Differences in physical traits such as coat score and hide-thickness together with tick burdens and body condition score in four breeds in the Southern Free State

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Abstract
A study was conducted to determine differences between four breeds pertaining to coat score, hide-thickness, tick burden and body condition score. Forty heifers representing four breeds (10 from each breed) were used. The participating breeds were Afrikaner, Braford, Charolais and Drakensberger. A system of subjective scoring of cattle coats, 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 counts were also determined. Measurements were carried out on the same ten animals of each breed from August 2007 to early March 2008. Highly significant ($P < 0.0001$) differences in body condition score, hide-thickness and tick counts were observed between breeds on all instances. Coat scores differed significantly ($P < 0.0001$) between breeds in the earlier and latter stages of the study becoming less significant midway in the study. There was also a significant ($P < 0.0001$) difference in body condition score within breeds. Hide-thickness did not differ significantly within breeds.

Keywords: Coat score, hide-thickness, tick burden, body condition score

Introduction

Farmers are constantly looking for ways to improve production and profitability of their livestock enterprises. Choosing a cattle breed to farm is one of the most important decisions a farmer will have to make.

Cattle have to be productive in an environment that can be described in terms associated with heat, ultraviolet radiation, humidity, parasites, diseases and nutrition. Susceptibility to these stressors accounts for large differences in growth rate, fertility and mortalities between and within breeds. It stands to reason that stress-resistant breeds are more profitable. In the case of parasite control, parasiticides are expensive and the development of resistant strains of parasites confines the options for control and amplifies expenses further (Maree & Casey, 1993). While evaluating the resistance of beef cattle breeds of African, European, and Indian origins to ticks Frisch and O'Neill (1998) found that even while low tick infestations 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.

The main force responsible for selection in nature is the survival of the fittest in a particular environment. Nature tends to select against the weaker animals and only the strong survive 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. There is no doubt that the adaptability marvel exhibited by 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 our domestic livestock without having to suffer losses, which a process of natural selection would have caused (Bonsma, 1983).

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

Materials and Methods

All experimental procedures were conducted on the farm "Quaggafontein", south of Zastron, in the south-eastern Free State, South Africa. Animals were farmed extensively on the natural pasture occurring in the region. Ten heifers of the Afrikaner, Braford (⅝ Hereford, ⅜ Brahman), Charolais and Drakensberger

breeds, all between 7 and 9 months of age, were introduced onto the farm during July 2007. Animals were acquired from the same area where the study was conducted 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 1), very short (2), fairly short (3), fairly long (4), long (5), woolly (6), very woolly (7). The coat scoring was done once in winter and on four occasions in summer due to breed differences in the shedding process. The Bonsmara and Simmentaler heifers had to be withdrawn from the research in February 2008 due to conflicting breeding programs.

Body condition was appraised according to the scores of thin (1-3), borderline (4), optimum (5-6), and fat (7) and was determined on three occasions from January to March of 2008.

Skin-fold thickness was determined using a caliper. The skin over the midside area was measured as Tulloh (1961) found that the skin over this area is relatively uniform in thickness. Skin-fold thickness was measured in December 2007 and again in January 2008. An additional skin-fold measurement was taken in March 2008 on the Afrikaner, Braford, Charolais and Drakensberger heifers.

Animals in the experimental group were allowed to become naturally infested with ticks without acaricidal intervention except for patch treatments applied in October and November to contain *Boophilus decoloratus*, *Hyalomma marginatum rufipes* and *Rhipicephalus evertsi* infestations. Two officers, one on either side, carefully examined the restrained animals, recording all visible ticks. The species of tick were not specified and ticks were not removed from the animal. Tick burdens were determined on five events during February 2008.

Results and Discussion

Highly significant ($P < 0.0001$) differences in coat scores were observed in each of the five sampling events between breeds except on the second sampling were the significant difference between breeds concerning coat score was slightly lower ($P < 0.05$). The Afrikaner had the lowest coat score on the 1st, 3rd, 4th and 5th sampling days and the Charolais the highest coat score throughout the course of the study. It is clear that the coat scores were affected by season as mean breed coat score decreased from August through to February. Peters *et al.* (1982) report likewise results finding breed differences in coat type to be highly significant ($P < 0.001$). Turner and Schleger (1960) established that coat score was effected by season, age, sex, pregnancy and lactation, nutrition, breed and individual differences but that the greatest contribution to the differences in coat score being breed. Bonsma repeatedly stresses the importance of coat type in adaptation and presents striking examples of it (Bonsma, 1983). Turner and Schleger (1960) indicate the potential value of coat characters in selecting tropical beef cattle. However, they conclude that a sleek coat may have a greater significance as an indicator of metabolic efficiency or of a capacity to react favourably to stress.

