

**RMRD SA**

**RESEARCH PROJECTS**



**Executive Summaries**

**March 2014**

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*If you require any further information or are interested in applying for funding for research please contact the RMRD SA Administrator Prof Hettie Schonfeldt at: [info@rmrdsa.co.za](mailto:info@rmrdsa.co.za) or on Tel: 012 348 6649 or Fax: 012 361 2333*

## 1. South African Retail Beef Quality Audit.

**Researcher:** Dr Phillip Strydom  
**Team members:** Dr Lorinda Frylinck, Dr SM van Heerden, Prof A Hugo, Ms J Anderson, Dr M Hope-Jones, Mrs JD Snyman, Mrs JL van Niekerk, Miss L Mosimanyana, Miss L Liebenburg  
**Research Institute:** Agricultural Research Council, Animal Production Institute  
**Research focus area:** Animal Products, Quality and Value-adding



### Aims of the project

- To measure the instrumental/physical quality and composition (shear force tenderness, water holding capacity/cooking loss, fat and muscle colour, muscle fat content, collagen properties, oxidative status (rancidity)) of beef loin samples from various retail outlets (including brand names and generic products).
- To determine the reasons for variation in quality by chemical, histological, physical and biochemical tests.
- To use the information from 3.1 and 3.2 to arrive at a list of factors needed to be addressed in research and/or technology transfer to improve meat quality in South Africa

### Executive summary

Porterhouse steaks (or a similar cut containing the *m. longissimus lumborum* or loin muscle) were purchased from either bona vide butcheries or food retailers (Pick and Pay etc.). The cuts were purchased as non-vacuum-packed (fresh from counter, packed or cut from primal) or vacuum-packed or frozen (one product). Thirteen outlets were selected and 21 products were tested over 20 collection days spread over 9 months. Price was recorded and shear force tenderness, colour of meat and fat, steak thickness, purge and cooking loss measured as properties valued by consumers at or after purchase. Histological, biochemical and physical measurements were performed in an attempt to explain variation in consumer related properties: Considering tenderness as most important quality trait:

- Price per kg did not correlate well with tenderness. In fact one of the three cheapest products was more consistent in tenderness than some other products much more expensive. However, the most expensive products tended to be more consistent in tenderness.

- Vacuum-packaging was no guarantee for tender meat. In both butcheries and food retailers, tenderness values for vacuum-packed and fresh cuts occurred in tender and tough categories. In some butcheries the chances of selecting a fresh tender steak was higher than a tender vacuum-packed steak. In food retailers, the chances for a tender steak were slightly better when purchased as brand named vacuum-packed steak.
- Brand named products with claimed aging periods from food retailers were in most cases more consistent in tenderness than fresh products with no claim of but did not always guarantee tender products every time.
- Compared against tenderness values (benchmarks) of controlled trials (at this institute) it is clear that the inconsistency in general and poor tenderness of a large portion of the products is the combined effects of the use of beta agonists and poor harvesting and post-harvesting procedures. The results is a sign of a lack of knowledge or reluctance to apply proper procedures or complacency among the various role players in the industry.

For other quality parameters the following were found:

- Steaks from grass fed animals were darker in appearance than steaks from feedlot.
- Almost all quality traits of the frozen product showed that the process and/or duration of freezing was poorly executed which resulted in poor tenderness, excessive drip and poor colour. While frozen products are expected to be inferior to fresh products proper control can minimise the differences.
- Poor colour and moisture characteristics recorded for certain products suggest that harvesting and post-harvesting processes of certain products are neglected.
- Despite a substantial variation in quality, in particular tenderness, of this product, consumers seems to be satisfied across the spectrum since everybody is doing business. In the case of lower cost products with lower eating quality consumers have probably adjusted their tolerance to afford their taste for meat (steak). Where poor quality products are selling for higher prices, consumers probably have a natural high tolerance for poorer quality. With the prices of meat increasing, will the consumer reach a point where the price does not justify the quality?

### List of outputs

- Strydom, P. E., 2012. Choose the right cut. Farmlink, Winter 2012, pp40-42.

- Strydom, P. E., 2013. Lamb: Is it worth the price? Merino Journal 2013, pp6-10
- Strydom, P E, 2011. Meat Quality Survey 2. How consistent is meat quality in SA retail. Elsenburg Forum, RSG Landbou. 1 September 2012 (<http://www.elsenburg.com/radio/2012/f120901.html>).
- Strydom, P E, 2012. Beef: The pricy embarrassment. Lecture at TUKSFoST for Food Science students and lecturers. University of Pretoria, 14 September 2012 (40 students).
- Strydom, P.E., Liebenberg, L., Mosimanyana, L. & Hope-Jones, M. (2012). South African beef quality audit. (2012). Evaluation of alternative packaging methods for retail beef cuts. Proceedings of the 58th International Congress of Meat Science and Technology, Montreal, Canada, August 12-17. ICoMST2012paper33.pdf. 4 pp.
- Strydom, P.E. 2012. Beef Quality Audit. THRIP Annual Progress report. 29 June 2012.

## 2. The establishment of economic and management study groups for sheep, goats and cattle.

**Researcher:** Dr Antonie Christoffel Geyer

**Team members:** Me C Van Heerden, Mr J Venter, Mr JL Venter, Mr J Louw, Mr ASJ Van der Walt, Mr G Van Wyk, Mr J Jansen van Rensburg, Mr HN Van Niekerk, Mr JIF Henning

**Research Institute:** Dept. Agricultural Economics, University of the Free State

**Research focus area:** Consumerism, Market development and Trade



### Aims of the project

- To ensure and support strategic management and marketing in the livestock industries – Red Meat, Wool, Mohair.
- To act pro-actively on changes in the market trends.
- To nurture better relationships amongst role players – Red Meat, Wool, Mohair.

### Executive summary

Study groups must be seen as a powerful tool that empowers farmers with relevant economic and management information. For a farmer everyday boils back to decision making. Thinking strategically, economic results will pave the way for the next season or even couple of years. The study group results show that for the last couple of seasons the Merino/wool enterprises performed extremely well.

### OBJECTIVES

The following objectives are set for the small stock study groups:

- a) Determine production norms (Wool, mohair and meat production).
- b) Determine reproduction norms (Lambing and weaning percentages).
- c) Analyses of all the different enterprises on the farm.
- d) Determine the efficiency ratios of the different individuals and for the regions of the study groups.
- e) Provide management information to support the producer.

### WOOL AND MEAT RATIO

With wool and mohair being complementary to mutton production, it emphasizes the importance of the production and reproduction factors. Wool sheep farmers typically derive almost 70% of their annual income from meat. The results showed that the average income for Merinos in the Eastern Cape is compiled of 67.80% meat and 32.20% wool. The 3 year average for all the Merinos showed that the income is derived from 69.62% meat and 30.38% wool.

### **WOOL PRODUCTION**

The Eastern Cape Province is the largest wool producing region in South Africa with 13.95 million kg of wool for the 2011/2012 season. The study group results for Merinos in the Eastern Cape showed that the average production per sheep shorn was 4.27 Kg of wool. The 3 year average for all the other Merino study groups averaged 4.13 Kg of wool.

