

treated ewes (75.010.9 for both) compared to CON ewes (6.3±9.05% and 16.7±17.8%, respectively). Number of lambs born per ewe mated was also greater ($p < .03$) for ewes treated with MGA (1.4±.23 lambs) compared to CON ewes (.33±.38 lambs), but number of lambs born per ewe lambing (1.8±.15 lambs) and total litter birth weight (7.0±.36 kg) was not influenced by treatment. Day 112 serum ES concentrations for ewes lambing tended to be positively correlated with total litter birth weight ($r^2 = .30$, $p < .07$), but not with number of lambs born ($r^2 = .21$, $p < .14$). Overall, progesterone priming in combination with the ram effect in hair sheep increased fertility and fecundity of ewes bred during summer.

Key Words: MGA, Hair sheep, Ram effect

490 Effect of breed type on shear force, sensory analyses and fatty acid content of lamb. S. P. Greiner^{*1}, S. K. Duckett², and D. R. Notter¹, ¹Virginia Polytechnic Institute and State University, Blacksburg, ²University of Georgia, Athens.

Eighty eight lambs from two locations (L1, L2) were evaluated to assess breed differences in longissimus muscle tenderness, sensory attributes, and fatty acid content. At L1, Dorper (DP) and Dorset (DO) crossbreds (out of -DO, -Rambouillet, -Finnsheep ewes) were produced in 2000 and 2001, along with straightbred Katahdin (KT) and Barbados Blackbelly x St. Croix (HH) wethers in 2001. At L2, DP and Suffolk (SU)-sired lambs (out of SU ewes) were produced in 2001. Lambs were weaned at 90 d of age, grazed, and then fed a high-concentrate diet prior to slaughter at 8 mo of age. Racks from carcasses were aged at 4°C for 10 d and frozen at -20°C for subsequent Warner-Bratzler shear force (WBS), sensory, and fatty acid (FA) analyses. Chops were rated by a trained sensory panel for 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). FA content of intramuscular lipid was determined by GLC. A model that fit 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 0.62 kg lower ($P < 0.01$) for DP than ND (2.38 vs 3.00 SEM = 0.15). Similarly, panelists rated DP more T ($P < 0.01$) than ND (5.51 vs 5.02 SEM = 0.08). J, LF, and OF were similar ($P > 0.32$) for DP and ND. Concentrations of stearic, palmitic, and lauric acids were higher ($P < 0.05$) in DP-sired lambs, whereas the percentage of linoleic acid was lower ($P < 0.05$). DP tissues had higher ($P < 0.05$) percentages of total saturated FA, along with lower ($P < 0.05$) percentages of monounsaturated and polyunsaturated FA than ND. At L1 in 2001, WBS

values were higher ($P < 0.05$) for DO than DP and KT. WBS values were similar ($P > 0.05$) for DP, KT, and HH lambs. HH lambs received higher ($P < 0.05$) and more desirable T scores than DO and KT lambs. However, no differences were detected between breed types for J, LF, or OF. Longissimus tenderness was improved with Dorper genetics.

Key Words: Lamb, Sensory evaluation, Fatty acid

491 Effects of low protein and limit-fed corn based diets on diet digestibility and metabolism of N and P in sheep. M. Abdullah^{*1}, S. C. Loerch², P. Tirabasso², and G. D. Lowe², ¹University of Agriculture, Faisalabad, Pakistan, ²OARDC, The Ohio State University, Wooster, OH 44691.

Low protein and limit-fed diets decrease excretion of N and P and help decrease environmental pollution. Twelve wether lambs (42kg BW) grouped into three blocks and kept in metabolic crates, were fed the experimental diets to determine the effects of low protein and limit-fed corn-based diets on DM digestibility and N and P metabolism. Treatment were; i) ad libitum intake, corn-SBM control, ii) limit-fed (2.5% of BW), low N and P corn diet, iii) ad libitum intake, low N and P soy hull-corn silage diet, and iv) limit-fed (2.5 % of BW), low N and P soy hull-corn silage diet. The trial consisted of a 19 d period, 14 d for adaptation and 5 d for total collection of feces and urine. N intake by lambs fed the low N diets was about 38% lower ($P < .05$) than that of lambs fed the control diet. Lambs fed the soy hull-corn silage based diets consumed 45% less ($P < .05$) P than those fed the corn-based diets. Fecal output (g/d) by lambs fed soy hull-corn silage-based diets was nearly two times greater ($P < .05$) than that of lambs fed corn-based diets. Fecal N output followed a similar trend, but fecal P output was not affected ($P > .05$) by diet. DM ($P < .001$) and N ($P < .01$) digestibility was lower for ad libitum or limit-fed soy hull-corn silage diets than for the control or limit-fed (low N and P) corn diet. N and P retention (g/d) was also lower ($P < .05$) for the limit-fed corn diet and ad libitum or limit-fed soy hull-corn silage diet. N retention was negative for the limit-fed low N and P soy hull-corn silage diet. Similar trend was observed for N retention as % of N intake. N retention as % of N digested was negative ($P < .05$) for the limit-fed low N and P soy hull-corn silage diet, whereas, no difference was found between control, limit-fed corn and limit-fed soy hull-corn silage diets. High fiber, lower digestibility diets increase N excretion and decrease N retention (regardless of intake level), compared with corn-based diets.

