SATISFYING THE BEEF INDUSTRY AND ULTIMATELY can the Ngu

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Why do consumers choose beef as the main component of their meal? Or should we perhaps ask do consumers still prefer beef above other foodstuffs? Primarily, they are looking for a satisfying eating experience that is a combination of desirable flavour, juiciness, and tenderness – characteristics that are not necessarily obtained from the other foodstuffs on the plate.

By moving one step back in the production chain (beef is the final step in a long fragmented production chain), we may add affordability, visual appeal in terms of fat, bone and muscle content, fat and muscle colour, safe from pathogens and health-threatening residues to complete the set of demands before the "statement" in the first sentence becomes a reality. On the other side of this ideal scenario, we find the producer (primary or secondary) operating under completely different circumstances with his own set of goals in terms of keeping cattle – the origin of this ideal product. These include mothering ability, adaptability (according to the climatical challenges), inter-calving period, functional efficiency and most important of all a passion for the animal or breed itself,

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not necessarily always a function of the aforementioned. The evidence that the Nguni kept under various environmental circumstances adhere to the above these criteria are well published and well-known.

Without even considering the rest of the production process in the middle of these two endpoints (the animal and meat), it is clear that satisfying the consumer of beef might sound like a simple “natural” process of an animal that is slaughtered to produce meat, but it is probably more complex than many highly technical production processes. Why?

It is simply this: There are very few industries that are so fragmented with so little flow of information along the production line like the red meat industry. This does not need to be a problem if we were working with a simple blueprint where the final product is a function of putting together a number of components to end up with a specific quality product. Meat, the product we eat, is created/manufactured at the point where the sperm and the ovum join to become an embryo. From this point onwards, many of factors within and outside this “perfect” product can affect its development into a commodity that either keeps or improves its original quality or becomes imperfect and not suited for the dinner plate.

Growth performance and carcass yield

As already mentioned, the primary producer has his own operational procedures to ensure an income, very seldom with the final product in mind, because most of the time he has limited knowledge of the specifications for the final product. He might, however, judge the cattle for meat conformation ending up with the perception that bigger animals produce more meat (just as a general example, but not necessarily applying to Nguni breeders). According to facts from Meat and

Livestock Australia, Brahman and Belmont Red carcasses had retail beef yields comparable to Charolais, Herefords, Angus and Shorthorn, despite their smaller size and lower conformation score. Unfortunately, this applies to a completely different production system than our local system, where the potential of the weaner calf to gain carcass weight to such a point where optimum fat levels are reached (4 to 6 mm) and the negative price margin is overcome, largely determines its suitability for feedlot production. In this regard, the Nguni normally falls short of specifications since its potential to reach the average carcass weight popular to the processors (210 kg) as weaner calf is limited (Table 1). Although many different factors play a role in feedlot economics, it is interesting to note that despite its size, the Nguni adapted very well to the feedlot environment in three trials at the ARC-Irene feedlot. Its growth rate due to its size was slightly lower than its heavier counterparts, but its efficiency in weight gain compared well with these other breeds (Table 1) when compared on a basis suitable for local conditions, i.e. the fat level at slaughter. Unfortunately, under local feedlot conditions size influences profit. Most of the time a positive feed margin and negative price margin exist, meaning that a weaner is purchased at a higher cost than the value of its carcass. To turn the negative margin into profit, as much weight needs to be added within fat limits. However, only when weaner prices and feed costs are low and carcass prices are high, can smaller breeds compete with larger breeds (the higher turnover rate of smaller breeds are not considered here). It might be added that it is common practice that feedlotters background smaller animal types on pasture and still benefit from these types in the feedlot. By backgrounding, the initial size/frame of the animal is increased before entering the feedlot, resulting in higher final weights and more opportunity to add weight. In addition, ox producers can benefit from the breed since the size of the carcass after 18 months will suite the market very much. Niche markets for smaller carcasses is also an option, since certain consumers are becoming more sensitive to portion size, preferring smaller more affordable portions (steak size) or quarters (hind- and forequarters).

