PERSPEKTIEF OP DIE OORSPRONG VAN DIE TULI BEESRAS EN SY TOEKOMSTIGE ROL IN VLEISPRODUKSIE

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Die nuutste navorsing bevestig dat die huidige Afrika-beeste uit drie verskillende gebeurtenisse ontstaan het. Die eerste een is die domestikasie vanaf Asië langs die Nylvallei en verder deur Egipte. Die tweede domestikasie gebeurtenis het deur die "horing" van Afrika of van die Ooskus na Madagaskar plaasgevind. Die derde teorie beweer dat daar ook domestikasie binne die Afrika-kontinent plaasgevind het en daarom is die middelpunt van oorsprong van die primitiewe Sanga-beeste waarskynlik Oos-Afrika.

Antieke mense het vanuit Egipte deur Afrika migreer en soos hulle handel gedryf het langs die ooskus van Afrika met Indië, het nuwe beesgenotipes ontwikkel. Vandag kan Afrika-beeste geklassifiseer word in drie hoofgroepe: *African B. Taurus, B. Indicus* en Sanga-tipes (Afrika skoflose *Bos-Taurus* x geskofte *Bos indicus*). Afrika taurus-beeste is wyd versprei dwarsdeur Wes- en Sentraal-Afrika en word verdeel in lang-horing (*B. Taurus longifrons*) en kort-horing (*B. Taurus brachyceros*). Indicus beeste word hoofsaaklik in die oostelike en droë dele van Wes-Afrika aangetref, terwyl die Sanga-rasse hoofsaaklik in oostelike en suidelike Afrika voorkom.

Studies op die Y-chromosoom en DNA-studies dui daarop dat die infusie van Zebu genotipes op die Afrika-kontinent hoofsaaklik deur manlike diere was. Dit is ook belangrik om daarop te let dat alle Afrika-beeste taurus mitochondriale DNA dra, wat aandui dat daar geen suiwer Zebubeeste (*B. indicus*) op die vasteland van Afrika is nie.

'n Belangrike waarneming is dat Sanga-beeste in suider-Afrika, suid van die Trypanosomiase-strook (Figuur 1), 'n metasentriese Y-chromosoom het wat ooreenstem met dié van *B. Taurus,* terwyl Sanga-beeste, wat tans noord van die Trypanosomiase-strook voorkom, ook die akrocentriese Y-chromosoom van Zebu (*B. indicus*) tipes vertoon. Die Zebu is vatbaar vir trysanosomiase wat deur die tsetsevlieg versprei word, en dit word gepostuleer dat die Zebu-genotipes uit die beeste ge-elimineer is soos wat hulle suid gemigreer het.

Figuur 1: Historiese verspreiding die tsetsevlieg in Afrika (FAO, 1999)

Die hedendaagse suider-Afrikaanse Sanga-beeste, soos die Tuli, kan beskryf word as taurus tropiese aangepaste genotipes, wat hulle uniek maak. Dit maak 'n ras soos die Tuli uiters geskik vir kruistelimg of the ontwikkeling van komposiet rasse. Volgens navorsing in Australië styg die bruto marge met sowat 52 Australiese dollar per diere-eenheid (ekvivalent van ons GVE) met die toevoeging van Sangagene.

Die gebruik van die unieke eienskappe van 'n inheemse ras, soos die Tuli, **in kruisteling en die ontwikkeling van alternatiewe produksiestelsels** sal baie meer aandag moet geniet, indien die huidige produksie vlakke gehandhaaf of selfs uitgebrei moet word ten spyte van die dreigende klimaatsveranderings.

Onder kommersiële boerdery toestande en gemiddelde bestuursvlakke, maar met ongunstige toestande en relatiewe lae vlakke van voeding, mag terminale kruisteling met kleiner koeie daarin slaag om die uitset van vleisbees boerdery te verhoog. Dit word toegeskryf aan die toename in doeltreffendheid van produksie weens die laer inname en onderhoudsbehoeftes van kleiner koeie. Vir die opkomende boer is dit nog meer belangrik.

