GROWTH, SIZE & EFFICIENCY

OF NGUNI CATTLE FOR OPTIMUM ADAPTATION AND REPRODUCTIVE EFFICIENCY

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NTRODUCTION

Beef cattle production has benefitted from major advances in production practices like the selection for adaptability, growth and reproduction efficiency during the turn of the previous century(Webb & Casey, 2010). In the case of the Nguni cattle breed there has been some debate about the relevance of selection for growth and efficiency, although selection for adaptability and fertility traits have hugely benefitted the breed. Feedlots increasingly favour medium-larger frame weaners with high growth potential, which puts more pressure on extensive beef cattle producers to change the types of cattle and breeding systems to supply the growing demand in such weaners. Nguni cattle are renowned for its adaptability and fertility despite its small-frame size, but there is mounting pressure to change the selection strategies of this breed in order to remain competitive.

Beef cattle production is practised under a wide variety of ecological regions with varying environmental conditions. The efficiency of cattle production is a function of yield, time and natural and human resources required to produce edible tissues of consistently high quality in a sustainable way (Webb, 2012).

The question that remains is to what extent selection for growth and efficiency affects adaptability and reproduction rate of Nguni cattle.

A production system is regarded as sustainable if a consistently high level of efficient production can be achieved over a long term (longevity).The purpose of this paper is to focus on the potential effects of selection for growth and efficiency on the adaptability and reproductive characteristics of Nguni cattle, as well as other strategies to remain competitive.

HARDY AFRICAN CATTLE FOR SUSTAINABLE BEEF PRODUCTION

A strategic question centres on the importance of growth, nutrition and crossbreeding of beef cattle in terms of reproductive efficiency of Nguni cattle. It is critical to understand that growth and development are the dynamic outcome between the genetic make-up of an animal and the environmental factors, which include both the physical and internal environments (Webb & Casey, 2010).This implies that the expression of an animal's genetic blue-print depends on the extent to which the total environment allows its expression, resulting in a unique phenotype. Adapted animals are less affected by environmental limitations and that is where the indigenous breeds like the Nguni often excel.

The importance of the internal environment, notably the rumen and its microbes and the ability of cattle to maintain homeostasis, are often ignored. Nguni cattle are ideally suited to harsh conditions and they are able to better utilise poor quality grazing with a relatively high crude fibre content compared to other cattle breeds.

Heat of digestion or "heat increment" due to the digestion and fermentation of high crude fibre diets, adds an additional burden on cattle to maintain heat balance. European cattle breeds generally struggle to maintain heat balance in such conditions, especially during hot summer months in southern Africa. These features and the inherent small size of the Nguni cattle breed should be carefully managed in order to retain a genetic resource that can provide long-term sustainable beef cattle production in resource constrained environments.

EFFECTS OF SELECTION FOR GROWTH ON SIZE AND EFFICIENCY OF NGUNI CATTLE

It is established that growth occurs in a specific sigmoidal sequence which involves the increase in cell number(hyperplasia), increase in cell size (hypertrophy), organisation of growth and ultimately cell and tissue differentiation. During this complex process, the rate, proportions, composition and extent of growth of different cells and tissues change in a fixed way. However it has been demonstrated in pigs and other livestock (Hammond et al., 1971) that selection for growth and efficiency changes the conformation of animals which may affect the components of fertility like gonadal development, pelvic dimensions and endocrine balance that supports efficient reproduction. These aspects become increasingly limiting in harsh environments and it was demonstrated (Botsime & Webb) that Nguni cattle suffer only a marginal depressions in reproduction efficiency in such environments compared to European and composite cattle breeds.

GENETIC SELECTION, PRODUCTION AND REPRODUCTION

The question that remains is to what extent selection for growth and efficiency affects adaptability and reproduction rate of Nguni cattle. Adequate growth and development provides the impetus for subsequent gonadal growth and secondary sexual development of both bulls and heifers. Growth and reproduction are sensitive indicators of environmental limitations and management practices. Fertility is a complex aspect which is poorly understood because it has a low heritability, which implies that a major part of the variation in fertility is due to environmental and management factors. In this regard growth, mature size and maintenance of body condition directly affect the rate and repeatability of reproductive performance in a beef cattle herd. There are a number of important aspects that can be addressed to ensure efficient beef cattle production in resource constrained environments.

1. Selection for growth and mature size:

Since cattle production systems are directly dependant on the natural resource base (quantity and quality of grazing and planted pastures as well as supplemental feeding), it is vital to synchronise the quality of the resource base with beef herd management practices like breeding season, age at breeding, weaning and re-breeding.

a. South Africa is characterised by frequent variations in its natural resources e.g. quality and quantity of grazing and water due to seasonal variations, sporadic droughts, veld fires, pressure on agricultural land and land claims.
b. It follows that cattle that are adapted and fertile in the particular production environment are non-negotiable aspects of successful and sustainable beef production.
c. A key principle is that the production environment will determine the optimal size and level of production of beef cattle.

d. It is not feasible to breed and select phenotypes that exceed the capacity of the farm, by substituting the natural grazing with large quantities of expensive feeds and supplements.
e. Selection for medium frame size cows generally yields better production compared to either their small and large framed counterparts. Medium frame size cattle tend to be more adaptable in harsh environments and such animals can be selected by EBV's and visual appraisal of functional efficiency and hide and coat characteristics like a thick hide and smooth hair coat.