### **FINANCIAL ANALYSES (Gross margin – GM)**

The Gross Margin (GM) for the Merino the increased the past 2 years with 35.74% The increase was from R 431.97/SSU in 2009/10 up to R 586.37/SSU in 2010/11. It represents an increase of R 154.40/SSU. For all the other Merino study groups the increase was 26.75% (R 112.36/SSU). It represents an increase from R 420.08/SSU up to R 532.44/SSU. The 3 year average GM for the Merino in the Eastern Cape was R 440.31/SSU compared to the overall 3 year average of R 441.96/SSU.

### **REPRODUCTION**

The study group results confirmed the importance of reproduction. The 3 year average for the Merino in the Eastern Cape resulted into a lambing percentage of 101.95% and a weaning percentage of 92.84% indicating a 9.11% loss from lambing to weaning. The 3 year average for all the other Merino study groups in the country showed a lambing percentage of 98.30%, a weaning percentage of 89.74% indicating an average loss of 8.56% from lambing up to weaning.

### **CONCLUSION**

The establishment of an Unit in Livestock Economics at the University of the Free State pave the way of introducing economic data bases for all livestock in South Africa. This Unit together with the study groups will disseminate reliable economic information informing the participants with reliable information to support the decision making process, lowering risk factors ensuring sustainable agriculture on farm level.

## List of outputs

## Photo's





### 3. Validation of standard quality control methods, the newly developed bacterial PCR (polymerase chain reaction) method and vaccine safety tests. Bovine, Vaccines.

**Researcher:** Mr Nazeem Ismail-Cassim  
**Team members:** Dr J Van Heerden, Mr L Ikaneng, Mr L Mabena, Mrs I Burger-Rosa  
**Research Institute:** ARC-OVI TADP(Agricultural Research Council-Onderstepoort Veterinary Institute, Transboundary Animal Diseases Programme)  
**Research focus area:** Animal Products, Quality and Value-adding



#### Aims of the project

To validate a newly developed bacterial PCR method

To validate standard sterility test methods

To validate in vitro safety tests for foot-and-mouth disease virus

#### Executive summary

##### Bacterial PCR

It has been demonstrated that conventional polymerase chain reaction (PCR) assays present a practical solution for the early detection of bacterial contamination in pharmaceutical production processes. Combining PCR assays with DNA intercalating dyes reduced the occurrence of false positive results caused by the presence of non-viable bacterial cells. Propidium monoazide (PMA) binding dye, which intercalate with DNA of damaged cells rendering the DNA insoluble, were utilized to distinguish between viable and non-viable bacterial cells, using universal primers that amplify a  $\pm 1.5$  kb fragment of 16S rDNA. Results showed that the PCR methods were not only more expedient than the standard sterility test, but also more sensitive since it consistently detected low levels of contamination which could not be detected using the standard methods. A comparative sensitivity analysis performed using mixed cultures revealed the ability of PMA, used in combination with conventional PCR, to detect the presence of viable cells. The results of the

PMA-PCR assay correlated with those observed for the untreated control. It is clear that a higher level of sensitivity can be achieved using PMA combined with conventional PCR.

### **Growth promotion tests of microorganisms**

Each batch of prepared bacterial culture medium must be tested for growth promotion using suitable microorganisms as per European pharmacopeia (EP, 2005). Portions of TG (Thioglycollate) medium, TSB (Tryptone Soya Broth), NB (Nutrient Broth), and (BTA) Blood agar plates were inoculated with 100 colony forming units (CFU) per milliliter (ml) of four different species of microorganisms (*E. coli*, *S. Aureus*, *S. typhi* and *Klebsiella*). After incubation, clearly visible growth of all four species of microorganisms was observed indicating that the bacterial culture media are suitable for use.

### **Sterility Test Validation**

It is important to determine if the material used for production of vaccines (antigens, cell seeds, medium etc.) that will be sterility tested, contains elements that will interfere with the growth of microorganisms within the bacterial culture media used for the test. After transferring the contents (1 ml) of the materials used in production to be tested to the bacterial culture medium, an inoculum of a small number of viable microorganisms (100 CFU/ml) was added to the various samples tested. Each sample was tested separately against the four different species of microorganisms. The growth promotion test was used as a positive control, and bacterial culture medium, with no inoculum of test product or microorganisms, as a negative control. After incubation, clearly visible growth of all four different microorganisms was observed in all samples, except ATV (Active Trypsin Versene), gentamycin and penicillin. Thus indicating that the product being tested possesses no antimicrobial activity under the conditions of the test or such activity has been satisfactorily eliminated. The test for sterility may then be carried out without any modification. ATV contains sodium hydroxide which has antimicrobial activity and gentamycin and penicillin are antibiotics that show antimicrobial activity against the microorganisms tested, indicating that the test is not suitable for evaluation of these products.

### **Validation of Safety Tests**

According to the European Pharmacopeia (2005), a proportion of each batch of bulk inactivated antigen representing at least 200 doses must be tested for freedom from infectious virus by inoculation into sensitive cell cultures. For validation of the safety test, different cell lines were used, which includes BHK (baby hamster kidney) and IBRS<sub>2</sub> (porcine kidney). The antigen sample to be tested was spiked with a FMDV vaccine strain with

known titer and the cells were then observed for CPE (cytopathogenic effect). In general, all controls with no seed virus were negative and all spiked samples showed CPE indicating that the test is valid.

### List of outputs

- X
- X

### Photo's



#### 4. Marker detection in beef cattle.

<b>Researcher:</b>	Prof Azwihangwisi Maiwashe	
<b>Team members:</b>	Ms O Mapholi-Tshipuliso, Dr L Frylinck, Dr CB Banga, Mr M Ratsaka, Mr K Leeuw, Dr TL Nedambale, Dr HE Theron, Mr EL Matjuda, Mr NB Nengovhela, Miss ML Magahlela, Dr B Greyling, Dr C Pilane, Dr RR van der Westhuizen, Mr FJ Jordaan, Dr D Latif, Mr A Spickett, Dr KA Nephawe, Dr E Marle-Koster, Dr M MacNeil, Dr T Smith	
<b>Research Institute:</b>	ARC, University of Pretoria, Limpopo Department of Agriculture, USDA-ARS	
<b>Research focus area:</b>	Livestock production with global competitiveness	

#### Aims of the project

- To detect quantitative trait loci (QTLs) for tolerance to ticks in beef cattle
- To detect QTLs for growth and efficiency in beef cattle
- To detect QTLs for carcass traits in beef cattle

#### Executive summary

The recent sequencing of the bovine genome has created opportunities for interrogation of the genetic basis underlying the expression of economically important traits in livestock production. In this research, we investigate the potential application of genetic markers to improve traits that are either difficult or expensive to measure. This project consists of two phases: Phase I focuses on the establishment of an F2 discovery population formed from Nguni cows bred to Angus bulls as parental breeds; Phase II involves the collection of phenotypic data on traits of interest i.e. tolerance to ticks, post-weaning growth rate and feed efficiency, and carcass traits. We report on the progress achieved regarding Phase I of the project. The breeding of the Nguni cows to Angus bulls using artificial insemination has been completed. The first crossbred calves from this breeding were born in 2011 and they have been in turn inter se mated in 2013. The first second generation calves are expected towards the end of 2013. The training of technical staff on collection of tick count data has been completed and the results indicate that there is sufficient variation within the Nguni breed. In addition, new

protocols have been developed for DNA extraction from hair that would be suitable for genotyping using the 50K SNP chip.

