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World sheepmeat production: a meta-analysis

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The free trade agreements among the world's countries are generating greater openness and balance, which is being reflected in the production of heavier sheep carcasses for export cuts worldwide. The aim of this study was to conduct a meta-analysis to identify differences with regard to the weight of sheep carcasses and their main characteristics obtained in production systems around the world, according to their genotype and geographic location. A meta-analysis of the types of sheep carcasses produced worldwide (64 studies, n=36,583 animals) was performed, using the databases Scopus and Web of Science. The data analysis was performed using the methodology of mixed method. The Kruskal-Wallis and Mann-Whitney tests were applied. The average daily gain (g/d) among genotypes varied (P<0.05), being higher for wool vs hair genotypes; the hot and cold carcass weight (kg), the hot carcass yield (%) and backfat thickness (mm) were higher (P<0.05) in animals supplemented with concentrate; the initial live weight (kg) was higher (P<0.05) in animals in the feedlot system, which also had a higher cold carcass weight. The free-range system (P<0.05) achieved a higher hot carcass weight compared with the feedlot system. The average weight gain, hot carcass weight and longissimus dorsi area (cm²) was higher for animals situated in the southern hemisphere (P<0.05) compared with those in the northern hemisphere and intertropical area. We conclude that the world market shows a homogeneous production of carcasses, which have increased in weight regardless of the production and feeding system.

Species, breeds and potential for improvement in animal fibre production in Europe

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Keratin-based fibre is a natural product of a range of animal species routinely farmed in Europe. The major species are wool-producing sheep, which include 62 m breeding ewes (Eurostat) with production (EU28), of both fleece and skin wool, of 186,000 tonnes (FAO), and small numbers of goats (Angora; Cashmere), South American camelids (SAC: Alpaca) and Angora rabbits. There is considerable variation in sheep populations, raw wool produced and profitability in different countries. Trends in wool production indicate reductions, including those noted in Central and Eastern Europe following political change, and frequently poor economic returns. While knowledge on the genetics and underpinning biology of keratin-fibre production has increased, there is limited production of fine fibre as a primary product. Sheep are kept for meat (mainly) or milk. In excess of 150 breeds have been identified with, for example, 73 breed societies listed by the British Wool Marketing Board. Sheep wools vary in colour, lustre and diameter: the finest Merino superfine at 16-21 micron to the coarser-wooled Blackface at 35+ micron. Concomitant uses range, with reducing fineness, from fine knitwear to knitting yarns, wool blends for apparel, blankets, Japanese futons, floor carpets and insulation products. Utilisation may be small-scale craft (including goat, rabbit and SAC fibres), or at larger scale industrial level. Some wool of poor quality may be discarded. Up to 90% of better quality may go for export. Finer qualities are typically imported from other countries and processed into high value products such as suiting and knitwear. Strategies to improve production, quality and utilisation in Europe will be explored.

Heritabilities for preweaning and its genetic correlations with other traits in Peruvian alpacas*A. Cruz¹, I. Cervantes², A. Burgos¹, R. Morante¹ and J.P. Gutiérrez²**¹INCA TOPS S.A, Miguel Forga 348, Arequipa, Peru, ²Universidad Complutense de Madrid, Departamento de Producción Animal, Avda/ Puerta de Hierro s/n, 28040 Madrid, Spain; gutgar@vet.ucm.es*

The aim of the study was to estimate genetic parameters for preweaning traits and their genetic relationship with reproductive, productive and morphological traits in alpacas. The data was collected from 2001 to 2015 by Pacamarca experimental farm for Huacaya (HU) and Suri (SU) ecotypes. Birth Weight (BW), Birth Withers Height (BH), Weaning Weight (WW), Weaning Withers Height (WH), average Daily Gain (DG) and Survival to Weaning (SW) were analyzed. The genetic models included additive, maternal and residual random effects for all traits, and sex, color, number of calving and month-year as fixed effects. Age at weaning were used as linear covariate for WW and WH. The estimated direct heritabilities were, respectively in HU and SU, 0.097 and 0.131 for BW, 0.070 and 0.162 for BH, 0.497 and 0.336 for WW, 0.364 and 0.659 for WH, 0.447 and 0.201 for DG and 0.038 and 0.150 for SW. These figures for HU and SU maternal heritabilities were 0.248 and 0.376 for BW, 0.179 and 0.324 for BH, 0.289 and 0.392 for WW, 0.192 and 0.263 for WH, 0.265 and 0.355 for DG and 0.020 and 0.061 for SW. Since alpacas could be use for fiber or meat production, the genetic correlation values suggested that WW would be recommended to be used directly as a selection criterion under meat production objective. However, under a scenario of fiber production it would be necessary to use a genetic index as a selection criterion to take into account the genetic correlations with fiber traits. Direct genetic correlations of preweaning traits with reproductive traits were favorable but unfavorable for maternal effects, especially for SU. Genetic correlations with morphological traits were high and positive for SU, but not important for HU, which suggests a spurious association for SU ecotype in the tested population.