2. Early breeding and re-conception:

Scientific studies point to the benefits of early breeding and re-conception.

a. Cattle reproduction consists of several harmonised steps namely conception, implantation, gestation, parturition and involution. These physiological events are directly controlled by the delicate interplay between the hypothalamus (master gland of the endocrine system), gonadotropins (reproductive hormones) and environmental stimuli.
b. Although there is a trend to select for larger frame size due to favourable correlations between frame size and growth rate, with subsequent benefits on feedlot performance, medium frame size cattle are more likely to produce well in resource constrained environments in South Africa.
c. Selection for early breeding has a beneficial effect on growth by acting as a more sensitive gauge to synchronizing environmental effects with growth and size.

3. Puberty and early conception:

Economic aspects of puberty and early conception emphasise the importance of using heifers retained for breeding purposes as soon as possible.

a. Barren heifers and cows are unproductive and put extra burden on the production costs of the cow herd.
b. Obviously the period from birth to first conception is 'unproductive time' and costly. There is a fine balance between early conception and performance because early puberty should not be at the expense of reduced performance!
c. Early conception affects skeletal development and mature size and provides a way to exploit sexual dimorphism in livestock, provided that an acceptable mass is attained at breeding, which is usually ca. 55-60% of mature size.
d. Research at the University of Florida suggests that faster growth decreases the age at puberty by between 30 to 90 days and at 30 to 50 kg lower body mass. Such heifers achieved a higher first exposure pregnancy rate and rebreeding conception rate (79,2% vs 64,9%), but with no differences from 4 years of age onwards.

4. Methods to improve reproduction efficiency:

Reproductive efficiency is determined based on services per conception, calving rate and non-return rates.

a. These parameters are affected by the proportion of the cow herd that can be bred, herd health, age profile and replacement percentage of the herd and bull fertility or efficiency of artificial breeding.
b. The research by Taylor & Webb on Santa Gertrudis cattle in Namibia clearly indicates that large farmed cows have lower fertility. A similar study by Visagie & Webb in South Africa confirmed the effect of cow size, but indicated smaller differences in cow size.
c. Suckling significantly decreases re-conception rates in cows and this can be improved by early weaning strategies or calf removal before re-breeding (Escrivao et al., 2009 & 2012).
d. Pre-partum feed supplementation of extensive beef cows had little effect on ovarian activity or re-conception rates (Bayemi et al., 2014a&b), so it is recommended that cattle breeders focus more on achieving optimum pre-partum body condition scores with creep feeding of calves to facilitate early weaning and higher re-conception rates in cows post-partum.

5. Longevity:

Longevity is a measurement that is often neglected, but can be improved by retaining cows in the herd as long as they produce a good calf annually and maintain an acceptable body condition.

6. Beef herd dynamics:

Beef herd dynamics are often neglected in beef herd management, despite the fact that the replacement percentage is as important as the calving or weaning percentage of the beef herd.

a. The ideal replacement percentage for beef cattle in South Africa is ca. 18%.
b. Deviation from this norm will result in a larger or smaller proportion of productive cows, depending on the replacement %, which will adversely affect the cash-flow of the farming operation.
c. Other parameters that may contribute to more efficient beef production include age at first calving, adjusted weight of heifer, weaning weight of calf and scrotal circumference of bulls.

7. Crossbreeding Bonsmara cattle:

Crossbreeding is an aspect that lost popularity in recent years. Indigenous cattle breeds like the Nguni has high potential in crossbreeding programmes in extensive production systems to exploit hybrid vigour for hardiness, adaptability, fertility and added effects on growth and efficiency of crossbred cattle in resource constrained environments. The Nguni Cattle Breeders' Society should seriously consider emphasising previously unique parameters such as tick indexes and scrotal circumference of Nguni breeding stock.

CONCLUSIONS

Selection for size of Nguni cattle should be carefully synchronised with environmental and management factors, to avoid possible adverse effects of large mature size on reproduction efficiency. Cow size can be better synchronised with the production environment by means of selection for faster growth to medium size, early puberty, resulting in early breeding and conception. Early breeding has positive effects on reproductive criteria, by better synchronising frame size with the production environment. Excessive supplementary feeding is not beneficial in terms of sustainable beef cattle production. Reproductive efficiency can be improved by better management of cow body condition, breeding season, weaning methods and herd dynamics. ■

SELECTION FOR SIZE OF NGUNI CATTLE SHOULD BE CAREFULLY SYNCHRONISED WITH ENVIRONMENTAL AND MANAGEMENT FACTORS

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