

DIFFERENCES IN PHYSICAL TRAITS SUCH AS COAT SCORE AND HIDE-THICKNESS, TOGETHER WITH TICK BURDEN AND BODY CONDITION SCORE, IN FOUR CATTLE BREEDS IN THE SOUTH-EASTERN FREE STATE PROVINCE OF SOUTH AFRICA

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ABSTRACT

A study was conducted to determine the differences between four breeds in respect of coat score, hide-thickness, tick burden and body condition score. The study was comprised of 40 heifers – 10 of each breed, namely Afrikaner, Braford, Charolais and Drakensberger. A subjective system of coat scoring, ranging from extremely short to very woolly, was used. Body condition score was measured subjectively, with 1 being emaciated and 9 being obese. Hide-thickness (in mm) and tick count were also determined. Between August 2007 and early March 2008, measurements were carried out on the same 10 animals of each breed, with highly significant differences in body condition score, hide-thickness and tick count being observed between the breeds in all instances. Coat scores differed significantly between breeds in the earlier and latter stages of the study becoming less significant midway through. A significant difference in body condition score within breeds was also found, while hide-thickness did not differ significantly within breeds.

Keywords: Body condition score, Coat score, Hide-thickness, Tick burden

1. INTRODUCTION

Climate change and water scarcity are inescapable, with all indications being that South Africa is growing ever warmer and drier. The farmer is in a position to cope with these eminent challenges by farming sustainably and in harmony with the environment, and by making use of suitable production systems and adapted breeds (Mentz, 2002). As such, farmers are constantly looking for ways to improve production and the profitability of their livestock enterprises. Selecting a particular breed with which to farm is one of the most important decisions a cattle farmer will make, as it is most often the key to adaptability and sustainability.

The cattle-farming environment is susceptible to stressors associated with heat, ultraviolet radiation, humidity, parasites, disease and nutrition. Susceptibility to such stressors accounts for large differences in growth, fertility and mortality rates between and within breeds, and it therefore stands to reason that stress-resistant breeds are more profitable.

In the case of parasite control, parasiticides are costly, and the occurrence of resistant strains of parasites confines the options for control and amplifies expenses further (Maree & Casey, 1993). While evaluating the tick resistance of beef-cattle breeds of African, European and Indian origin, Frisch and O'Neill (1998) found that even with low levels of tick infestation, the regression of live-weight gains on tick counts was about 0.5 kg per tick per year for each genotype.

The main driving force behind natural selection is survival of the fittest in a particular environment, with only the strong surviving to reproduce the species. In the long run, natural selection leads to an improved genetic acclimatisation to the prevailing environmental interactions (Du Preez, 2000). Adaptability plays a vital role in trouble-free commercial cattle farming, and there is no doubt that the impressive adaptability exhibited by wild animals in unfavourable climates has a parallel in our domestic animals. Consequently, by applying our knowledge of the occurrence of adaptability, we can breed for adaptability in domestic livestock without having to suffer the losses that would have been caused through natural selection (Bonsma, 1983).

Epperson and Zalesky (1995) and Martin and Noecker (2006) reported that hot and humid weather creates dangerous conditions for all livestock, particularly heavy-fed cattle. Dark-coloured beef cattle on a high-energy diet, carrying lots of body condition, are the first to be affected by heat and humidity. A lean body condition improves the ability to lose heat, meaning that “fat” cattle are at greater risk of heat stress due to the fact that excess body fat acts as insulation and slows the rate of heat loss (Coventry & Phillips, 2000).

Cattle primarily cool themselves by increasing blood flow to the surface of their bodies, which is known as vascularisation. Cooling through the skin is far more effective than panting, and animals with thick hides, which allow for more blood flow, are much more heat tolerant than animals with thin hides. A thick, loose hide also helps the animal to repel flies and ticks (Nation, 2009).

The present work is an attempt to describe and evaluate breed, coat type, body condition score and hide-thickness in terms of their relevance to tick burdens in the Afrikaner, Braford, Charolais and Drakensberger breeds.