In the whole process of live animal evaluation, no final judgement can be made on the outcome of palatability or yield. Deciding on the slaughter point of cattle is gained by experience, yet does the producer know if the final product will conform (meat, fat, bone, palatability) with what the consumer regard as value for money? In this regard, and in contrast to general belief, the Nguni compares very favourably with other breeds. Due to its size, it dresses out (carcass weight relative to live weight) lower than larger breeds (Table 2), yet its meat yield is far from inferior to other breeds. In addition, it has been found by many researchers, including in local trials, that smaller breeds tend to have less intermuscular fat (fat between muscle or seam fat) than larger breeds. In the processing of the carcass, intermuscular fat normally goes to waste since it is trimmed off. For that reason, the muscle to bone ratio of the Nguni compares even better to those of the other breeds than the meat to bone ratio that includes seeming fat as meat (Table 2). So, despite the smaller carcass of the Nguni, edible yield relative to the weight of the whole carcass, is far from inferior when compared to larger breeds.

TABLE 1: Growth performance of the Nguni under intensive feeding conditions

Parameter	Nguni	Comparative group[a]
ADG 1[b] kg /day	1.10	1.55
ADG 2[c] kg/day	1.66	1.83
Feed conversion ratio 1 (kg feed per kg gain)	7.36	7.78
Feed conversion ratio 2 (kg feed per kg gain)	5.15	5.32

a Values of the comparative group is a summary of Bonsmara, Santa Gertrudis, Pinzgauer, Braunvieh or a commercial medium frame group of animals

b, c 1 and 2 represent two trials where Nguni were fed together with other breeds or a commercial group of medium frame animals. In Trial 2, a higher energy/higher protein diet was used. Both trials compare the Nguni to the mean values of the

other breeds/animals together and comparisons are made at the same carcass fatness in terms of classification – fat code 2 to 3.

TABLE 2: Carcass characteristics of the Nguni (carcass surface fat or subcutaneous fat % was the same in other words the fat classification was the same)

Parameter	Nguni	Comparative group[a]
Slaughter weight 1	298	440
Slaughter weight 2	336	421
Carcass weight 1	168	255
Carcass weight 2	186	240
Dressing % 1	56.3	57.7
Dressing % 2	55.0	56.8
Carcass composition (yields expressed relative to carcass weight or hindquarter weight -%)		
Meat %[e] 1	79.0	79.7
Muscle %[f] 1	68.5	65.8
Bone % 1	16.4	15.7
Intermuscular fat (seam fat) % 1	10.4	13.7
Trimmed meat % 2 – hindquarter[g]	75.7	75.7
Bone % 2 – hindquarter	16.6	17.4
Trimmed fat % 2 - hindquarter	7.5	6.6

e Meat is defined as muscle with fat between muscles still intact – only subcutaneous fat is removed

f Muscle – all fat is removed

g Only excessive fat is trimmed on each cut of the hindquarter to a standard of ~ 4mm.

Meat quality

It is often believed that eating quality, with emphasis

on meat tenderness, starts and ends with the breed. However, after fattening, the process starts where utmost care is of paramount importance to quality. Very often in a fragmented system, like the meat production process, responsibilities are negotiated to the next link in the production chain without verifying its ability to sustain the inherent quality of the product (animal, carcass, or meat). Just rounding those cattle up and transporting them to the abattoir can negate 12 to 24

months of effort in a matter of hours. Off-loading a naturally stressed animal at abattoirs with poor facilities and poor handling skills increases the problem. Poor slaughter facilities and lack of skills continue this process so that the final product is not what the final link in the chain, the meatpacker or butcher would like to display to his customer. The irony of this all is that the butcher has all the responsibility to satisfy the customer but had the least input into the quality of the final product.

Many of you might say that this is an exaggerated view and far from the truth. And it may be, but this is just to demonstrate to you what can go wrong along the way. What is the solution then? Total quality management. Firstly, we must identify critical control points along the production line. Broadly speaking, there are four categories here, viz.