### List of outputs

- A tick count booklet for tick species identification
- Students and technicians were trained on collection of tick count data
- Ms Mapholi (PhD student in the project) presented a poster at the 45th Congress of the South African Society for Animal Science held in July 2012 in East London Eastern Cape.X

### Photo's



## 5. Evaluation of genetic relationship between milk yield and weaning weight in beef cattle in the subtropics.

**Researcher:** Prof Azwihangwisi Maiwashe  
**Team members:** Dr NB Nengovhela, Mr FJ Jordaan, Dr KA Nephawe, Prof AE Nesamvuni, Dr M MacNeil, Mr J Sebei, Mr NT Nesengani  
**Research Institute:** ARC, Limpopo Department of Agriculture, USDA-ARS  
**Research focus area:** Livestock production with global competitiveness



### Aims of the project

- To ascertain the value of maternal breeding value for weaning weight as an indicator for milk yield in beef cattle raised under sub-tropical conditions

### Executive summary

Milk production in beef cattle is undoubtedly one of the most economically important traits. This trait is difficult to measure under conventional beef production setting and maternal breeding value for weaning weight is used routinely as an indicator for milk production. The use of maternal breeding values to select for milk production is an appropriate practice provided a meaningful genetic relationship exists between the two traits. Strong genetic correlation has been confirmed by research conducted mainly in the United States and Australia. Since genetic parameters are population specific, it is important that similar research is conducted in South Africa using local breeds raised under prevailing production conditions. The objective of this research was to estimate the genetic correlation between milk yield and maternal genetic effect for weaning using data collected on Nguni cattle. Results indicate that a strong genetic correlation exists between milk yield and maternal genetic effect for weaning weight in Nguni cattle. Thus, selection for milk yield using maternal breeding values for weaning weight is an appropriate practice and should lead to genetic improvement. Milk production ability of the Nguni and Bonsmara cattle was also evaluated and the results from this research should be useful for accurate economic evaluation of beef production system that uses either Nguni or Bonsmara cattle as a dam line.

### List of outputs

- Scientific article

A. Maiwashe, N.B. Nengovhela, K.A. Nephawe, J. Sebei, T. Netshilema, H.D. Mashaba, L. Nesengani & D. Norris. (2013) Estimates of lactation curve parameters for Bonsmara and Nguni cattle using the weigh-suckle-weigh technique. South African Journal of Animal Science 2013, 43 (Issue 5, Supplement 1). Peer-reviewed paper: Proc. 45th Congress of the South African Society for Animal Science

**Photo's**



## 6. Innovative management to increase beef productivity in South

### Africa.

<b>Researcher:</b>	Ms SM Grobler
<b>Team members:</b>	Dr MM Scholtz, Dr A Maiwashe, Mr PJJ Breytenbach, Dr L Nedambale, Dr RH, Dr MA Magadlela, Dr A Smith, Mr P Burger, Dr L Swallbach
<b>Research Institute:</b>	ARC-Irene Animal Production Institute
<b>Research focus area:</b>	Livestock production with global competitiveness



### Aims of the project

- To establish if synchronization can lead to an increase in the total mass of calves weaned from a limited calving season, most likely by decreasing the days to calving, but also by increasing number of calves born
- To establish if breeding replacement heifers at 14 months have an economic advantage over breeding heifers at 26 months in term of reproductive performance
- To establish the impact of the two different grazing strategies on veld condition, grass species composition and basal vegetation cover over time

### Executive summary

This report presents the final results of the project: Innovative management for improved productivity: Beef. The motivation for this project is that the South African beef market has changed with a need for livestock research and development to think in terms of a livestock enterprise approach. This entails the combination of genetic improvement, sound natural resource utilization, nutrition, forage management, physiology, product technology and economics of production to ensure a sustainable production enterprise over time through the allocation of limited resources.

Results of the project in the first year were promising and showed that a practical way to decrease the length of the breeding season is to use oestrous synchronisation followed by natural mating. This effect diminished after the first year and it seems that the biggest effect was achieved in the first year. There may be no economic advantage in synchronizing fertile productive cows each consecutive year during their productive lives



although final conclusions will only be reached at the end of the already refunded extension of the project. If long calving seasons are shortened and calving percentage increase, more and heavier calves of a uniform age can be weaned. Cows calving earlier in the season have a longer “recovery period” and have the opportunity to calve in a better body condition during the next season, compared to cows calving late in the season. Cows that calve early also have a better chance of conceiving in the next breeding season. However, results from this study showed that there are no differences between conception rates of cows and heifers that were either synchronised or non-synchronised. Conception rates of heifers mated at 24 months was significantly higher than heifers mated at 14 months. However, it must be noted that this research is conducted in an extensive production system and available literature indicates that conception rates of 14 month old heifers may be higher in semi-extensive and semi-intensive production systems. There was no significant difference between production results from groups on either high utilized grazing or controlled selective grazing. Veld condition also did not change dramatically between the two grazing systems over the 3 year period. The only significant difference ( $P>0.05$ ) obtained over the 3 year period was between production results in different years. Highest production was obtained in 2009 and lowest production during 2010 which may be related to the below average rainfall for 2010.

When the project was planned it was clear that a period of 3 years was not enough to evaluate extremely valuable long term effects on herd life and veld condition; however the RMRD-SA only fund projects for a maximum of 3 years. A second application is now submitted and approved to cover the remaining period of the project.

## List of outputs

### CONFERENCES

- Grobler, S.M and Scholtz, M.M., 2010. Innovative management to increase reproductive performance in beef cattle. 5th All Africa Conference on Animal Agriculture – commercialization of livestock agriculture in africa: challenges and opportunities., October 25-28 2010. Poster
- Grobler, S.M., Scholtz, M.M., Schwalbach, L.M.J. and J.P.C Greyling., 2011. Effect of synchronisation on calving date following natural mating in beef cattle. South African Society of Animal Science 44th Biennial Congress – Stellenbosch University, Western Cape Province 11-14 July 2011. Poster
- Grobler, S.M., Scholtz, M.M and Greyling J.P.C. Effect of synchronization on reproduction performance of beef heifers mated naturally at different ages. South

African Society of Animal Science 45th Congress – East London, Eastern Cape Province 09-12 July 2012. Poster

**SCIENTIFIC ARTICLES:**

- Grobler, SM., Scholtz, M.M., and J.P.C Greyling., 2011. Reproduction performance of beef heifers mated naturally at different ages with or without oestrus synchronization. Appl. Anim. Husb. Rural Develop, 2012. In pressX

**Photo's**



## **7. Traceability systems for the governance of alternative sheep meat quality attributes in fresh sheep meat supply chains in South Africa.**

**Researcher:** Miss Melissa Van der Merwe  
**Team members:** Mrs Hester Vermeulen, Prof Johann Kirsten, Mr Danie Jordaan  
**Research Institute:** Department of Agricultural Economics, Extension and Rural Development, University of Pretoria  
**Research focus area:** Unlocking the Potential of Red Meat through commercialization and technology transfer

### **Aims of the project**

- To develop a model and subsequent recommendations towards establishing an effective traceability system in the fresh sheep meat supply chains in South Africa, that will protect manage and govern the various food safety and quality attributes of locally produced sheep meat.
- To determine the readiness of role players in the South African fresh sheep meat supply chain to implement the traceability model developed.
- To develop recommendations on how greater consumer trust in sheep meat quality labels and certification marks can be achieved through an improved consumer awareness of these labels or marks.