2. MATERIALS AND METHODS

All experimental procedures were conducted on the farm “Quaggafontein”, south of the town of Zastron in the South-eastern Free State Province of South Africa, where animals were being farmed extensively on the natural pasture occurring in the region. Ten heifers of the Afrikaner, Braford (5 out of 8 Hereford, 3 out of 8 Brahman), Charolais and Drakensberger breeds, all between seven and nine months of age, were introduced onto the farm during July 2007. The animals were acquired from the same area where the study was conducted in order to minimise the effect of adaptation.

Only animals from stud breeders were selected to ensure the trueness to type of each animal. The following is a general description of the scoring system used (Turner & Schleger, 1960): Extremely short (score of 1), very short (score of 2), fairly short (score of 3), fairly long (score of 4), long (score of 5), woolly (score of 6), and very woolly (score of 7). The coat scoring was done once in winter and on four occasions in summer due to breed differences in the shedding process.

Hide-thickness was determined using a calliper that slips at a constant pressure. Measurements were taken of the skin over the mid-side area, since Tulloh (1961) found the skin over this area to be relatively uniform in thickness. Measurements were taken in December 2007 and again in January 2008, with additional measurements taken in March 2008.

Body condition was appraised according to the scores of thin (1-3), borderline (4), optimum (5-6) and fat (7-9), and was determined on three occasions between January and March of 2008. Skin-fold thickness was determined by means of a calliper.

Animals in the experimental group were allowed to become naturally infested with ticks with no acaricidal intervention apart from patch treatments applied in October and November 2007 to contain infestations of *Boophilus decoloratus*, *Hyalomma marginatum rufipes* and *Rhipicephalus evertsi*. Two officers, one on either side, carefully examined the restrained animals, recording all visible ticks. The tick species were not specified, and ticks were not removed from the animal. Tick burdens were determined on five occasions during February 2008. The study was executed during late winter and early summer (December 2007 to February 2008) using the repeated experimental design. The measurement parameters of tick count, hide-thickness, coat colour, coat score, body and condition score of the four different breeds were tested in respect of any significant differences between the breeds.

The SAS procedure for general linear models (PROC GLM) with the repeated measures option was used to test for significant differences between groups (breeds) over time (SAS, 2004).

3. RESULTS AND DISCUSSION

A highly significant ($P < 0.0001$) difference in coat score was observed in each of the five sampling events between breeds, with the exception of the second sampling where the difference was slightly less significant ($P < 0.05$). The Afrikaner breed had the lowest coat score on the first, third, fourth and fifth sampling days, while the Charolais breed has the highest coat score throughout the course of the study. Coat score was clearly affected by season, as the mean coat score per breed decreased from August through to February.

Williams, Garrick, Enns and Shirley (2006) reported that the progeny of slick-haired sires had higher weaning weights and post-weaning weight gains than the progeny of non-slick sires. Peters, Horst and Kleinheisterkamp (1982) reported similar results, finding breed differences in coat type to be highly significant ($P < 0.001$). Turner and Schleger (1960) found coat score to be effected by season, age, sex, pregnancy and lactation, nutrition, breed and individual differences, with breed being the greatest determinant of coat score. Bonsma (1983) stressed the importance of coat type in adaptation, presenting several striking examples. Turner and Schleger (1960) indicated the potential value of coat characteristics in selecting tropical beef cattle, but concluded that a sleek coat may have greater importance as an indicator of metabolic efficiency or a capacity to react favourably to stress.

Table 1. Least-square breed means (\pm s.e.) for coat score (CS), with 1 being extremely short and 7 very woolly

Parameter	Month	Afrikaner (n=10)	Braford (n=10)	Charolais (n=10)	Drakensberger (n=10)
CS 1	August	3.6 \pm 0.16 ^a	4.8 \pm 0.13 ^b	6.4 \pm 0.16 ^c	4.7 \pm 0.15 ^b
CS 2	December	3.2 \pm 0.20 ^{ab}	3.0 \pm 0.26 ^a	4.0 \pm 0.21 ^b	3.5 \pm 0.27 ^{ab}
CS 3	January	1.7 \pm 0.15 ^a	2.7 \pm 0.21 ^{bc}	3.6 \pm 0.16 ^d	2.2 \pm 0.13 ^{ab}
CS 4	February	1.3 \pm 0.15 ^a	2.5 \pm 0.17 ^b	3.4 \pm 0.16 ^c	1.7 \pm 0.15 ^a
CS 5	March	1.1 \pm 0.10 ^a	2.5 \pm 0.17 ^b	4.0 \pm 0.26 ^c	1.8 \pm 0.13 ^d