In teenstelling met rotasie kruising plaas terminale kruisteling geen addisionele las op bestuurspraktyke nie. **Dit behels slegs dat die bulle van die vader- en moederlyn rasse in die verlangde proporsie met die koeie gepaar moet word.** Die koeie wat met die verskillende bulrasse gepaar word kan selfs as een kudde bestuur word gedurende die teelseisoen. Alle kruisnageslag sowel as die suiwer geteelde bulnageslag moet egter geslag word.

Belangrike eienskappe vir moederlyne is daardie eienskappe wat met reproduksie en koei onderhoud geassosieer is. Sulke vroulike diere moet aangepas en gehard wees, lae onderhoud vereis (klein in grootte), maklik kalf, gemiddelde melkproduksie en 'n lang reproduktiewe lewe hê. **Dit is belangrik om daarop te let dat die voordele van terminale kruisteling nie in die hoër groeitempos per se lê nie.** Die voordeel van terminale kruisteling hang af van die mate waartoe die gewig van die slagdiere toeneem, relatief tot die gewig van die moeder of teeldier. 'n Ander unieke voordeel van die Tuli is dat dit 'n natuurlike poenskop is. Met die druk van dierewelsyn-groepe gaan dit in die toekoms al hoe meer belangrik word.

Vleiskwaliteit word belangriker aangesien verbruikers wêreldwyd aandring op konsekwente hoë kwaliteit vleis. Dit is waar dat sekere rasse sagter vleis as ander het. Gelukkig het die Sanga-beeste (Afrikaner, Bonsmara, Nguni, Tuli) van suider-Afrika almal baie sagte vleis.

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HEAT STRESS

The Tuli can relieve the effect of heat stress in beef cattle

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Ambient temperature is the factor which has the biggest direct effect on livestock production. The majority of ruminants perform at their best at temperatures between 4° and 24°C. In the tropics and sub-tropics the temperatures frequently rise above this comfortable temperature and therefore it is important that animals are adapted to these higher temperatures.

Maximum daily temperature is not the biggest problem, but if the night temperatures do not drop below 20°C, the non-adapted animals will suffer from tropical degeneration. High temperatures and solar radiation decreases intake in order to reduce digestive heat production, and reduce 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).

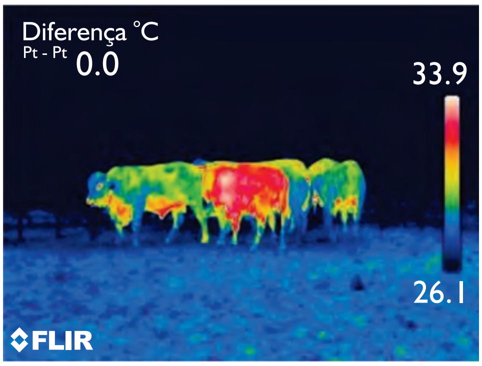
Nutritional stress has the largest indirect effect on the grazing animal in the tropics and sub-tropics. In these environments, natural pasture has both lower nutritional value and lower tiller density than in temperate regions. As a result, climate change will have the greatest impact on ruminant species.

Livestock in the southern African countries will need to adapt to higher ambient temperatures, lower nutritional value of the grass in some cases, and expansion of diseases, especially ticks and tick borne diseases as a result of warmer climates. With such challenges, matching genotypes with production environments will become crucial, requiring the utilization of diverse genetic resources with the appropriate genetic potential for growth, milk production, resistance to disease and fertility. The Tuli breed can play an important role in this regard.

Heat stress is a common cause of ineffective reproduction in mammals. The quality of semen decreases when bulls are continually exposed to high ambient temperatures. It decreases sperm concentration, lowers sperm motility and increases percentage of morphologically abnormal sperm in an ejaculate. After a period of heat stress, semen quality does not return to normal for approximately eight weeks because of the length of the spermatic cycle, adding to the carry-over effect of heat stress on reproduction.

