



Review

Do indigenous Southern African cattle breeds have the right genetics for commercial production of quality meat?

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ABSTRACT

The establishment of cattle breeds which are now indigenous to Africa is believed by historians to be very closely associated with man, his development, migration and specific behaviour from 6000 years BC. Today these breeds compete with exotic breeds in a commercial system driven by global economical principles. Results from various trials are discussed to verify if these breeds can adhere to these principles and compete in the South African beef market to produce quality beef economically. Variation in frame size among indigenous breeds will determine their suitability as feedlot cattle depending on the price and feed margins driving profit in this industry sector. Meat quality analyses indicate small or no differences between indigenous and exotic European/British breeds but with potentially superior quality compared to *Bos indicus* breeds.

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1. Basic principles for quality beef production

Major beef producing countries like the USA and Australia agree that objectives for producing beef for export and local consumption have changed over recent years and are based on two basic principles:

- 1.1 The consumer has to be satisfied while the industry stays competitive with regard to price and profitably in produc-

tion (Morgan et al., 1991; McKenna et al., 2002; Gaden, 2007).

- 1.2 All sectors of the industry must play their part to adhere to the first principle.

Apart from meat safety factors, attributes such as colour, aroma/flavour, juiciness and tenderness are collectively regarded as quality factors involved in a satisfied eating experience. Of these, tenderness is certainly the most important for consumer satisfaction, as witnessed by quality surveys, but is also the most influenced by every link in the supply chain (Morgan et al., 1991; Brooks et al., 2000; Thompson, 2002). Also in South Africa, a recent

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survey by AC Nielson (Unpublished) raised the concern about the effectiveness of the present beef value chain when beef was ranked fourth after chicken, fish and mutton for perception of tenderness.

2. The South African beef industry

Under this section a brief description of how the beef industry operates in South Africa is given to clarify later discussion on beef quality issues. The drive for profit and hence the focus on factors involving profit is, despite the smaller scale in South Africa compared to other major beef producing countries, amplified by the fact that more than 75% (1.35 million carcasses) of beef is produced through feedlots (SAFA, 2008a). This is in comparison with 35% for Australia (Gaden & Bertam, 2007) and much less for countries like Argentina, Brazil and New Zealand that mainly produce beef from natural pasture. More so than in the past, the global feedlot industry is under increasing pressure, due to exceptionally high grain prices, to use cattle types that are heavier at the same or younger age than in the past. For example, the average carcass weight of cattle from South African feedlots increased by 10% (from 226 kg to 250 kg), while both the weaner and carcass prices doubled over the last seven years (SAFA, 2008b). Age at entry into feedlots varies between 7 and 9 months (weaners) or at the most 10–12 months (long weaners). Therefore, as in other feedlot operations, the demand for suitable breeds and maturity types will dictate breeding and production objectives of the weaner calf producers in order to overcome shrinking margins.

The 25% (some sources indicate up to 40%) cattle produced from pasture are slaughtered at 2–4 years (oxen) or as old cull animals. Although a large proportion of South African farming land is suitable for grazing (85%; Anonymous, 2006), factors like inconsistent rainfall, overgrazing and the variation of biomes (from desert to tropical) limit the carrying capacity and therefore also dictate the type of breed used in different regions.

While most of the formal statistics on cattle and meat production exists for the commercial farming sector, a second and third group of farmers are also distinguished, namely communal and emerging farmers. The latter are in the process of entering the larger commercial sector, while the communal farmers are generally regarded as subsistence farmers. According to Olivier (2004), both groups are counted under the 24,000 small commercial farmers providing to local, regional or informal markets. It is reported that this sector own 40% of the cattle in South Africa (5.7 million head), yet has only 10% of the market access (Winter, 2007). While other farming groups are not excluded, communal farmers are often characterized as having lower skills for pasture management practices leading to overgrazing and low quality stock (Bester, Matjuda, Rust, & Fourie, 2001).

