THE NGUNI AND CLIMATE CHANGE: CHALLENGES AND OPPORTUNITIES

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Climate change is expected to have a more extreme effect on southern hemisphere continents than on other continents and the anticipated global warming is expected to have a negative effect on the beef production environments of these countries. Such negative effects will include high ambient temperatures, nutritional stress and altered patterns of animal diseases. The Nguni breed will also be affected by this climate change, but as an indigenous breed it has the potential to be adapted to these changes. The challenges and opportunities posed to the breed should be taken seriously and the necessary actions should be taken.

CLIMATE CHANGE

Tropical and subtropical climates have both direct and indirect effects on livestock. Factors such as temperature, solar radiation, humidity and wind all have direct effects on animals, whereas factors such as digestibility of feed, intake, quality and quantity of grazing, pests and diseases, which are themselves directly influenced by climate change, all have indirect effects on animals. It is predicted that climate change will have a more extreme effect on the African continent than on any other continent. The anticipated global warming will change the southern hemisphere environments and vegetation of Africa, and in some areas the grazing capacity is expected to decline.
The following changes are predicted for South Africa:

- Significant aridification in the western regions
- Shorter rainfall periods in the western and interior regions
- Increased temperatures in the interior (up to 2.5° C)
- Increased winter rainfall in the south-western region
- More frequent floods in the north- eastern region
- Change in species diversity across all biomes
- 20% reduction in maize production over the next 50 years
- Increase in pests and diseases in the agricultural sector
- 20% reduction in forage production of the savanna biome
- Grassland will be encroached by savanna

AMBIENT TEMPERATURE

Ambient temperature is the factor that has the largest direct effect on livestock production. Most livestock perform at their best at temperatures between 4 and 24°C. In the tropics and subtropics, temperatures frequently rise above this comfort zone and it is therefore important that livestock are adapted to these higher temperatures. High temperatures and solar radiation decreases intake in order to reduce digestive heat production, and reduces grazing time (animals do not graze in hot midday hours), whereas sweating and water intake increases.
Other factors involved in thermal comfort include the external coat of the animal (thickness, structure, thermo isolation, absorption and reflectivity) and body traits (shape, size and superficial area).

Indigenous cattle breeds (such as the Nguni) have been exposed to high temperature conditions for centuries and it appears that through adaptation, these breeds have developed mechanisms to cope with heat stress.

NURTITION STRESS

Nutrition stress has the largest indirect effect on the grazing animal in the tropics and subtropics. In these environments, natural pasture has both lower nutritional value and lower tiller density than in temperate regions. These tropical grasses (C_4) have developed a different photosynthetic pathway to adapt to the climate. The C_4 refers to a 4 carbon compound compared to a 3 carbon compound (C_3) in temperate grasses. C_4 plants have a higher photosynthetic rate, which results in high fibre content, low leaf to stem ratio, reduced digestibility and intake. Climate change will thus have the greatest impact on ruminant species.

A nitrogen (N) deficient diet reduces feed intake by limiting microbial growth and organic matter digestion in the rumen. This reduces the amount of amino acids available for digestion and absorption from the small intestines. The optimum level of ammonia (NH_3) in the rumen of cattle for proper microbial activity is 50 mg/l. It was observed that Nguni cattle were more capable of maintaining their body weight during winter than other breeds and they had higher blood urea (N) and ruminal NH_3 levels. It is interesting to note that the Nguni maintained a NH_3 level of 45 mg/l during winter, which is slightly below the optimum level of 50 mg/l.

Furthermore, Ngunis are not just sniffing as the other animals are urinating, but they were physically drinking the urine. This will result in higher plasma urea levels, which in turn may have a beneficial effect on intake and fermentation. These adaptive traits may make it easier for the Nguni to utilize the C_4 grasses.