Key Words: Low protein diets, Limit feeding, N and P metabolism

Animal Behavior & Well Being Symposium: Alternative housing for livestock

679 Current and future trends in dairy housing. G. L. Bethard^{*1} and J. G. Martin², ¹G&R Dairy Consulting, Inc., ²Joseph G Martin Consulting Engineer.

Dairy Housing has changed markedly over the last 30 years. Most new dairy facilities in the United States are either free stall confinement housing, or dry lot housing in areas with minimal rainfall. Many older facilities were designed to provide worker comfort and labor efficiency. Buildings in warm and cold weather climates were designed to minimize worker exposure while restricting ventilation. The impact of facility design on animal performance was rarely measured. More recently, researchers have measured the impact of facilities on the cow's ability to handle stressful environmental conditions such as heat, cold, and overcrowding. In particular, heat abatement has been a critical design component in most regions of the United States. Handling waste has become a major issue, with scrape or flush systems predominant. The dairy industry has moved away from worker comfort to cow comfort, realizing that comfortable cows are healthier, more productive and profitable. Dairy design goals are to ease manure handling and maximize cow comfort, labor efficiency, and productivity while minimizing investment. Future trends will focus on improving cow comfort and productivity, with an increasing emphasis on heat abatement.

Key Words: Dairy housing, Free stall, Heat abatement

619 Housing the sow without crates - challenges and solutions. J. N. Marchant-Forde^{*}, USDA-ARS.

Confining sows in crates throughout gestation, farrowing and lactation is commonplace in North America. In Europe, crating the sow throughout gestation will be prohibited from 2013 and the farrowing crate continues to be scrutinized by a powerful animal well-being lobby. In North America, major retailing chains are already introducing welfare guidelines and the issue of sow housing is an area that is attracting a great deal of attention, not least because of recent legislation enacted in Florida. However, loose housing of the gestating and farrowing sow does present real challenges that need to be addressed in order to safeguard pig well-being and ultimately, productivity. The major challenge of group housing the gestating sow is that of inter-sow aggression. Sows will fight especially when mixed and when having to compete for access to resources. Therefore, the ways in which sows are introduced to each other and how they are fed are major factors in determining the success or failure of a system, both in well-being and productivity terms. For loose-housed farrowing sows, the major challenge is that of safeguarding the well-being of her piglets, in terms of pre-weaning mortality and ensuring even growth. Over the last decade, aspects of sow housing have undergone a great amount of research. Although the majority of this work has been carried out outside of North America, many of the research results are likely to be directly applicable to the swine industry here. This paper will highlight work done to date with a focus on the development of practical solutions, derived from both system design and system management techniques, that allow the skilled and motivated stockperson to work what are called

alternative housing systems. At the end of the day, it is the stockperson who will ensure the success or failure of any sow housing system and the well-being of sows within that system. However, the tools do exist to safeguard pig well-being and productivity when removing them from confinement systems and, importantly, perhaps address some of the negative public perceptions about the swine industry.

Key Words: Sows, Alternative housing, Well-being

492 Animal welfare and international trade: European and American perspectives. A. Lawrence* and D. Oglethorpe, *The Scottish Agricultural College*.

International trade in agriculture has developed enormously since the 2nd World War, and with it demands for liberalisation of the trade have grown. In 1994 the pressure for liberalisation resulted in agriculture being included in the General Agreement on Tariff and Trade (GATT). Despite this attempt to arrive at globally applied rules on agricultural trade, many countries still operate "systems", which in various ways are designed to protect national agriculture industries. Since 1995 the GATT rules have been enforced by the World Trade Organisation (WTO), and the EU and the US have so far initiated the majority of disputes over application of the rules. This tension between the US and EU over agriculture trade has relevance to the debate over animal welfare and its incorporation in international trade rules.

In recent WTO negotiations the EU has proposed that the growing importance of animal welfare as a socio-economic issue, requires that international trade agreements take account of it. Specifically, the European Commission would like to see support for animal welfare fall into the "Green Box" of agricultural support payments — those payments seen as delivering public goods and services and not influencing production decisions. Although it is likely that improved margins could be gained from improving the animal welfare attributes of a product, the EU contend that improved animal welfare is partly a public good that is demanded by society at large.

The EU has proposed three approaches to resolve the incorporation of animal welfare into international trade negotiations: multilateral agreements on protection of animal welfare, appropriate labelling to allow consumers to make informed choices, and the use of some form of compensatory payments to balance any increased costs of production resulting from raising animal welfare standards. What is important to provide however, is evidence to suggest that society does actually derive a non-market benefit from the existence of animal welfare farm systems. If this is the case, it will then be worthwhile comparing the costs of delivering those animal welfare benefits, compared to the cost of delivering other public goods or services from agriculture, such as biodiversity or amenity. We will examine these two issues and we will discuss the role that public/consumer attitudes in the EU and the US may play in determining the market for 'animal welfare foods'.

