

Optimal mature weight in beef cattle

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Determination of optimal mature weight supporting production efficiency in beef cattle in the different South African (ecological) production environments

Heartwater is caused by the organism Ehrlichia ruminantium which is transmitted by ticks of the Amblyomma species. It affects mainly domestic and wild ruminants and it is controlled by use of a live blood vaccine. Alternative vaccines are required due to the limitations associated with the current vaccine. At ARC-OVI research towards alternative vaccines has been ongoing and one example is the use of DNA vaccines. Previous studies has shown that the DNA vaccines could offer protection in the laboratory but failed in the field where the disease is transmitted by ticks. In this project we investigated the use of a multi-epitope DNA vaccine which is made up of short sequences from different antigens that were shown to be immunogenic. After three inoculations with the multi-epitope DNA vaccine delivered by i.m. injection and the gene gun, none of the sheep survived challenge with E. ruminantium infected ticks. However, when the same multi-epitope DNA vaccine was formulated with an adjuvant, it protected three of the five sheep against tick transmitted E. ruminantium infection. From this project we learnt that when using subunit vaccines like DNA vaccines, it is very important to include appropriate adjuvants in the vaccine formulation in order to improve the immunogenicity of the DNA vaccine. The production environment is known to have a large influence on extensively managed beef cows. A better understanding of the relationship between the beef cow and her environment should be useful in the pursuit of improving beef cow efficiency. The influence of the production environment on the efficiency of extensively managed Bonsmara cows was investigated through a series of research objectives. It was found that VEGMAP's bioregion classification system can be used to describe the South African beef production regions. The environmental characteristics with the potential to influence beef cow efficiency were identified as temperature, rainfall, cation exchange capacity, soil pH, soil organic carbon, soil P and grazing capacity.

A dataset was created that contains the historical cow production records for every Bonsmara breeder. GIS tools were then used to link the cow production records with the production region in which the farm is located, as well as the environmental characteristics for that specific location. The combined dataset was then statistically analysed to investigate the research objectives. The influence of the geographic location, production region and breeder on Bonsmara production traits was investigated by cluster analysis and ANOVA. Results from

ANOVA indicate that production region has a statistically significant ($p < 0.05$) influence on production traits. The influence of the breeders on the same production traits was, however, statistically much larger ($p < 0.0001$) than production region. Bonsmara production traits are therefore influenced to a greater extent by the breeders rather than production environment. Stepwise regression analysis was used to determine the influence of the combined environment on production traits. The combined environment has a statistically significant ($p < 0.0001$) influence on all the production traits. The results indicate that the extent of the influence of the environment on production change through the growth curve. The environment's influence was the greatest at weaning (9%) and yearling age (10%). Bonsmara weaning and yearling weights therefore show the largest potential for manipulation through management.

The influence of individual environmental characteristics on all the Bonsmara cow production traits was then investigated by the same stepwise regression analysis. Most of the environmental characteristics were found to have a statistically significant ($p < 0.0001$) influence on the production traits. Rainfall and temperature had the largest influence on Bonsmara production traits. The negative influence of rainfall was attributed to the influence of rainfall on the quality of the grazing. The influence of temperature on production traits was small. The small negative influence of temperature could indicate that Bonsmara cows are well adapted to the main South African beef production regions. Finally, the relationship between Bonsmara cow size and reproduction was investigated by linear regression analysis. Results indicate that larger Bonsmara cows are to some extent more reproductive than smaller cows. The study confirmed that production environment influences beef cow efficiency. Bonsmara breeders however have a much larger influence on the efficiency of their cows through the implementation of management practices and breeding objectives.