1. Genetic inputs: the correct combination of genes to ensure a well-adapted animal for a specific production system and environment, but with favourable yield and quality characteristics too (a tall order!)
2. Pre-harvest management: These include a traceable system regarding medicine, feedstuffs, and general management (processing, movement of animals, etc.). In addition, the selection of animals for slaughter, transport and handling pre-slaughter according to specifications.
3. Early post-mortem management: Application of electrical stimulation, chilling regime, hygiene during slaughter and boning.
4. Further post-mortem management: Ageing, packaging, distribution, promotion

Palatability according to most descriptions comprises of tenderness, juiciness, and flavour. Flavour is influenced to a large extent by diet (and some factors after slaughter), while juiciness is mostly a result of correct abattoir and preparation processes. None of these is directly influenced by breed. Provided that all processing effects as described above are equal, small breed differences in tenderness exist (although it is generally accepted that within breed differences could even be larger than between breeds). At the same age

of the animal, breed differences are mostly a function of the potential of the meat to age or to tenderise during post-mortem storage (unfrozen). This process is controlled by different enzyme systems of which the calpain system is one. Calpain is an enzyme acting on the muscle fibre structure post-mortem by breaking down the structure (proteolysis) and thereby increasing tenderness. Calpastatin is an inhibitor, acting against calpain, thereby slowing down the proteolysis. Under controlled conditions of correct pre-slaughter, slaughter and post-slaughter practices, the Nguni showed very favourable shear force values with various trials (Table 3). Shear force is a mechanical method to determine meat tenderness. An Instron machine equipped with a device to mimic the bite and shear action of a consumer is used to measure the force (N or kg) to shear through a standard piece of cooked meat. Higher values indicate tougher meat.

In Trial 1, and another trial not reported here, certain muscle characteristics of different breeds were investigated. According to these trials, the histological and biochemical characteristics of Nguni loin muscle is favourable to produce tender meat (NB: if correct pre-slaughter, slaughter, and post-slaughter management are applied). The amount of fragmentation, which basically describes the effect of enzymes during post-mortem tenderisation (ageing), was higher than that of the comparative group of breeds at 7- and 14-days post-mortem (Table 3). Furthermore, the activity of the inhibitor, calpastatin (slowing down the ageing process), was like that of the Bonsmara, and much lower than those of the Hereford, Simmentaler and Brahman (not in tables). These favourable values support the capacity of its meat to age or tenderise well. According to the literature, muscle fibre types could influence meat tenderness under different conditions. Muscle consists of mainly three fibre types which is categorised according to their contraction speed and energy metabolism. The three categories are slow-twitch oxidative (SO), fast-twitch oxidative glycolytic (FOG) and fast-twitch glycolytic (FG). There is some evidence that larger and more abundant FG fibres are less favourable in terms of meat tenderness than smaller FG fibres and more abundant SO and SOG fibres. In this regard, the Nguni compared favourably with the comparative group.

TABLE 3: Meat quality and muscle characteristics of the Nguni

Parameter	Nguni	Comparative group[a]
Tenderness (shear force or SF in Newton)[h] 1	91	100
Tenderness 2 after 3 days of ageing (SF in kg)	5.4	5.1
Tenderness 2 after 21 days of ageing (SF in kg)	3.3	3.3
Fragmentation index 1 – 7 days post-mortem	136	105
Fragmentation index 1 – 14 day post-mortem	141	116
White fibre size (micron2)	5 130	7 889
White fibre ratio (%)	36.3	40.1

h Higher values in N or kg indicate tougher meat

By no means, this short overview of the meat production process has covered every detail in total quality management, nor was it an attempt to give a full description of the Nguni and its potential in our local industry. The conclusion to be drawn is that every breed has a potential in our industry and certain strong points need to be exploited to the maximum benefit of the breed, while certain shortcomings can most often be cured by applying modern technology (e.g. various abattoir practices), by sensible marketing strategies and common sense. A breed society can never rely on genetics alone and should always remember that the expression of performance and quality most often depends on the management of the environment (feeding, transport, abattoir, etc.).