If bulls cannot increase the rate of heat loss from the body when they are exposed to elevated ambient temperatures, semen quality and potential fertility is therefore reduced. It is important to note that in the South African beef production programs, eight weeks is crucial for resumption of normal semen production after bulls are exposed to elevated ambient temperatures that cause heat stress, especially where fixed summer mating seasons are practised.

But what are the recommendations for the farmer in view of the negative effect of high temperatures on bull fertility? One is tempted to suggest that the bulls must be kept cool before the breeding season, but this is not practical. A more practical approach would have been for farmers to re-do fertility testing / semen evaluation since the tests that were done prior to the mating season, may not be applicable at the start of the mating season. One can also consider using multi-sire mating, where at least a percentage of the bulls used, are from genotypes which are more heat tolerant, like the Tuli. It may even be an advantage to use, for example, only Tuli bulls during periods or years where very high temperatures are predicted. With global warming this will be occurring more often.



This infrared photo of a group of cattle clearly shows that some cattle can handle heat better than others. The animal that appears predominantly red, is suffering from heat stress and will struggle to adapt to warmer climates. (Photo: Prof. Connie McManus, Brazil).

ZAMBIA
TULIVUKA

Reporting from the Tuli Vuka desk in Zambia once again it must be said that despite the tough economic conditions prevailing in Zambia for the beef industry, like so many of the other livestock divisions (dairy, pigs, poultry) the Tuli breeders are pressing ahead with a vision to make an impact on the industry as a whole.

Yes! it must be said that since the first of many waves of genetic Tuli stock been imported over the last six years the breed has certainly created an interest amongst the commercial cattle breeders as well as the traditional communal farmers and like I have reported in previous years, the significant Tuli crossbred steers in feedlots and breeding heifers entering the commercial herds is beginning to be seen. It remains to be seen how they perform as crossbred stock in both feedlot and as breeding stock for the beef industry.

Stud/purebred breeders will have to be strict with their selections and not be lured into just supplying "bulls" to satisfy demand because if we produce mediocre to poor specimens just because they have a pedigree inheritance as a result of their parentage will cause great harm to the breed in the medium to long term future. Strict selection by 'eye' and correct measuring protocols should be the utmost in every stud breeders mind, policy and standard to stay the course if they are to make an impact long lasting for generations to come.

The pool of female genetics is small in Zambia and like any country starting out with a new breed will have to expand with the upgrading system but I advocate that not any female of another breed or mix of breed be used in order to begin the process of increasing the female Tuli herd of genetic pool expansion, rather select from the indigenous gene pool and known Sanga breeds. Also that a five generation upgrade be used with proven stud bulls by natural or A.I. service with the strictest selection imposed on these animals, especially with pressure of breeding high fertility demands on these animals. The late Len Harvey when he set out to breed an indigenous breed primarily to improve the communal cattle stock from whence he sourced his breeding stock, he put pressure on the females in that heifers had to breed at 18/24 months, wean a good calf and calve again the next summer season, otherwise it was culled. Stud bulls were adjudged by twenty-two of their progeny in their first year of breeding at two years of age of which nineteen of the progeny had to meet the selection criteria at weaning. Back in the '40s and '50s there were no computers and beef performance programs so Len Harvey devised a simple system of what the animal should look like and then a high pressure performance selection as described above. A question I have to fellow Tuli breeders here in Zambia and in the region – are we to be strict on our selection as was the founder of the breed and more so with the 'tools' we have to hand to insure the Tuli stays the course to make an everlasting impact on the beef industry?