### **Executive summary**

In a consumer driven world consumers want to experience a connection between the product that they are consuming and the origin of that product. To guarantee the validity of this connection and therefore the product's origin attribute, traceability systems are required. The main purpose of this paper is to assess current traceability systems implemented in South African sheep abattoirs thereby establishing their ability to guarantee the origin of a carcass. Research indicated that the South African sheep abattoirs have traceability systems in place and can guarantee the origin of a meat product. The descriptive analysis and hypothesis tests identified the tipping factor for the implementation of a traceability system, as the requirement from retail markets to which abattoirs deliver their product.XXXXXXX

### List of outputs

- MSc (Agric) thesis – Evaluating traceability in the South African sheep meat industry
- Paper presented at the Agricultural Economics Association of South Africa's conference, Bloemfontein, South Africa. 2012
- Paper presented at the International Congress of Meat Science and Technology, Izmir, Turkey. 2013
- Paper presented to the Agricultural Economics Association of South Africa's conference, Bela-Bela, South Africa. 2013
- Mcom thesis – Applying experimental economics to determine consumers' willingness to pay for food attributes

### Photo's

## 8. Adapting recombinant, dual-action, anti-Rhipicephalus (Boophilus) microplus and anti-R. (B.) decoloratus vaccines to cattle in South Africa.



**Researcher:** Dr Christine Maritz-Olivier

**Team members:** Prof A Neitz, Prof J de la Fuente, Prof D Berger, Prof F Joubert, Mr N Olivier, Ms N Coetzer, Mr C Stutzer, Ms A Barnard, Mr W Van Zyl, Ms S Richards, Mr R Theron, Mr P Mokoena, Ms I Kiper, Ms A Bosman

**Research Institute:** University of Pretoria – Departments of Genetics and Biochemistry

**Research focus area:** Animal Health and Welfare

### Aims of the project

- To identify dual-action, highly conserved (i.e. possible cross protective antigens) in the prominent cattle tick species, *R. microplus* and *R. decoloratus* using DNA microarrays.
- To validate dual-action candidates as possible anti-Rhipicephalus (*Boophilus*) *microplus* and *decoloratus* vaccines via *in vivo*, *in situ* or transovarial gene silencing.
- To express promising dual-action vaccine candidates for subsequent small-scale cattle vaccine trials.

### Executive summary

The research of Christine Maritz-Olivier on ticks and tick-borne diseases comprises four pillars. The first is the development of anti-tick vaccines using a combined functional genomics and reverse vaccinology approach, of which a number of antigens is currently at cattle trial stages. The second focuses on understanding the genetic diversity of ticks throughout South Africa, their current acaricide resistance status and tick-borne pathogen profiles. The third research pillar aim to enhance our understanding of pathogen-host interactions of the tick-borne pathogens *Babesia divergens* (causative agent of redwater) and *Anaplasma marginale* (causative agent of gall sickness) via drug screening, transcriptome analyses and interactome studies. The fourth research pillar is entails the development of vector-control strategies for haematophagous vectors such as mosquitoes and biting midges using *in vivo* gene silencing strategies and artificial feeding systems.

**Additional comments:** The antigens identified and recombinantly produced in this project will be evaluated for their protective abilities in cattle challenged with *R. microplus*. If some of these antigens provide protection above 75%, this will be a tremendous step towards development of an anti-tick vaccine.

## List of outputs

### NATIONAL CONFERENCES AND PRESENTATIONS

- Annette Bennett, Riann N Christian, Luisa Nardini, Sam Vezenegho, Annette-Christi Barnard, Christine Maritz-Olivier, Maureen Coetzee and Lizette L Koekemoer. (2012). The application for in vivo gene silencing and phenotype assessment of *An. arabiensis* feeding on subolesin using double-stranded RNA (dsRNA). Wits Research Day, 19 September, 2012 (poster)
- Ilkadir Kiper, Christine Maritz-Olivier. (2012) Protein-protein interaction analysis and functional annotation of Bm86 and ATAQ from the cattle tick, *Rhipicephalus microplus*. Joint SAGS and Computational Biology Conference, Stellenbosch (Oral)
- W.A. Theron, C. Maritz-Olivier. (2012) A bioinformatical and reverse vaccinology approach towards the identification of protective GPI-anchored proteins from the cattle tick, *Rhipicephalus microplus*. Joint SAGS and Computational Biology Conference, Stellenbosch (Oral)
- W.A. van Zyl, C. Stutzer, C. Maritz-Olivier. (2012) From prediction to protection: In silico identification and in vitro validation of promising anti-*Rhipicephalus* vaccine candidates. Joint SAGS and Computational Biology Conference, Stellenbosch. (Oral – Best oral presentation award)
- C Maritz-Olivier, C Stutzer, W van Zyl. (2012) A systematic, functional genomics approach for the identification of protective antigens from the cattle tick, *Rhipicephalus (Boophilus) microplus*. Joint SAGS and Computational Biology Conference, Stellenbosch (Oral)
- Christine Maritz-Olivier, Willem A. van Zyl, Christian Stutzer (2012) 5th Research Symposium of the Gauteng Department of Agriculture. Towards an anti-*Rhipicephalus microplus* tick vaccine for South Africa. (Oral- Best oral award).
- Annette-Christi Badenhorst and Christine Maritz-Olivier (2012) A reverse genetics approach to evaluate metzincins as anti-*Rhipicephalus microplus* tick vaccine candidates. SASBMB FASBMB congress, Drakensberg, South Africa (Oral)
- Christine Maritz-Olivier, Annette-Christi Badenhorst, Ard Nijhof, Frans Jongejan, Albert Neitz (2011) Transcriptional networking of Metzincin metalloproteases in the cattle tick, *Rhipicephalus (Boophilus) microplus*. Joint ZSSA and PARSAs conference, Stellenbosch, South Africa (Oral presentation)

- W van Zyl, C. Stutzer, C. Maritz-Olivier (2011). Identification of conserved genes between *Rhipicephalus (B.) microplus* and *R. (B.) decoloratus* tick species using DNA microarray. Joint ZSSA and PARSA conference, Stellenbosch, South Africa. (Oral)
- C Stutzer, W van Zyl and C Maritz-Olivier (2011). Transcriptome analysis of immature life-stages and adult tissues of the cattle tick, *Rhipicephalus (Boophilus) microplus*. Joint ZSSA and PARSA conference, Stellenbosch, South Africa (Oral)
- Christine Maritz-Olivier, Elizabeth Louw, Jose de la Fuente, Ard Nijhof, Frans Jongejan, Albert Neitz. (2011). Identification and small-scale animal vaccination trials of promising protective antigens against the cattle tick, *Rhipicephalus (Boophilus) microplus*. Joint ZSSA and PARSA conference, Stellenbosch, South Africa. (Oral)
- Sabine Richards and Christine Maritz-Olivier (2011) Relative Real-time PCR Validation of Putative Reference Genes and GPI-Linked Membrane Protein Transcription Profiles from *Rhipicephalus (Boophilus) microplus* and *R.(B.) decoloratus*. Joint ZSSA and PARSA conference, Stellenbosch, South Africa (Poster)
- Ilkadir Kiper, Antoinette van Schalkwyk, C. Maritz-Olivier (2011). Gene sequencing of a Kunitz-encoding vaccine candidate in the cattle tick, *Rhipicephalus (Boophilus) microplus*. Joint ZSSA and PARSA conference, Stellenbosch, South Africa. (Poster).
- Willem A. van Zyl, Christian Stutzer , Nicky Olivier, Nanette Coetzer, Fourie Joubert, Christine Maritz-Olivier (2009). A systematic approach towards anti-tick vaccines using an integrated immunoinformatics and functional genomics approach. 22nd Congress of the South African Society for Biochemistry and Molecular Biology (Bloemfontein, January 2009). (Oral)