Table 1 Least-squares breed means (± s.e.) for coat score (CS), 1 being extremely short and 7 very woolly

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

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

BCS is an effective tool for cattle producers who cannot weigh cattle and it may even surpass the measurement of cow weight in improving reproductive performance. Most studies show that body condition decreases at a faster rate than weight loss (Rossi and Wilson, 2006). Highly significant ($P < 0.0001$) breed differences with regards to body condition score were reported throughout the course of the study. There was also a significant ($P < 0.0001$) difference in body condition score within breeds. On the basis of mean BCS, the breeds have been ranked in order of decreasing BCS as Braford > Afrikaner, Drakensberger > Charolais.

Table 2 Least-squares breed means (± s.e.) for body condition score (BCS), 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 ± 0.16^{ab}	6.9 ± 0.10^{a}	5.4 ± 0.16^{c}	6.2 ± 0.13^{b}
BCS 2	February	7.0 ± 0.00^{a}	7.0 ± 0.00^{a}	5.6 ± 0.16^{b}	6.8 ± 0.13^{a}
BCS 3	March	7.0 ± 0.00^{a}	7.9 ± 0.31^{b}	5.3 ± 0.15^{c}	6.9 ± 0.10^{a}

[1]Means in the same row with different superscript letters differ significantly: P < 0.0001.

The animal hide, consisting of the skin and hair covering, is the largest organ of the body. The skin comprises approximately seven to eight percent of the live weight of the animal. The hide 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). A highly significant (P < 0.0001) difference in hide thickness between breeds was reported. The Afrikaner heifers had the thickest hide throughout 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 research done by Spickett *et al*. (1989) who found no significant difference in double skin-thickness between Nguni, Bonsmara and Hereford breeds and thus no correlation between skin thickness and tick resistance could be determined.

Table 3 Least-squares breed means (± s.e.) for hide-thickness (H) measured in millimeters

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

[1]Means in the same row with different superscript letters differ significantly: P < 0.0001

Across all measurements the Afrikaner heifers had the least ticks and the Charolais heifers the most ticks with the significant difference in tick count between these breeds being P < 0.001. No significant differences in tick counts were observed between the Afrikaner and Drakensberger heifers. In the present study, the indigenous Afrikaner and Drakensberger breeds had a lower tick infestation compared to the Braford and Charolais heifers. Spicket *et al.* (1989) showed likewise results in that the indigenous Nguni breed harboured significantly fewer ticks during periods of peak abundance than either Bonsmara or Hereford cattle. Frisch and O'Neill (1998) ranked the Charolais sire breed last for tick resistance thus also corroborating present research. On the basis of mean tick count, the breeds have been ranked in order of decreasing resistance to ticks as Afrikaner, Drakensberger > Braford > Charolais.

Table 4 Least-squares breed means (± s.e.) for tick (T) counts

Para-meter	Date	Afrikaner (*n*=10)	Braford (*n*=10)	Charolais (*n*=10)	Drakensberger (*n*=10)
T 1	06-02-2008	12.3 ± 1.71^{a}	20.2 ± 2.70^{a}	36.2 ± 2.58^{b}	18.2 ± 1.74^{a}
T 2	13-02-2008	9.0 ± 1.04^{a}	14.9 ± 2.64^{a}	24.7 ± 3.00^{b}	14.1 ± 1.72^{a}
T 3	20-02-2008	9.6 ± 0.83^{a}	15.9 ± 1.35^{ab}	21.9 ± 2.34^{b}	14.0 ± 1.77^{a}
T 4	27-02-2008	13.4 ± 1.43^{a}	21.6 ± 1.78^{bc}	27.1 ± 2.90^{c}	17.2 ± 2.15^{ab}
T 5	05-03-2008	15.1 ± 1.48^{a}	21.7 ± 2.21^{ab}	26.2 ± 1.57^{b}	17.7 ± 1.83^{a}

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

Conclusion

From this study it is evident that breeds differ in their capacity to resist ticks. The indigenous Afrikaner and Drakensberger breeds are well as the Braford heifers to some extent, appear to

surpass the Charolais heifers in their ability to resist ticks. These animals had significantly thicker hides as well as sleeker coats, which act as a deterrent to ticks, resulting in lower tick infestations.

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