It is extremely costly importing stock from our southern neighbours and as I have reported before it takes anything from eighteen months to two plus years for the animals to adapt to the sourveld (low octane veld) of Zambia and numerous tick and fly borne diseases that the animals have to encounter, therefore the stud breeders as much as they would like to import more breeding stock are reluctant and financially limited, especially as the Zambian currency devalued by 100% to the US dollar. The devaluation has caused the beef industry to be "stone walled" and will continue to be retarded in its expansion as inputs have doubled in price but the producer price for stock both long weaners and finished ready for slaughter has remained pre-currency devaluation. Only innovative ways of increasing carrying capacity with improved pastures, etc. will see the beef producer remain in business and hopefully the hardiness and fertile Tuli will be able to contribute to the commercial beef breeder in his/her endeavour to keep producing beef for the consumer.

The best is yet to come!

Chris Rogers.

SELECTING COW:CALF RATIO

SENSIBLE OR NOT?

by Japie van der Westhuizen:
SA Stud Book and
Animal Improvement Association

Since the calf to cow weight ratio is dependent on weights of two different animals it is essential to look deeper into the factors influencing them.

It has gone as far as some people using differences in these ratios among breeds and herds within breeds to compare differences in efficiency of cow herds. A critical first step should be to proof the objectivity or even defining the trait, prior to linking it to higher (or lower) efficiency. It therefore warrants considering the trait definition first. In general, the trait is described by means of a percentage or proportion of the calf weight (at weaning) in relation to that of the dam (recorded at the same time).

UNDERSTANDING THE DYNAMICS OF COW AND CALF WEIGHT CHANGES DURING THE SUCKLING PHASE.

Since the calf to cow weight ratio is dependent on weights of two different animals it is essential to look deeper into the factors influencing them.

It is well known that the weight of the suckling calf is mainly influenced by:

- the birth weight (especially at a very young age),
- the effect of the dam's maternal environment, mainly due to quantity and quality of her milk, and
- the own ability of the calf to grow. These factors are furthermore obviously influenced by environmental factors that might impact on any of them.

Environment can furthermore be defined as the total environment, namely physical, farm, season, camp, treatment, feeding regime and others. Although the expectancy is that the calf will follow a typical growth curve as part of its response to the nutrition it receives from the dam and from other sources, **the dam's weight change during suckling is the added dynamic in assessing the ratio of calf to dam weight.**

The expected cow weight changes can be linked to the **days in milk after the birth of the calf.** Initially there will be a weight loss as the expectant feed intake will not make up for the energy drainage due to milk production. After peak milk production (60 – 120 days in milk) the expectancy will be that the dam will start picking up weight (obviously given the environmental constraints). These expected weight changes in the cow and calf have serious implications for the way that "Cow Efficiency" is defined.

BODY WEIGHT, WHAT IS IT TELLING US ABOUT EFFICIENCIES AND CAN WE SIMPLY DIVIDE BY THE ACTUAL BODY WEIGHT WHEN COMPARING DAMS?

It is well established that body weight is a major indicator of the maintenance requirement of an animal. It is, however, not as simple as is sometimes being perceived. Not only is the relationship between body weight and maintenance requirement **not a one-to-one** relationship (the maintenance requirements of a 700 Kg animal is not twice that of a 350Kg animal) but the state and function of the animal will also influence the real maintenance needs (eg. a lactating or animal gaining weight will have a different maintenance requirement compared to the requirements of others). **Maintenance** is also sometimes defined differently and individual animals also differ (within species or breed) in terms of these needs. In essence, the intake of feed (especially the energy intake) determines the level that the animal will be comfortable with to maintain basic body functions (basal metabolism), being able to adapt to the environmental conditions (extra need to maintain core body temperature, walk to feed and water, deal with parasites, etc.) and being able to take in above maintenance to perform in such a manner to be profitable (needs for reproduction, milk production and growth or increase in body fat).

What is this telling us?

Although live **body weight** is the prime indicator for maintenance requirements and therefore points to the basic feed intake needed to be productive, **other factors** also need to be considered. Furthermore, the accepted role that body weight should play should be linked to a descriptor of maintenance requirements such as comparing animals based on their "metabolic weights", rather than actual weights.