**NATIONAL INVITED SPEAKER PRESENTATIONS:**

- Plenary speaker, 5th Research Symposium of the Gauteng Department of Agriculture (2012). A systematic, functional genomics approach for the identification of protective antigens from the cattle tick, *Rhipicephalus (Boophilus) microplus*.
- Invited speaker at NHLS Vector Control Unit (2011). A reverse vaccinology approach for the identification of protective antigens in the cattle tick, *R. microplus*.
- Invited speaker at GDARD (2011). A functional genomics approach to development of anti-tick vaccines.

- Invited speaker at ARC-OVI (2010). A functional genomics approach to development of anti-tick vaccines.
- Invited speaker at NHLS (2010). Novel approaches to vector control.

#### **INTERNATIONAL CONFERENCES AND PRESENTATIONS**

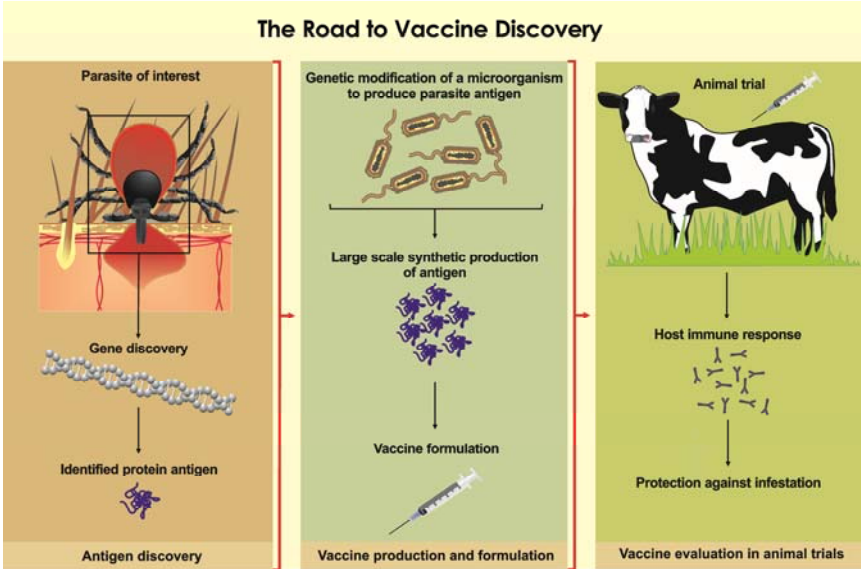
- S Richards and C Maritz-Olivier (2012). Characterization and expression of in silico predicted membrane bound protective antigens from *R. microplus*. EMBL meeting on New Perspectives on Immunity to Infection, EMBL Heidelberg, Germany (Poster)
- Annette-Christi Badenhorst and C Maritz-Olivier (2012). A reverse genetics approach to evaluate Metzincins as anti-Rhipicephalus microplus tick vaccine candidates. The 1st Regional Conference of the Society for Tropical and Veterinary Medicine (STVM) entitled: "A change in global environment, biodiversity, diseases and health", Phuket, Thailand. (Oral - Best oral presentation award).
- C Maritz-Olivier, C Stutzer, W van Zyl (2011). A systematic, functional genomics approach for the identification of protective antigens from the cattle tick, *Rhipicephalus (Boophilus) microplus*. TTP7, Zaragoza, Spain (Oral - selected for publication in special edition of Ticks and Tick-borne Diseases Journal).

#### **SCIENTIFIC ARTICLES**

- Christine Maritz-Oliviera, Willem van Zyl, Christian Stutzer. 2012. A systematic, functional genomics, and reverse vaccinology approach to the identification of vaccine candidates in the cattle tick, *Rhipicephalus microplus*. Ticks and Tick-borne Diseases Jun(3), pp 179-187.
- Christian Stutzer, Willem A. van Zyl, Nicholas A. Olivier, Sabine Richards, Christine Maritz-Olivier. 2013. Gene expression profiling of adult female tissues in feeding *Rhipicephalus microplus* cattle ticks. International Journal for Parasitology. *In press*



Photo's



## 9. Investigate *Babesia bovis* vaccine breakthroughs.

**Researcher:** Mr Michael P Combrink  
**Team members:** Dr BJ Mans, Mr PC Troskie, Dr AA Latif  
**Research Institute:** ARC-Onderstepoort Veterinary Institute  
**Research focus area:** Animal Health and Welfare

### Aims of the project

- To determine if the *B. bovis* vaccine protects against virulent field isolates.
- To determine the impact and possible consequences that field isolate variants of *B. bovis* from different areas may have on the movement of vaccinated and unvaccinated cattle and disseminate this information to the industry.

### Executive summary

Immune-competence of *Babesia bovis* (Asiatic redwater) vaccinated cattle to heterologous challenge

*Babesia bovis* is an intra-erythrocytic protozoon found in cattle and is only transmitted in South Africa by the one-host tick vector *Rhipicephalus* (*Boophilus*) *microplus*, which is also commonly known as the blue tick. Distribution of disease is determined by the prevalence of this vector, which is normally restricted by humidity and temperature to areas in the eastern parts of the subcontinent.