Key Words: Welfare, Trade policy, European

Forages & Pastures Symposium: Forage strategies for arid climates

493 Supplementing grazing beef cattle: If, when, with what, and especially how often? J. E. Huston*, *Texas Agricultural Experiment Station, Texas A&M University System*.

The literature was reviewed on the needs for and responses to supplementation by beef cattle grazing range forages. Only cases of adequate quantity of forage were considered. Rangelands vary in climatic conditions and plant species composition thereby causing differences in diet quality among occupied areas and during seasonal periods within those areas. Also, nutrient requirements of the cow unit vary with genetic potential and stage of production. An extensive dataset collected in western Texas (average annual rainfall = approximately 500 mm) over a 17-year period was used to illustrate responses to supplemental feeding and various feeding practices. Unsupplemented, mature beef cows lost 18.4% of their fall weight (including reproductive tissues) before the beginning of the breeding season (April 1) and conceived at a rate of 81%. Cows fed the equivalent of one-half of their daily protein requirements in a concentrated supplement lost 12.9% of fall weight and had a 91% conception rate, a satisfactory reproductive rate in a mixed-age herd. Various preparations and supplementary nutrients were tested against this standard response. Several experiments were conducted to compare the relative responses from feeding identical weekly amounts of supplemental feeds but broken into daily, three times per wk, and weekly portions. Generally, feeding interval did not affect mean responses in reduced body weight and condition score under the conditions of these studies and with the supplements offered. Those fed weekly (approximately 6.5 kg at a single weekly feeding) showed less variability in supplement and forage consumed and in changes in body weight. These data and inferences drawn are summarized in "The Eleven Commandments of Supplemental Feeding of Beef Cattle."

Key Words: Beef-cattle, Supplemental-feeding, Feeding-interval

494 Complementary forages and grazing systems for beef cattle production on arid rangelands in the Western US. T. DelCurto*, D. W. Bohnert, C. S. Schauer, and G. D. Pulsipher, *Eastern Oregon Agricultural Research Center, Oregon State University, Union and Burns*.

Western beef cattle producers are faced with numerous challenges relative to forage resources and nutritional opportunities. Specifically, much of the western US is characterized by high elevation rangelands that typically have short growing seasons and limited, highly-variable, precipitation. As a result, forage availability and quality are often low throughout much of the grazing period and limit optimal beef cattle production. Numerous opportunities exist, however, to improve the nutritional plane of beef cattle grazing arid rangelands. The introduction

of complementary forages can lengthen the period of adequate nutrition. Forage species including alfalfa, forage kochia, crested wheatgrass, and winterfat have all been shown to offer unique nutritional advantages. Likewise, forage species that tolerate winter grazing and snow can provide economic advantages to western producers by decreasing the reliance on feeding harvested hays to cattle during the winter period. Grazing systems that utilize topographical characteristics of rangelands to enhance the nutrition of cattle production are also potential opportunities. For example, using pastures with southern exposures early and northerly aspects late can effectively increase the nutritional plane of grazing cattle. In addition, the use of rangelands that have diverse forb and shrub components late in the grazing period will improve the nutritional plane of the cattle. Care must be taken, however, to develop grazing systems that maintain or enhance the biological diversity of the forage base and long-term sustainability of the rangeland resource. In summary, nutritional opportunities do exist to improve the nutritional plane of cattle grazing western rangelands. Specific strategies need to be tailored to the resources available to beef cattle producers and will necessarily differ from location to location.

Key Words: Complementary forages, Grazing systems, Western rangelands

495 Management strategies for optimal distribution and use of arid rangelands. D. W. Bailey*, *Montana State University*.

Application of existing and novel management techniques can alter traditional livestock grazing patterns and significantly improve the sustainability of arid rangelands. Livestock often congregate and heavily graze riparian areas and other sensitive rangeland while abundant forage remains in other areas. Increasing the uniformity of grazing can help protect fisheries, wildlife habitat and other vegetative and watershed resources. For years, managers have improved grazing distribution in extensive arid pastures by developing new water sources. In addition, strategic supplement placement can be used to lure cattle to graze areas that typically receive little use. Placement of low moisture molasses blocks in steeper areas that were far from water increased forage use by 14% at distances up to 600 m from supplement in foothill rangeland. Recent research has examined the potential of breed and individual animal selection to improve grazing distribution patterns. Cattle breeds developed in mountainous terrain utilize rugged rangeland more ($P < 0.05$) uniformly than breeds developed in more gentle terrain. In pastures that were grazed by cattle identified as "hill climbers" (previously observed on rugged terrain), more residual vegetation ($P < 0.05$) was left on gentle slopes and areas closer to water than in pastures grazed