The most accepted norm for this is body weight raised to the power of 0.75. In the mentioned example the metabolic weights of the 700 Kg and 350Kg cows will be (7000.75 and 3500.75) 136Kg and 81Kg, respectively. Given that a cow needs a certain amount of energy daily, based on her metabolic weight and that has to be maintained over the total period while suckling her calf, the perceived maintenance needs and the needs based on metabolic weight therefore differs tremendously. Figure 1 shows the relative comparison of the energy intake needs of a beef cow, weighing 480Kg and suckling her calf for 205 days, firstly based on the wrongly perceived idea that body weight is the indicator versus the more correct metabolic weight indicator.

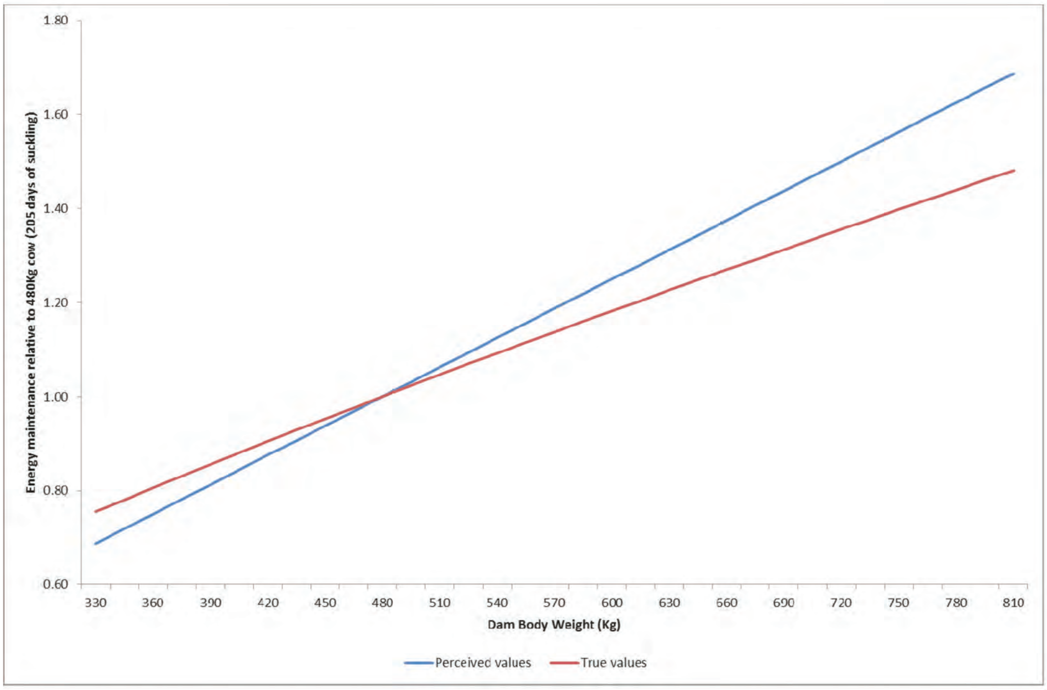


Figure 1. Energy intake needed for maintenance of a 480 Kg beef cow while suckling a calf for 205 days. Comparing two methods of calculation. Relative values.

The **big message** of Figure 1 is that all energy requirements of cows heavier than the (example) 480Kg cow are over-estimated by the assumptions based on actual body weight. All lighter cows are under-estimated, using true body weight.

The implications of these wrong assumptions are that light dams are unfairly favoured in the simple way of comparing cows for 'cow efficiency' based on 205 days weight of calves divided by their dam's true weight.

COW WEIGHT CHANGES DURING THE SUCKLING PHASE AND THE IMPACT ON COW EFFICIENCY ASSUMPTIONS. WHAT IS REALISTIC?

It is also well known that cows will lose weight during early lactation. This is mainly due to the known lactation curve causing dams to be in a negative energy status as they are unable to take in enough energy to make up for the loss due to milk production. This is even worse in drier years (or where rainy season started late) and for young females that have not yet reached maturity.