¹Means in the same row with different superscript letters differ significantly: $P < 0.0001$, with the exception of the second day of sampling (CS2) where the significant difference in CS between breeds was $P < 0.05$

Prayaga and Henshall (2005) found the heritability of coat score to be high (>50%). The negative correlation between coat score and body condition score across genotypes (-0.33 to -0.44) indicates a genetic advantage of sleek coats in the tropics. A positive genetic correlation between coat score and age, at first observed corpus luteum (0.73) in Brahman, indicates that Brahman with sleeker coats are genetically prone to early maturing.

Body condition score is an effective tool for cattle producers unable to weight their cattle and may even surpass the importance of weight in improving reproductive performance. Most studies show that body condition decreases at a faster rate than weight loss (Rossi & Wilson, 2008). Highly significant ($P < 0.0001$) breed differences with regard to body condition score were reported throughout the course of the study, along with a significant ($P < 0.0001$) difference in body condition score within breeds. On the basis of mean body condition score, the breeds can be ranked in decreasing order as follows: Braford > Afrikaner, Drakensberger > Charolais.

Table 2. Least-square breed means (\pm s.e.) for body condition score (BCS), with 1 being thin and 9 obese

Parameter	Month	Afrikaner (n=10)	Braford (n=10)	Charolais (n=10)	Drakensberger (n=10)
BCS 1	January	6.4 \pm 0.16 ^{ab}	6.9 \pm 0.10 ^a	5.4 \pm 0.16 ^c	6.2 \pm 0.13 ^b
BCS 2	February	7.0 \pm 0.00 ^a	7.0 \pm 0.00 ^a	5.6 \pm 0.16 ^b	6.8 \pm 0.13 ^a
BCS 3	March	7.0 \pm 0.00 ^a	7.9 \pm 0.31 ^b	5.3 \pm 0.15 ^c	6.9 \pm 0.10 ^a

^aMeans in the same row with different superscript letters differ significantly: $P < 0.0001$

The hide, consisting of the skin and hair covering, is the largest organ of the animal's body. The skin comprises approximately seven to eight percent of the live weight of the animal and is of paramount importance in determining the adaptability of the animal to prevailing environmental conditions, as it forms a barrier between the external environment and the animal (Bonsma, 1983).

Table 3. Least-square breed means (\pm s.e.) for hide-thickness (H) measured in millimetres

Parameter	Month	Afrikaner (n=10)	Braford (n=10)	Charolais (n=10)	Drakensberger (n=10)
H 1	December	14.1 \pm 0.52 ^a	12.8 \pm 0.51 ^{ab}	8.0 \pm 0.30 ^c	11.5 \pm 0.43 ^b
H 2	January	14.6 \pm 0.47 ^a	12.6 \pm 0.43 ^b	7.9 \pm 0.43 ^c	11.0 \pm 0.49 ^b
H 3	March	16.4 \pm 0.16 ^a	14.5 \pm 0.54 ^b	10.4 \pm 0.40 ^c	13.4 \pm 0.31 ^b

^aMeans in the same row with different superscript letters differ significantly: $P < 0.0001$

A highly significant ($P < 0.0001$) difference in hide-thickness between breeds was reported. The Afrikaner heifers had the thickest hide throughout the course of the study, and the Charolais heifers the thinnest hide. No significant differences in hide-thickness were noted between the Braford and Drakensberger heifers. These results contradict the research of Spickett, De Klerk, Enslin and Scholtz (1989) who found no significant differences in double hide-thickness between Nguni, Bonsmara and Hereford breeds and thus no correlation between hide-thickness and tick resistance. Figure 1 clearly illustrates the breed differences in terms of hide-thickness.