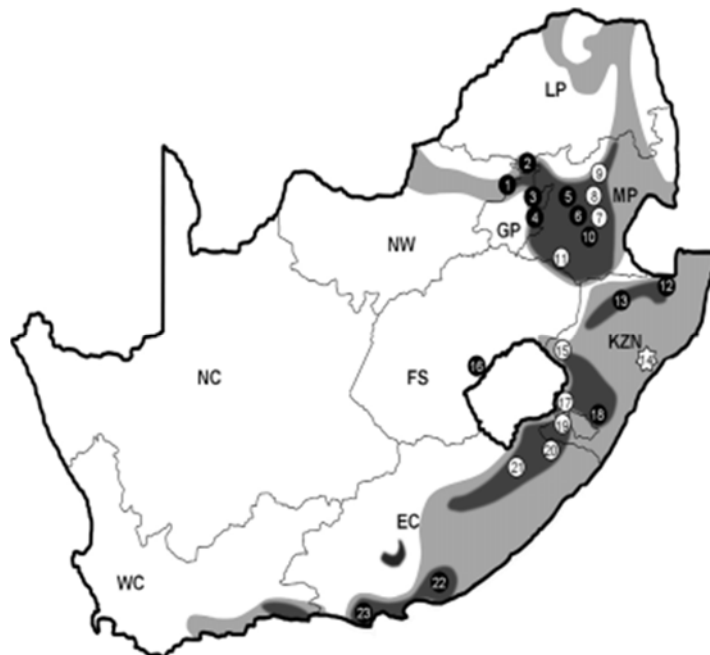


Fig. 1 A map of South Africa indicating the geographic distribution of 44 genotyped *B. bovis* (Asiatic redwater) field isolates collected in this study. The distribution of *Rhipicephalus (B.) microplus* is indicated in light gray. Areas of dark gray indicate historical reported incidents of redwater outbreaks from 2002 to 2013. Black dots with white numbering indicate sites where clinical isolates were sampled. White dots with black numbering indicate sites where field isolates were obtained during visits to farms. The star indicates where the isolate was from a tick. Numbers indicate regions sampled: 1 – Pretoria, 2 – Bela-Bela (Warmbaths), 3 – Bronkhorstspuit, 4 – Delmas, 5 – Middelburg, 6 – Hendrina, 7 – Carolina, 8 – eMakhazeni (Belfast), 9 – Dullstroom, 10 – Ermelo, 11 – Standerton, 12 – Pongola, 13 – Vryheid, 14 – Eshowe, 15 – Bergville, 16 – Ladybrand, 17 – Underberg, 18 – Ixopo, 19 – Swartberg (Kokstad), 20 – Kokstad, 21 – Maclear, 22 – Grahamanstown, 23 – Humansdorp. Provinces are indicated by WC (Western Cape), EC (Eastern Cape), NC (Northern Cape), FS (Free State), NW (North West), GP (Gauteng), MPL (Mpumalanga), LP (Limpopo) and KZN (KwaZulu-Natal).

Disease control by total eradication of the tick vector or allowing natural infection by limiting the degree of tick control may not prove sustainable solutions in those areas where the vector is already well established. Therefore, integration of the strategic use of acaracides and application of the vaccine should prove the most cost efficient method of control.

Applying *B. bovis* infected blood as a live vaccine, requires a parasite genotype characterized by low pathogenicity and the ability of developing lasting protective immunity against heterogeneous challenge. It is known that *B. bovis* vaccine strains with little genotypic diversity are not as immunogenic as those with more diverse populations. Considering the rumour that the vaccine was inadequate (although the contrary was proven at the time), that the South African *B. bovis* vaccine consists of only 1 genotype parasite population and have since use as a commercial vaccine only been evaluated successfully against challenge from 2 field isolates collected from cattle during vaccine failure claims, obviously required re-assessment of its immune-competence to heterogeneous challenge from more isolates.

During 2011 to 2012, with the collaboration of farmers and veterinarians, visits were made to 46 farms in 20 districts across the country where blood samples were collected from 1,947 cattle. Rural veterinarians also contributed by sending in blood samples collected from clinical cases (Fig. 1). In this way 44 genotypic diverse field isolates of Asiatic redwater were collected from which the vaccine strain could be clearly

distinguished from the field isolates with the polymerase chain reaction (PCR). The vaccine strain was found on 1 farm only, approximately 3 weeks after vaccine application, during the expected vaccine reaction period. This unique differentiation of the vaccine parasite can be utilized in the South African setting to determine if the vaccine plays a role in Asiatic redwater disease outbreaks. To date, none of the clinical cases indicated the presence of the vaccine during disease outbreaks.

Seventeen of the 44 field isolates collected were selected on the basis of their unique distinguishable genetic differences and their presence in areas prone to problems experienced with *B. bovis*. These isolates were tested individually in vaccinated and non-vaccinated animals, where after the individual reactions obtained in the cattle were evaluated against each other to determine vaccine efficacy. Results indicated that the vaccine showed adequate protective response against all 17 genotype different field isolates. Serving as proof that although the current Asiatic redwater vaccine consists of only 1 *B. bovis* genotype population, it is suitable for continued use as a live vaccine.

This study clearly illustrated how underestimated the effect is that stress related factors such as age, feeding, climate, disease status, internal parasites etc. have on the inherent ability of an animal to immunologically resist and cope with disease during primary or re-infection reactions. It can be accepted that the degree of vaccination and challenge reactions obtained for this study, will in all probability be more pronounced under field conditions. It is therefore good practice to vaccinate only healthy animals in good condition.

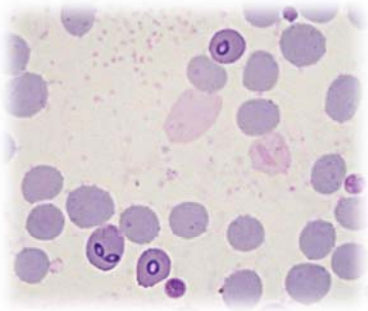
The study also showed a high level of genotypic diversity for the *B. bovis* field isolates, found not only across South Africa, but in herds on the same and adjacent farms. Continued movement of parasite infected cattle and ticks in the country will effectively contribute to the diversity of the existing gene pool. Consequently it is impossible to predict the outcome that movement of cattle may have and vaccination of cattle before moving is advised.

## List of outputs

### SCIENTIFIC ARTICLES

- M.P. Combrink, P. C. Troskie, A.A. Latifa, B.J. Mansa. () Immune-competence of *Babesia bovis* vaccinated cattle to heterologous challenge in South Africa.
- M.P. Combrinka, P.C. Troskie, R. Pienaar, A.A. Latif, B.J. Mans. (2014) Genotypic diversity in *Babesia bovis* field isolates and vaccine strains from South Africa. *Veterinary Parasitology* 199, pp144– 152.

Photo's



## 10. A decision support system for managing climate impacts and quantification of production risk on the financial feasibility of “cattle” farming.

<b>Researcher:</b>	Prof Bennie Grové
<b>Team members:</b>	Dr HJ Fouche
<b>Research Institute:</b>	University of the Free State; ARC Animal and Forage Production Institute (ARC-AFP)
<b>Research focus area:</b>	Sustainable natural resource utilization

### Aims of the project

- To develop a decision support system to assist “cattle” farmers to plan for climatic changes and to assess the economic impact thereof on their industry in order to promote sustainability and profitability and improve risk management

### Executive summary

For farmers to plan effectively for the upcoming season and to alleviate the effect that possible drought conditions might have on their livestock production, reliable information on the interaction between weather and veld conditions is needed. The main objective of this research is to provide information with respect to future climatic conditions and to translate such information into usable information concerning veld production that could be used to manage livestock production. The best way to provide information regarding the interaction between weather and veld conditions is to use a mathematical simulation model that simulates the effect of weather on the dry matter production of natural veld. The PUTU 11 model was used in this research to simulate rangeland productivity for a Themeda triandra veld. Weather, soil and plant physiological data was used to simulate the growth of natural veld, as well as data pertaining to El Niño or La Niña events. The output of the PUTU 11 model was then used to simulate the expected veld production for the coming season.

A regression model was then used to provide an estimate of the known movements in the data. In essence only deviations from these known movements can be attributed to risk and therefore the residuals of the regression model were used to gain insight into the production risk associated with dry matter production.

The regression results demonstrated good predictability of future veld production given good estimates of past production is available. Stochastic sequences of dry matter production were simulated by adding the errors of the time series model to the predicted

dry matter production to provide a stochastic forecast of dry matter production. The stochastic forecasts were then used to predict the offtake percentages that will result in enough veldt being available for the remaining animals.

