Heterosis - beef sensory and leather quality traits

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Research focus area: Animal Products, Quality and Value-adding

Full Title of the project

Characterization of breed-specific additive and heterosis effects on beef sensory and leather quality traits

Aims of the project

- To characterize the maternal and paternal heterosis effects on sensory beef traits
- To characterize the maternal and paternal heterosis effect on leather traits

Executive summary

The project had two objectives, namely to estimate direct and maternal breed effects and heterosis contributions for Afrikaner (A), Simmentaler (S), Brahman (B), Charolais (C) and Hereford (H) on sensory carcass traits and leather traits.

Sensory carcass traits

Five sensory traits (tenderness, juiciness, aroma and flavor and residual connective tissue) and two physical meat traits viz shear force (N/2.5cm2) and cooking loss (%) were investigated. Data (N=375) arising from 5 straightbred and 24 crossbred combinations were modeled by multiple regression of the phenotypes on expected breed proportions and heterozygosity.

Only direct effects seem important for shear force, tenderness, and residual connective tissue. However, for juiciness and cooking loss maternal effects also seem relevant. This may indicate that effects manifested during the pre-weaning period on components of meat quality were retained through the time of harvest or a predisposition for creating differences in the sensory properties of the meat were established. The indigenous Afrikaner had generally the most favourable sensory profile relative to the imported breeds. This was particularly true for shear force and tenderness.

Sanga cattle, like the Afrikaner, are early maturing breeds. There is clear evidence that the use of exotic germplasm on Sanga breeds can increase feedlot performance and meat yield of cattle reared under South African conditions. Different crossbred genotypes also provide opportunity for more rapid conformation to the changes in market requirements and may offer opportunity for more revenue. However, it appeared based on the sensory data summarized, that crossbreeding with exotic germplasm has little to offer in terms of consumer satisfaction relative to the use of Afrikaner.

Leather quality

It is important to note that hides are normally purchased by weight, but leather is sold by surface area. It is therefore common practice to mechanically stretch the hides during tanning and manufacture. The standard practice is to stretch leather to 20% extension. There is however concern that this stretching may affect important aspects of leather quality and strength.

Hide yield (%) and 8 leather characteristics (leather yield (dm2/kg), force 20% extension (Mpa), extension grain crack (%), extension break (%), force break (Mpa), slit tear force (N/mm), distension grain crack (%), and force grain crack (N/mm)) were evaluated. The results indicate breed direct effects and individual heterosis, but not maternal effects, may be important for most of these traits. For all of the exotic breeds, direct effects reduced hide yield and increased leather yield relative to the indigenous Afrikaner. For both of these traits, individual heterosis effects arose primarily from indicus x taurus crossing with the Hereford x Brahman effect being most pronounced. Leather from the exotic breeds appeared to be stronger, as evidenced by greater direct effects for force required to achieve 20% extension and break, than leather from the indigenous Afrikaner. Direct effects on the extension required to crack the grain attributable to Hereford and Simmentaler were less than for the indigenous Afrikaner, Brahman, and Charolais. These results indicate opportunities to improve leather yield and quality through crossbreeding relative to straight bred Afrikaner.

Comprehensiver Report

1COMPREHENSIVE REPORT has been produced,constructed as follows:

10.1 Project Title
10.2 Name(s) of author(s)
10.3 Institutions
10.4 Executive summary
10.5 Date of submission
10.6 Introduction (including motivation)
10.7 Material and methods
10.8 Results
10.9 Discussion of results
10.10 Conclusions
10.11 Implications
10.12 Recommendations
10.13 References.

Scientific articles

MACNEIL, M D, SCHOLTZ, M M, THEUNISSEN, A, DE BRUYN, J F & NESER, F W C, 2016. Crossbreeding in beef production: meta-analysis of breed means to estimate breed-specific effects on leather properties. Animal Production Science. http://dx.doi.org/10.1071/AN15771

THEUNISSEN, A, MACNEIL, M D, SCHOLTZ, M M, DE BRUYN, J F & NESER, F W C. Crossbreeding to increase beef production: Additive and non-additive effects on sensory traits. To be submitted to Meat Science.

Conference, symposia

THEUNISSEN, A, MACNEIL, M D, SCHOLTZ, M M and NESER, F W C, 2014. Crossbreeding to Increase Beef Production: Breed-specific Effects on Sensory Properties. Proceedings, 10th World Congress on Genetics Applied to Livestock Production. https://asas.org/docs/default-source/wcgalpposters/716_paper_8463_manuscript_298_0BCDEAA38813E.pdf?sfvrsn=2

MACNEIL M.D, THEUNISSEN A, SCHOLTZ M.M, & NESER F.W.C. Crossbreeding in beef cattle: Breed-specific effects on leather properties. Proceedings 47th Congress of the South African Society for Animal Science, 40.