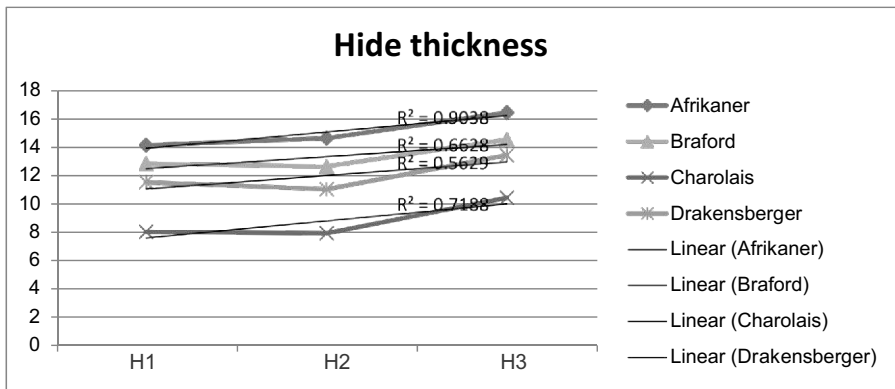


Figure 1: Mean hide-thickness per breed measured in mm

Across all measurements, the Afrikaner heifers had the fewest ticks and the Charolais heifers the most ticks, with the significant difference in tick counts between these breeds being $P < 0.001$. No significant differences in tick counts were observed between the Afrikaner and Drakensberger heifers. The indigenous Afrikaner and Drakensberger breeds were found to have a lower level of tick infestation than the Braford and Charolais breeds. Similarly, Spickett et al. (1989) found that the indigenous Nguni breed harboured significantly fewer ticks during periods of peak abundance than either the Bonsmara or Hereford breed. Frisch and O'Neill (1998) ranked the Charolais sire breed last in terms of tick resistance, thus corroborating the current research. On the basis of mean tick count and thus tick resistance, the breeds can be ranked in decreasing order as follows: Afrikaner > Drakensberger > Braford > Charolais. The average tick counts per breed are reflected in Table 4.

Table 4. Least-square means (\pm s.e.) for tick counts (T) per breed

Parameter	Date	Afrikaner (n=10)	Braford (n=10)	Charolais (n=10)	Drakensberger (n=10)
T 1	06-02-08	12.3 \pm 1.71 ^a	20.2 \pm 2.70 ^a	36.2 \pm 2.58 ^b	18.2 \pm 1.74 ^a
T 2	13-02-08	9.0 \pm 1.04 ^a	14.9 \pm 2.64 ^a	24.7 \pm 3.00 ^b	14.1 \pm 1.72 ^a
T 3	20-02-08	9.6 \pm 0.83 ^a	15.9 \pm 1.35 ^{ab}	21.9 \pm 2.34 ^b	14.0 \pm 1.77 ^a
T 4	27-02-08	13.4 \pm 1.43 ^a	21.6 \pm 1.78 ^{bc}	27.1 \pm 2.90 ^c	17.2 \pm 2.15 ^{ab}
T 5	05-03-08	15.1 \pm 1.48 ^a	21.7 \pm 2.21 ^{ab}	26.2 \pm 1.57 ^b	17.7 \pm 1.83 ^a

¹Means in the same row with different superscript letters differ significantly: $P < 0.001$

Prayaga and Henshall (2005) found that the genetic correlations among tick counts, faecal egg counts and rectal temperatures were moderately positive, suggesting that closely linked genes affect these adaptive traits.

In evaluating the tick resistance of beef cattle breeds of African, European and Indian origin, Frisch and O'Neill (1998) found that even while low levels of tick infestation were reported during their research, the regression of live-weight gains on tick counts was about 0.5 kg per tick per year for each genotype.

4. CONCLUSION

From this study it can be concluded that breeds differ in their capacity to resist ticks. The indigenous Afrikaner and Drakensberger breeds, as well as the Braford breed to some extent, appear to surpass the Charolais breed in terms of the ability to resist ticks. These animals have significantly thicker hides, as well as sleeker coats, which act as a deterrent to ticks, resulting in lower tick infestations. It is recommended that farmers select the breed most resistant to ticks, as this may have significant implications for the long-term sustainability of farming systems.

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