### List of outputs

#### CONFERENCES

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#### SCIENTIFIC ARTICLES:

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### Photo's

## 11. The greenhouse gas emissions from the South African livestock industry.

<b>Researcher:</b>	Mr CJL du Toit
<b>Team members:</b>	Prof WA Van Niekerk, Dr HH Meissner, Dr L Otter
<b>Research Institute:</b>	Tshwane University of Technology, University of Pretoria
<b>Research focus area:</b>	Sustainable natural resource utilization Livestock production with global competitiveness



### Aims of the project

- To calculate on a regional basis the enteric methane emissions from all relevant livestock sectors.
- To calculate on a regional basis the methane emissions from livestock manure.
- To calculate on a regional basis the nitrous oxide emissions from livestock manure

### Executive summary

There are increasing concerns about the impact of agriculture and livestock production on the environment. The objective of the study was to estimate methane and nitrous oxide emissions of South African livestock industries during 2010 on a provincial and national basis. The study focused on direct methane (CH<sub>4</sub>) and nitrous oxide (N<sub>2</sub>O) emissions originating from enteric fermentation and livestock manure management systems. Both methane and nitrous oxide are potent greenhouse gasses with 25 and 310 times the global warming potential of carbon dioxide. The Intergovernmental Panel on Climate Change (IPCC) Tier 2 methodology adapted for tropical production systems was used to calculate emissions. The Tier 2 methodology defines animals, animal productivity, diet quality and management circumstances to support a more accurate estimate of feed intake for use in estimating methane production. Livestock, including privately owned game, emitted and estimated 1330.6 Gg of CH<sub>4</sub> and 3.28 Gg of N<sub>2</sub>O during 2010. In South Africa, the principle species comprise of cattle, game and sheep producing collectively an estimated 95% of the total livestock emissions. Commercial beef cattle were the largest contributors of methane followed by emerging and subsistence cattle, sheep, game, dairy cattle, goats and feedlot cattle with 527 Gg, 276 Gg, 167 Gg, 131 Gg, 130.5 Gg, 40.7 Gg and 30 Gg of methane respectively. The poultry industry emitted the highest amount of N<sub>2</sub>O producing an estimated 2.61 Gg



followed by dairy cattle, horses and pigs with 0.54 Gg, 0.09 Gg and 0.04 Gg of N<sub>2</sub>O respectively. The Eastern Cape, Kwa-Zulu Natal and the Free State were the provinces with the highest GHG emission profiles, incorporating all species, producing 24.3%, 15.3% and 14.9% of the total national emissions.

### List of outputs

#### CONFERENCES

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#### SCIENTIFIC ARTICLES:

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### Photo's

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

<b>Researcher:</b>	Prof MM Scholtz
<b>Team members:</b>	Ms A Theunissen, Dr MD MacNeil, Prof FWC Nesor, Mr M Mpayipheli, Mr P Coetzee, Ms L Botha
<b>Research Institute:</b>	ARC-Animal Production Institute, Northern Cape Department of Agriculture, Land Reform and Rural Development
<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

### CONFERENCES

- THEUNISSEN, A, SCHOLTZ, M M & NESER, F W C, 2011. Crossbreeding heterosis in beef cattle in arid areas. 44th Congress of the South African Society for Animal Science, 11 – 14 July 2011, Stellenbosch, South Africa
- THEUNISSEN, A, SCHOLTZ, M M & NESER, F W C, 2012. Crossbreeding in beef cattle with reference to the South African situation – a review. 45th SASAS Congress, 9 – 12 July 2012, East London, South Africa
- THEUNISSEN, A, SCHOLTZ, M M & NESER, F W C, 2012. Crossbreeding to increase beef production: Additive and non-additive effects on weight traits. 45th SASAS Congress, 9 – 12 July 2012, East London, South Africa
- THEUNISSEN, A, MACNEIL, M D, SCHOLTZ, M M & NESER, F W C, 2013. Breed additive and heterosis effects in crossing the indigenous Afrikaner breed with exotic beef breeds in South Africa. 11th World Conference on Animal Production. 15 – 20 October 2013, Beijing, China, 171.
- MOKOLOBATE, M C, SCHOLTZ, M M, NESER, F W C & MULGETA, S D, 2013. Sustainable beef cattle crossbreeding systems in the era of climate change. Proc. 46th Congress of the South African Society for Animal Science, 23 – 26 June 2013, Bloemfontein, South Africa.
- THEUNISSEN, A, SCHOLTZ, M M, NESER, F W C and MACNEIL, M D, 2013. Crossbreeding to increase beef production: Additive and non-additive effects on fitness traits. Proc. 46th Congress of the South African Society for Animal Science, 23 – 26 June 2013, Bloemfontein, South Africa.
- THEUNISSEN, A, SCHOLTZ, M M, NESER, F W C and MACNEIL, M D, 2013. Additive and non-additive effects on feedlot and carcass traits. Proc. 46th Congress of the South African Society for Animal Science, 23 – 26 June 2013, Bloemfontein, South Africa.
- THEUNISSEN, A, MACNEIL, M D, SCHOLTZ, M M & NESER, F W C, 2013. Breed additive and heterosis effect in crossing the indigenous Afrikaner breed with exotic beef breeds in South Africa. 3rd Global Conference on Agriculture, Food Security and Climate Change, 3 - 5 December 2013, Johannesburg, South Africa.

**THESIS:**

- M.Sc thesis by Anette Theunissen – UFS. “Characterization of breed additive and heterosis effects in beef cattle using experimental results.”

**SCIENTIFIC ARTICLES:**

- SCHOLTZ, M M, McMANUS C, OKEYO, A M & THEUNISSEN A, 2011. Opportunities for beef production in developing countries of the southern hemisphere. *Livestock Science*, 142: 195 – 202
- THEUNISSEN, A, SCHOLTZ, M M & NESER, F W C, 2013. An overview of crossbreeding in beef cattle with reference to the Southern African situation. *Applied Animal Husbandry & Rural Development*, 6, 18 – 21.
- THEUNISSEN, A, SCHOLTZ, M M, NESER, F W C & MACNEIL, M D, 2013. Crossbreeding to increase beef production: additive and non-additive effects on weight traits. *South African Journal of Animal Science*, 43 (2): 143 – 152
- THEUNISSEN, A, SCHOLTZ, M M, MACNEIL, M D & NESER, F W C. Breed Additive and Heterosis Effects on Feedlot and Carcass Traits in Beef Cattle. *Journal of Animal Science* (submitted)
- THEUNISSEN, A, SCHOLTZ, M M, MACNEIL, M D & NESER, F W C. Crossbreeding to increase beef production in South Africa: additive and non-additive effects on fitness traits. *South Africa Journal of Animal Science* (submitted).

**POPULAR ARTICLES & MEDIA:**

- THEUNISSEN, A & SCHOLTZ, M M, 2012. Kruisteelt vir die toekoms. *Red Meat / Rooivleis*, 3 (4), 64 – 67
- THEUNISSEN, A & SCHOLTZ, M M, 2013. Kruisgeteelde en komposietbulle: Waar lê hul waarde? *Veeplaas*, September 2013, 81-83

**POPULAR ARTICLES & MEDIA:**

- THEUNISSEN, A & NESER, F W C, 2013. Different cross breeding systems for increased profit. *Aldam Stockman’s School*. 16 – 18 October, 3013.

**LITERATURE REVIEWS**

- Crossbreeding in beef cattle with reference to the South African situation – Phillip Coetzee. Honours seminar at University of the Free State.