3. The origin of indigenous African cattle and their history and role in South Africa

The establishment of cattle breeds which are now indigenous to Africa is believed by historians to be very closely associated with man, his development, migration and specific behaviour from 6000 years BC (Bachmann, 1983). Africa's indigenous cattle are believed to be a variation of crosses between humpless Hamitic long-horn cattle (*Bos taurus*) from Arabia, Zebu cattle from Asia (*Bos indicus*) and possibly humpless shorthorn cattle from Spain. As the migration of man continued southwards, new breeds and types evolved with some predominantly Zebu, such as the Boran, Masai, Sokoto, and others such as the Sanga types (also known as *Bos taurus africanus*; Afrikaner, Nguni, Pedi, Mashona and Tuli) showing genetic markers unique to both *Bos taurus* and *Bos indicus* cattle types (Meyer, 1984). Through the migration of certain human

tribes to southern Africa (San and Sudanic Bantu), Sanga cattle breeds were brought to this region and dominated the cattle population when Europeans arrived during the 15th century (Bachmann, 1983). Natural selection to overcome environmental challenges such as Tsetse fly and East coast fever resulted in an animal type which is anatomically and physiologically adapted to harsh extensive conditions.

At the time the Europeans came to the south point of Africa new agricultural practices were developed and veterinary services were established over the years, less adapted *Bos taurus* breeds were imported for their perceived higher income coupled with better carcass quality (yield, fat distribution). Since the 1970's, when commercial feedlots started in South Africa it became common practice to finish cattle for the market, rather than from grass feeding, later maturing *Bos taurus* breeds became even more popular, to the detriment of indigenous cattle (Bachmann, 1983), which were regarded as inferior and were decimated through government decree (Bester et al., 2001). Another import, the Brahman (*Bos indicus*), was now utilised as a dam or sire line to overcome climatic challenges the *Bos taurus* breeds could not adapt to, and for its vigorous heterosis with taurus breeds. Even in communal areas the mistaken perception of the local breeds' inferiority (especially the Nguni), led to the dilution of the genetic gene pool through replacement and cross breeding with exotic breeds. Fortunately, a number of events took place since the 1940's that arrested the degradation of the indigenous gene pool of the various cattle breeds. The Drakensberger Breed Society was formed in 1947 in South Africa and the Tuli Breed Society formed in 1961 in Zimbabwe. The Bonsmara, a composite indigenous breed originated in the 1940's from 5/8:3/8 combination of the Afrikaner (indigenous) and Shorthorn/Hereford (Bonsma, 1980, breed society established in 1964) to take advantage of the combination of the growth performance, carcass quality, fertility and milkability (mothering ability) of British breeds (which was lacking for the Afrikaner at that stage), and the hardiness of the Sanga. The erosion (through government decree) of other indigenous breeds, such as the Nguni, was turned around by the scientific motivations of Prof Bonsma (Bonsma et al., 1951) with the benefit of a committee appointed in 1985 to report on the desirability of a germ plasm bank for the hardiness of the various Sanga breeds (Hofmeyr, 1994). This gave a resurgence of the Nguni's popularity under commercial breeders that increased exponentially over the last decade. At present 23,298 female animals are registered under the National Beef Recording and Improvement Scheme, only second to the indigenous composite Bonsmara with 52,924 registered female animals (Bergh, Vermaak, Gerhard, & Havenga, 2007). For this reason, carcass and meat quality presented and discussed will mainly focus on the Bonsmara and Nguni. Initiatives such as the Kellogg-Nguni Cattle Project (Muchenje, Dzama, Chimonyo, Raats, & Strydom, 2008), the Beef Profit Partnership funded by Australian centre for international agricultural research (ACIAR) (Winter, 2007; Strydom, Frylinck, Van der Westhuizen, & Burrow, 2008) and Southern African Development Community/FAO/United Nations Development Program (Bester et al., 2001) are focused on the rescue and development of indigenous breeds in the region and the introduction of communal farmers into the mainstream commercial beef supply chain by utilizing indigenous genetics.

Delayed age at puberty (Plasse, Warnick, & Koger, 1968; Cartwright, 1980), lower vigor of newborn calves (Reynolds, DeRouen, Moin, & Koonce, 1980), less intramuscular fat (Huffman, Williams, Hargrove, Johnson, & Marshall, 1990; Whipple et al., 1990) and less tender meat (Crouse, Cundiff, Koch, Koohmaraie, & Seideman, 1989; Wheeler, Savell, Cross, Lunt, & Smith, 1990; Shackelford, Koohmaraie, Miller, Crouse, & Reagan, 1991a) resulting from high percentage Brahman seems to be main reasons for the loss of popularity of this breed in the USA and probably many other countries,

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