Generally, the weight of dams at weaning of their calves are used as indicators of 'cow efficiency'. The assumption is therefore that these dams will be in the same body condition state when compared for their efficiencies. Although the age of the calf is considered in the calculation, the days in milk (and its effect on the dam's weight) will not be considered. If it if furthermore given that it could be normal practice to weigh weaners between 150 and 270 days of age (according to the Logix Beef guidelines), the young calves get credit for growth to 205 days whilst the older ones will be discriminated against, when calculation 'cow efficiency' of their dams.

> The implications of these wrong assumptions are that light dams are unfairly favoured in the simple way of comparing cows for 'cow efficiency' based on 205 days weight of calves divided by their dam's true weight.

Figure 2 is an attempt to show three different scenarios, namely a calf weighed at 150 (Scenario 1), 205 (Scenario 2) and 270 (Scenario 3) days of age (same calf, same dam) and where these calculations were used in the dam's efficiency measurements based on the corrected calf weights and her own body weight.

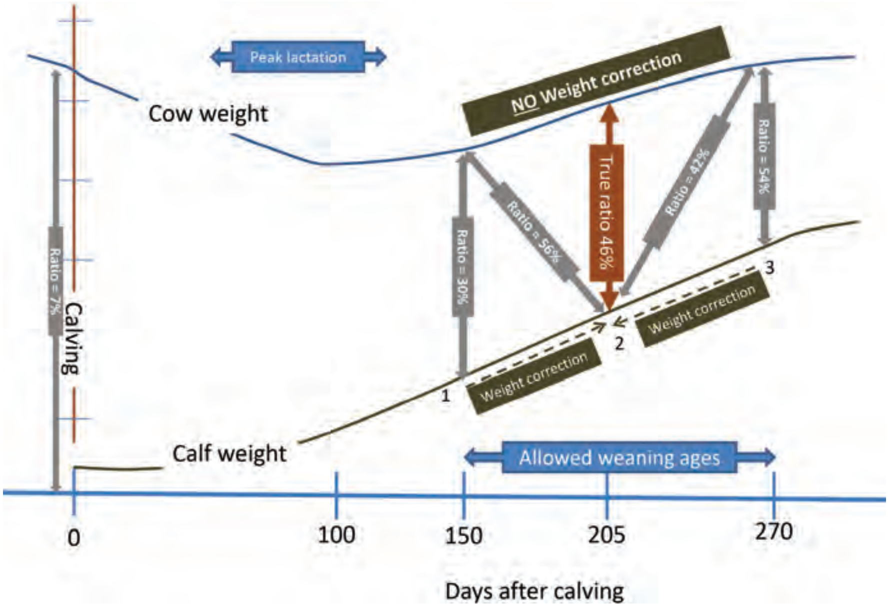


Figure 2. Changes in body weight of a typical dam, her suckling calf and the resultant ratios obtained when calculating the perceived 'cow efficiency' at different ages of the calf.

Figure 2 depicts the expected change in body weight of the dam from about 500Kg to a low of 450Kg at her peak milk production (losing a few body condition score points) and then gradually recovering. The calf weight approximately 7% of its dam at birth and exactly 46% at 205 days of age (as is depicted in Scenario 2). If, for some reason, the calf's weight at 150 days (Scenario 1) was used in the calculation, the resultant calculated ratio would have been 56%. The other side of the coin is the discrimination against a dam where her calf was weaned at 270 days of age (Scenario 3), resulting in a ratio of only 42%. Allowance for the changes in the body weight of the dam and calf weights at the given ages, would have resulted in ratios of 30%, 46% and 54%, respectively.

These examples show the futility of considering the calf to cow body weight ratios as dam efficiencies where calves were weighed at different ages and changes in cow weights during lactation nor body condition were not accounted for.

Even in the cases where the dam's metabolic body weight (body weight 0.75) is considered, these ratios also change, merely because of the age of the calf at recording. Figure 2, depicts the same three scenarios but where the metabolic weight of the dam is used in the calculation.