## **Photo's**



### 13. The food composition of raw and cooked beef offal (A Pilot study, as a pro-active activity).

**Researcher:** Dr SM van Heerden  
**Team members:** Dr LE Smit, Mrs MM Magoro, Dr IB Zondagh, Mrs JM van Niekerk, Mrs J Masilela, Mrs C Rapelego  
**Research Institute:** ARC-Animal Production Institute  
**Research focus area:** Red Meat Safety, Nutritional Quality and Value



#### Aims of the project

- To determine selected nutrients in a pilot study of raw and cooked, red and white South African beef offal
- To determine the total profile of nutrients should the results from the pilot study indicate the need for this?
- To make the data on the nutrient composition of South African beef offal available to the MRC to be included into the South African Food Composition Tables of the Medical Research Council (MRC)
- To compile and publish a comprehensive booklet on the nutrient content of South African beef offal

#### Executive summary

Scientific literature on the nutrient content and food composition tables of offal is relatively scarce. However the nutritive value of all food products including meat and meat products is important, in view of the consumer interest and demand for a healthier lifestyle (Pearson & Tauber, 1984). Therefore, there is a great need for more detailed information on food with adequate nutritive value, especially protein, for the informal and poorer sections of the population in South Africa.

With the WHO's estimation that 5 million people are dying every year from starvation, more attention should be given to the possibility of using proteins such as offal (beef, sheep), as protein sources in the diet (Poonam & Lawrie, 1986:144).



Offal, or organ meats, refers to the internal organs and entrails of a butchered animal, makes up a substantial portion of an animal's meat weight. The word does not refer to a particular list of edible organs, but includes most internal organs other than muscle and bone. <http://en.wikipedia.org/wiki/Offal>). It is also described as those parts of a meat from a carcass which are used as food but which are not skeletal muscle. It covers insides including the heart, liver, and lungs (collectively known as the pluck), all abdominal organs and extremities: tails, feet, and head including brains and tongue. In the USA the expressions "organ meats" or "variety meats" are used instead (<http://www.offalgood.com/what-is-offal>).

In South Africa offal is mostly enjoyed by South Africans of diverse backgrounds. Due to the popularity of this dish, it is one of the few customs that white (especially Afrikaners) and black South Africans share. Offal dishes in South Africa include stomach, hooves, shin, intestines, liver, head, tongue and very rarely in certain communities, testicles, and are consumed 'fresh' (i.e. not frozen).

## List of outputs

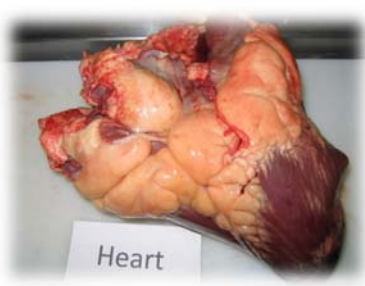
### CONFERENCES

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### SCIENTIFIC ARTICLES:

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## Photo's



## 14. Pilot study on investigating the current status and changes in the pest blackfly (Diptera: Simuliidae) problem on the Orange River - Recommendations of future applied research to address problems.

**Researcher:** N.A. Rivers-Moore

**Team members:**

**Research Institute:**

**Research focus area:**

### Aims of the project

- To
- To
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### Executive summary

Blackfly along the middle and lower reaches of the Orange River are major pests of livestock and labour-intensive agriculture, with losses to the industry calculated to exceed R300 million per annum based on current meat prices. The problem is attributed to winter high flows, with the main pest species being *Simulium chutteri* Lewis although there are times when *S. damnosum* s.l. Theobald and *S. impukane* de Meillon are problematic. During 2011, blackfly outbreaks in the middle and lower reaches of the Orange River were noted to have worsened. It was proposed that current reduced success in controlling *S. chutteri* using larvicides could be one of the reasons for this. Alternatively, or additionally, outbreaks may have been due to other species of blackfly not being targeted for control, particularly *S. impukane*. The aim of this study was to investigate the likelihoods of these competing reasons, and to propose control options. A weight-of-evidence approach was used to assess the most likely causes of the recent problems. The approach included a comprehensive literature review of the hydraulic preferences of both species, complemented by hydrological analyses of flow patterns from relevant gauging weirs along the middle Orange River to assess available habitat. A field survey of sites covering fast- and slower-flow habitats in single-channel and anastomosing reaches of the Orange River between Upington and the downstream town of Keimos was undertaken during November 2012. All data were related back to the classification of Palmer and Craig (2000) which classifies blackfly larvae based on seston concentration and flow velocity preferences. This was used as a predictive framework for assessing what the most likely species responsible for the outbreaks was

likely to be based on flow and habitat conditions. A third dimension of thermal preferences was considered, based on preliminary laboratory experiments to establish thermal thresholds (LT50 values). This was included to test the hypothesis that a species preferring higher flows was more likely to have a lower LT50 than a species which occurred in lower flow habitats.

A total of six species of *Simulium* were recorded: *S. adersi*; *S. chutteri*; *S. damnosum*; *S. mcmahoni*; *S. medusaeforme*; *S. ruficorne*, with no individuals of *S. impukane* found. *S. chutteri* was the most abundant and widespread species, while *S. ruficorne* was restricted to the slow-flowing, highly saline agricultural return flow channels. Notably, this was the first time that *S. medusaeforme* has been recorded from the Orange River (Palmer, 2012, pers. comm.). The blackfly species sampled showed distinct flow velocity preferences, with *S. chutteri* being the only species preferring flows  $> 1\text{ms}^{-1}$ , while the remaining species showed preferences for lower flows across a spectrum from  $0.35\text{--}0.68\text{ms}^{-1}$ . Analyses of flow data confirmed that flow conditions for a species such as *S. impukane* are only favourable for 1% of the time for flows of up to  $30\text{m}^3\text{s}^{-1}$ , although this may be higher in the anastomosed sections.

Based on the combined evidence, it is unlikely that the outbreaks experienced during 2011 were the result of another species of blackfly additional to *S. chutteri*. Hydrologically, it is an anomaly that *S. impukane* is a problem in the Orange River. Given its larval habitat preferences, it was noted that there should always be some habitat for *S. impukane* along certain reaches of the Orange River. Optimal habitat conditions would be during low-flow periods of clear water. It is therefore most likely that the main cause of the blackfly problem remains *S. chutteri*, where sustained high flow volumes and turbidity levels favour this species over the other species of blackfly. However, during periods of lower flow and lower turbidity, other species of blackfly may be favoured and contribute towards periodic outbreaks. Additionally, anastomosing reaches of the Orange River, such as near Keimoes, which are difficult to apply larvicides to because of limited downstream carry, may act as reservoirs of various species of blackfly. This may contribute towards periodic outbreaks of pest blackfly, caused by multiple blackfly species including *S. damnosum* and *S. impukane*.

Ongoing monitoring is recommended, where species are recorded, as well as turbidity levels. What this study has highlighted is that the best avenues for improved blackfly control should focus on the following two areas:

- Management issues around the control programme itself, as previously highlighted by Palmer et al. (2007)
- Hydraulic studies linked to investigations of downstream carry of larvicides in the anastomosing sections, which are likely to be the least well controlled areas on the middle Orange River. However, while it is unfortunate that these sections are associated with human settlement areas, it is also important to bear in mind that residual populations of different species of blackfly should be maintained in the range river as parts of its natural ecological functioning, and that the anastomosing sections could be serving a role as refugia.

### List of outputs

- X
- X

### Photo's