plasma was collected on D 42 and 70 for determination of aspartate aminotransferase (AST) activity. To simulate a pasture nematode infection, lambs were

inoculated between D 21 and 49 with 1500 L3 larvae weekly. FEC were reduced in COWP-treated lambs (COWP × day, $P < 0.03$). By D 21 FEC were reduced from more than 2500 eggs/g (epg) to less than 500 epg in COWP-treated and C-fed lambs and inoculation with L3 larvae failed to increase FEC in these three groups. FEC remained higher in the MS/no COWP group. PCV was reduced in MS-fed lambs (diet × day, $P < 0.001$). Plasma AST activity was similar among all groups on D 42, but 21 d after the second COWP treatment, AST activity was elevated in COWP-treated C-fed lambs (diet, $P < 0.03$; COWP × diet, $P = 0.10$). The MS diet alleviated potential copper toxicity and did not inhibit COWP from depressing *H. contortus* infection. However, the MS diet may have led to copper deficiency, perhaps decreasing natural immunity against gastrointestinal parasites. The complete ration fed to lambs appeared to have a protective effect against *H. contortus* as FEC remained low in C-fed lambs.

Key Words: Copper Oxide, *Haemonchus contortus*, Molybdenum

Swine Species: Swine Nutrition and Management

523 Studies on causes of sow disposal at different parities of Large White sows. J. Arango^{*1}, I. Misztal¹, S. Tsuruta¹, M. Culbertson², and W. Herrington², ¹University of Georgia, Athens, ²Smithfield Premium Genetics, Roanoke Rapids, NC.

Different reasons of sow removal (RR) at consecutive parities were analyzed with 13,838 records of Large White sows. Data were from seven pure-line farms having, on average, 5.9% unknown RR. Three traits were defined, each corresponding to a classification of RR (reproductive, no reproductive and others) as a five-category trait, according to parity of removal (0 to 4 or later). Univariate and multivariate linear and threshold models were implemented via animal or sire models. Additional analyses used pooled RR across parities as trait definition. Models included the effects of year, region, season, contemporary group and animal additive genetic effects. The most common RR was related to reproduction (48.5%). Illnesses of different origin and cause, old age/parity, and sow death or loss accounted for about 18, 7 and 4% of total culls, respectively. Analyses were by single trait censored model for each reason separately, and by three-trait threshold models where only one trait was observed and the other two censored. Genetic correlations from the last analyses could suggest whether all the reasons could be described collectively as fitness, or whether they need to be addressed separately. Estimates of variance components were consistent across models and methods of analysis, showing unrealistically small estimates of residual variance. The apparent model saturation led to large estimates of heritability, except when an additional uncorrelated random effect of sire was fitted in the model. With that model, estimate of heritability for reproductive RR in different parities was 0.09 and 0.07 using linear and threshold model, respectively. Data structure and volume are major limitations in studies of sow survival.

Key Words: Sow Removal, Sow Disposal, Sow Culling

524 Relations between lactation-, and slaughter/carcass traits in pigs. E. F. Knol^{*}, D. T. Prins, and R. Bergsma, *Institute for Pig Genetics (IPG), Beuningen, The Netherlands.*

Pork industry benefits from uniformity. Meat companies start to tighten weight grids and implement bonus/malus systems for carcass grading. We were interested in the relation between early development and final slaughter traits in pigs.

Data came from a 180 (3 week batch) farrow to finish experimental farm testing 6 sire lines on 3 dam crosses. 14,500 piglets, including stillborns, with birth-, and weaning weights, foster and mortality data were available. Resulting in 6700 slaughter records and 1688 dissected carcasses. Birth deviation is the difference between individual birth weight and litter average to give indication of competition challenge.

Within litter variation in weight at birth and at weaning was not related to any of the slaughter and carcass traits (not in the table). Absolute birth weight was

equally or more important than relative birth weight. High carcass gain started already at birth and (auto) correlated with all youth stages. Fat accretion appeared to start during nursery. Ham, but not loin, deboned weight was positively correlated with birth-, and weaning weight.

In a subset of the data (crossfostered (22%) piglets; n=1541), we added biological mother (sow) and nurse sow to model 1. Both HGP-fat and HGP-loin were significantly related (***) to sow, and not to nurse, suggesting a genetic influence and no milk quality or quantity effect. In contrast, lactation gain related only to nurse (***). Variation in carcass gain was related (***), equally to both sow and nurse, as was nursery gain (***).

Residual correlations between lactation-, and slaughter- traits. Corrected for batch, sire line, dam cross, sexe (model 1) and carcass weight (2).

	Birth weight	Birth deviation	Lactation gain	Weaning weight	Nursery gain
Carcassgain 1	0.33 ***	0.26 ***	0.36 ***	0.38 ***	0.43 ***
HGP fat 2	-0.06 ***	-0.08 ***	-0.04 *	-0.04 **	0.07 ***
HGP loin 2	-0.05 ***	ns	ns	ns	ns
Loinweight 2	ns	ns	ns	ns	ns
Ham weight 2	0.14 ***	0.09 **	0.06 *	0.10 ***	ns

ns non significant; * $P < 0.01$; ** $P < 0.001$; *** $P < 0.0001$

Key Words: Pigs, Lactation, Carcass Quality

525 Estimation of variance components including competitive effects of Large White growing gilts. J. Arango^{*1}, I. Misztal¹, S. Tsuruta¹, W. Herrington², and M. Culbertson², ¹University of Georgia, Athens, ²Smithfield Premium Genetics, Roanoke Rapids, NC.

Records of on-test average daily gain (g) of Large White gilts were used to estimate variance components of direct and associative genetic effects. Models included the effects of contemporary group (farm-barn-batch), birth litter, pen-group and two additive genetic effects: direct and associative. The total genetic variance was a function of the number of competitors in a group, the additive relationships between the animal performing the record and its pen mates, and the additive relationships between pen mates. To partially account for differences in pen size and in relationships among members of the pen a covariable ($q_i = 1, 1/n$ or $1/n^{1/2}$) was added to the associative genetic effect. There were 4,946 records from 2,409 litters and 362 pen-groups. Pen size ranged from 12 to 16. There were, on average, 1.2 and 2.6 full and half sibs per pen. Within the BLUPF90 family of programs, the mixed model equations can be set up directly. For variance component estimation, simple programs (REMLF90 and GIBBSF90) worked without modifications, but the more optimized programs