Lifetime production of Istrian pramenka sheep in Slovenia*D. Kompan**University of Ljubljana, Biotechnical faculty, Department of Animal Science, Jamnikarjeva 101, 1000 LJUBLJANA, Slovenia; drago.kompan@bf.uni-lj.si*

Istrian pramenka is the Slovenian autochthonous breed of sheep. It is used for milk production and lamb (dairy breed). The breed was developed in the area of the Karst and Istria, where shepherds kept the local, indigenous sheep, which they named istrijanka, Karst ewe, coastal sheep and even the coastal sheep of raw wool. In 2009, Slovenia had 1,150 animals of Istrian pramenka, among which 813 were ewes and 36 breeding rams. Production data, collected according to the ICAR rules by Istrian pramenka sheep born between 1994 and 2012 were used for the analysis of its lifetime production. Dataset included records of 1 290 ewes (5 565 lactations) from 10 flocks. The studied traits were lifetime milk yield production, lifetime fat yield production, lifetime protein yield production, number of lactations completed, number of born lambs in lifetime, age at first lambing and age at culling. Preparation of the data and statistical analysis were done by the statistical programme R and Excel. All ewes born to 1999 were culled. On average, these ewes had 3.4 lactations completed in their lifetime, 4.4 born lambs, 559.5 kg of milk yield, 36.4 kg of fat yield and 30.1 kg of protein yield. Ewes were on average 23.3 months old at first lambing and 76.6 months old at culling. Ewes born after 1999, had on average 3.0 completed lactations, 3.5 born lambs, 386.9 kg of milk yield, 26.8 kg of fat yield and 21.9 kg of protein yield during their lifetime. On average, ewes were 27.7 months old at first lambing and 70.1 months old at culling. Almost a half of the ewes were culled in the first and in the second parity. Even though the autochthonous Istrian Pramenka have relatively low lifetime production, the breed is important for our country due to its modesty, resistance and adaptability to relatively rough surroundings where it is bred.

Birthcoat type and lamb survival in the French Romane sheep breedD. Allain¹, Y. Boudillon², D. Marcon² and D. François¹¹INRA, UMR1388, GenPhySE, CS52627, 31326 Castanet Tolosan, France, ²INRA, UE0332, Domaine expérimental de Bourges, La Sapinière, 18390 Osmoy, France; daniel.allain@toulouse.inra.fr

Birth coat type is an important component of lamb survival for sheep raised under harsh environment. At birth two types of coat were observed in the Romane breed: a long hairy coat or a short woolly one. It was shown that hairy coat lambs are more adapted to survive around lambing time due to a better coat protection with less heat losses at coat surface and show better growth performances up to the age of 10 days than woolly coat lambs. The aim of the present work was to quantify lamb survival and growth performances in relation to birth coat type in the French Romane breed raised under standard or conventional indoor housing from birth. A total of 8,657 lambs were used in a 6 years experiment from 2011. Birth coat type, lamb survival and growth performances were registered from birth to weaning. At birth two types of coat were observed: a hairy coat (39.2% of lambs) or a woolly one (60.8% of lambs). It was shown that hairy-bearing coat lambs had a slight better survival from birth to 50 days of age (3.0 vs 4.1%, 5.5 vs 6.4%, 6.8 vs 7.6% and 7.4 vs 8.2% for total mortality rate at 1, 10, 30 and 50 days, respectively) but only the difference in lamb survival at 1 day was significant ($P < 0.01$). If at birth, any differences in weight were not observed between both birth coat types, significant differences ($P < 0.001$) were thereafter observed on the live body weight. Woolly-bearing coat lambs were significantly heavier than hairy ones: +250 g and +710 g at 30 days of age and weaning (about 65 days) respectively. If selection to obtain a hairy birth coat type had advantages when the Romane sheep breed is raised under harsh and permanent outdoors conditions, it seems to have some significant reverse effects under conventional indoors housing. A hairy coat lamb survived a little better (with a significant survival rate around birth) than a wool coat one but had a significant lower weight at weaning. It could be suggested a genotype×environment effect involving birth coat type on both lamb survival and lamb growth when comparing standard housing and harsh outdoors conditions.

Genetic loci involved in antibody response to *Mycobacterium avium* ssp. paratuberculosis in sheepF. Palazzo¹, G. Marras¹, E. Nicolazzi¹, E. Pieragostini², F. Petazzi², G. Gandini³, G. Pagnacco³, P. Crepaldi³, J.L. Williams⁴ and G. Minozzi^{1,3}¹Parco Tecnologico Padano, Via Einstein, 26900 Lodi, Italy, ²University of Bari, Piazza Umberto I, Bari, 70121 Bari, Italy, ³University of Milan, DIVET, Via Celoria 10, 20133 Milan, Italy, ⁴University of Adelaide, School of Animal and Veterinary Sciences, Faculty of Sciences, Roseworthy, 5371 Adelaide, Australia; giulietta.minozzi@unimi.it

Mycobacterium avium ssp. paratuberculosis (MAP) causes chronic enteritis in different ruminant species. In sheep, MAP causes a chronic disease called Johne's disease, or paratuberculosis. There have been several genome wide association studies over the last years that have identified genetic loci putatively associated with MAP susceptibility in cattle. The aim of this work was to perform a case-control study in the ovine species, using the 50K SNP panel (Illumina OvineSNP50 BeadChip) to unravel the genes underlining the mechanisms of susceptibility to Johne's disease in the ovine species. During 2011-2015 in the regions of Sicily and Apulia in Italy, more than 69.000 sheep have been tested for antibodies against MAP and blood sampled. In herds with high occurrence of Johne's diseases, three cohorts of animals designed for genome wide association studies, corresponding to three dairy sheep breeds (Sarda, Valle del Belice and Comisana) have been selected. All samples were classified based on the serum antibodies produced in response to MAP. This analysis refers to the first cohort, composed by the Sarda breed sampled in Apulia, consisting of a total 300 samples, 150 MAP ELISA positive and 150 negative. Whole genome association analysis was performed using the R package GenABEL with the Grammar-CG approach. The analysis identified several chromosomal regions associated with the disease status on chromosomes 1, 3, 5, and 13 in position 203971381, 70227376, 35140513 and 24755379 with high significance ($P < 5 \times 10^{-8}$). These results provide evidence for genetic loci involved in the antibody response to MAP in sheep. Adding further knowledge of genetic variations related to susceptibility in all the other breeds, will facilitate the improvement of the health status in the ovine species.