DISEASES

Another potential consequence of significant and permanent changes to the climate is altered patterns of diseases in animals. This may include the emergence of new disease syndromes and a change in the prevalence of existing diseases, particularly those spread by biting insects. The two most mentioned emerging and re-emerging cattle diseases in a recent OIE survey were Bluetongue and Rift Valley fever.

Climate also plays a vital part in determining the distribution of ticks, which are responsible for diseases such as East Coast fever, Heartwater, Gallsickness, and Red Water.
Prevalence and intensity of tick infestation have been associated with temperature and humidity. In southern Africa, Heartwater is considered to be the main tick-borne disease and has a significant economic impact on livestock. Economic losses due to Heartwater are a result of the high mortality rate it causes, which ranges between 20 and 90%, and the reduced productivity it engenders in both clinically ill and surviving/recovered animals.

There is clear evidence from observations that the Nguni may be tolerant to Heartwater, however this still needs to be proved scientifically.

It has been scientifically proved that the Nguni breed is the most resistant to ticks of all breeds in South Africa and that its production is least effected by ecto parasites. In the case of the Nguni, tick infestation resulted in a weaning weight loss of only 4.4 kg, whereas it was 29.5 kg in the case of the exotic breed under situations of severe tick infestation.

The bite of ticks can be painful and annoying and usually elicits a response from the host. Grooming behavior in response to ecto parasite annoyance is an important method of protection used by cattle. It has been recorded that the Nguni takes much more soil-baths than other breeds.

ADAPTATION

Adaptability of an animal can be defined as the ability to survive, reproduce and produce within a defined environment, or the degree to which an organism, population or species can remain/become adapted to a wide range of environments by physiological or genetic means. An improved understanding of the adaptation of livestock to their production environments is important, but adaptation is complex and thus difficult to measure.

Extensive research has been conducted on the direct measurement of adaptation. This included direct measurements on the animal such as rectal body temperature, respiration rate, Heart (pulse) rate, sweating rate (water loss), skin thickness and hair per cm^2. In addition, more sophisticated measurements investigated, included the heat tolerance test where the difference in body temperature was measured before and after exposure to extreme heat, and temperature change associated with exercising the animals.

Several proxy-indicators for adaptation are available and have also been used. These include reproductive traits such as fertility, survival, birth rate and peri-natal mortality; production traits such as growth rate, milk production, low mortality and longevity; and health traits such as faecal egg counts and number of external parasites.

Adaptation can also relate to either resistance or tolerance. Resistance means that animals do not get affected by unfavourable conditions, or they quickly get accustomed to them. Tolerance means that the animals stay affected but continue to live, with or without some degree of discomfort.

It should be ensured that the breed standards and breeding policy for the Nguni breed are such that it supports adaptation to climate change.

Functional traits for adaptation

Animals that are adapted to heat have a large surface area per unit of body weight in other words they have larger, looser skins. A short hair coat and glossy sheen reflects far more heat than long hair and no sheen. Cattle cool themselves by increasing blood flow to the surface of their bodies. Cooling through the body is far more important than panting. Cattle adapted to hot and humid areas also tend to have larger rumens due to lower digestibility of the grasses in these areas.

Breeding policy for adaptation

In selecting a breed such as the Nguni for adaptation it is suggested that selection should be for the proxy-indicators. In this case the selection criteria for adaptation should be;

- Age at 1st calving
- Calving interval
- Weaning weight (maternal and direct combined)
- 12 month weight
- Average daily gain
- Limitation on mature weight (The limitation on mature weight is suggested to limit the maintenance requirements of the cows, due to the high heat increment, high fibre content, low leaf to stem ratio and reduced digestibility of the natural grazing.)

THE FUTURE

Breeds that will prosper in a climate-changed world will tend to be those that are:

- Early to recognize its importance
- Foresee that there may be at least some implications for their breed (including farms)
- Take appropriate steps well in advance.

The pace of adaptation to climate change and the policies adopted by Breed Societies is likely to be one of the forces that will significantly determine whether specific breeds will be able to maintain their production levels, or even increase their market shares over the next number of years.