

# Characterization of breed additive and heterosis effects in beef cattle using experimental results

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<b>Research focus area:</b>	Livestock production with global competitiveness

## Aims of the project

- To characterize and quantify crossbreeding heterosis in South African beef cattle using experimental results.
- To estimate input values based on South African information to simulate breeding objectives in crossbreeding systems for South African conditions.
- To calculate heterosis values based on South African information that can be used in the estimation of multibreed EBV's.

## Executive summary

The aim of this study was to characterize the breed additive and heterosis effects in beef cattle using experimental results of 34 genotypes born from Afrikaner and Bonsmara as dam lines, using the experimental results of Els (1988) and De Bruyn (1991). During the study it became clear that the Afrikaner and Bonsmara cannot be analyzed in the same analyses due to difference in the mating plan and number of records between the two breeds. The results are therefore reported separately.

AFRIKANER

The aim of the study was to estimate direct and maternal additive and heterosis effects with the Afrikaner as dam line for (1) growth traits (birth weight, weaning weight, 19-month weight of heifers and cow weight) (2) fertility traits and feedlot and carcass traits from five purebred and 24 crossbred breed types. Afrikaner (A), Brahman (B), Charolais (C), Hereford (H) and Simmentaler (S) were evaluated as purebreds and as sire breeds on A and F1 BA, CA, HA and SA females. Breed additive effects were expressed as deviations from A. Effects of intra-breed genetic trend were assumed to be zero throughout. Solutions for the breed additive and heterosis effects were used to predict performance of the crossbred breed types to verify the adequacy of the genetic model.

#### Growth traits

Breed direct effects were consistently greatest for C and least for A across all traits, and maternal effects were greatest for S (except for 19-month weight) and least for C. Direct and maternal heterosis, on average, were positive for all weights. The indicus x sanga and indicus x taurus direct heterosis effects on all weight traits were greater than either the taurus x sanga or taurus x taurus effects, whereas the indicus x sanga maternal heterosis effect was consistently less than the estimated taurus x sanga maternal heterosis effect.

#### Fertility Traits

The average direct heterosis contributions, which were expressed as deviations from A, were +14.9, +109.1, -162.7, +21.0 and 15.4% respectively for conception rate (CR), calving difficulty (MB), pre-weaning mortality (MW), weaning percentage (WP) and weaning rate (WR) for ten two-breed genotypes. Similarly, the average maternal heterosis effects in four A crossbred dam genotypes were 0.0, -87.5, +97.7, -1.9 and -7.4% for the fitness traits respectively. The HA genotype had the highest expected WR of 83.1% in two-breed genotypes. The ACA, AHA and BHA genotypes had the highest expected WR of 86.9, 86.8 and 83.0% respectively.

#### Feedlot and carcass traits

Average direct heterosis was 17.9% for average post-weaning daily gain, being the largest in the B genotypes. The average maternal heterosis effects were less. Both average direct and maternal heterosis effects were essentially nil for daily feed intake, dressing percentage and percentage meat yield.

#### BONSMARA

The aim of this study was to estimate the additive and non-additive effects for weight traits in two-breed crosses with the Bonsmara (Bo) as dam line and the Simmentaler (S), Brahman (B), Charolais (C) and Herefords (H) as sire lines. The average direct heterosis contributions, which were expressed as deviations from Bo were 1.41 kg, and 13.64 kg for birth weight (BW) and weaning weight (WW) respectively in the four crossbred genotypes. The largest additive effect for BW was found in C x Bo while WW largest in S x Bo. The results indicate that C and S bulls could increase WW in the progeny of Bonsmara cows. C bulls should be used with caution due the additive effect on BW. The use of B and H sires on Bonsmara cows is not recommended due to the negative additive effect on WW. It needs to be mentioned that Els (1988) reported weaning rates (number of calves weaned as percentage of number of cows exposed to mating) 100.0, 96.6, 91.8, and 97.6 % for the B x Bo, C x Bo, H x Bo and S x Bo dam groups respectively. This may indicate an extremely high fertility in Bonsmara crossbred cows.

## List of outputs

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