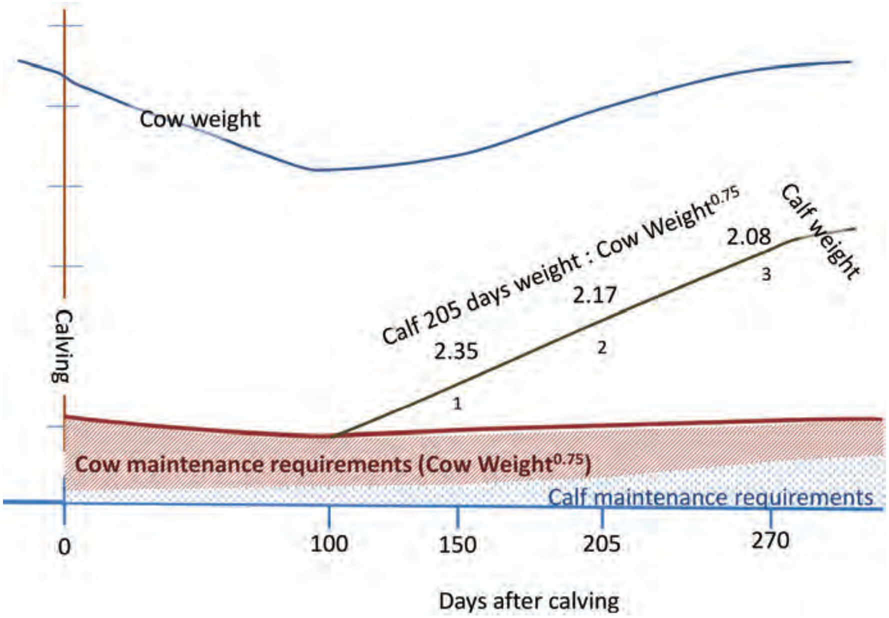


Figure 3. Changes in the maintenance requirements of the dam, her calf and the ratios of calf weight on dam metabolic weight recorded at 150, 205 and 270 days of age of the calf, respectively.

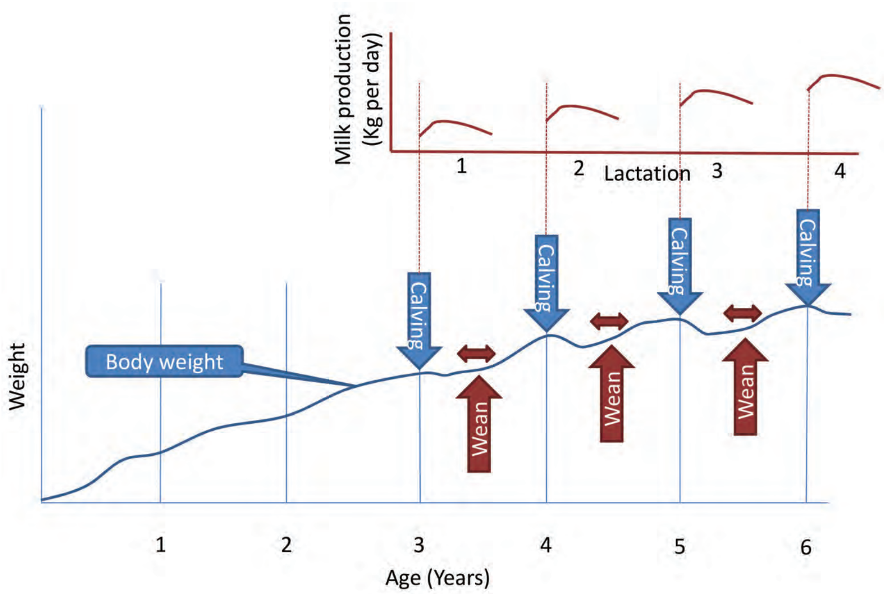
ARE OLDER DAMS LESS EFFICIENT? AGE OF THE DAM, A FURTHER COMPLICATION.

One of the severe limitations of using straight forward **phenotypic** (recording on animals) measurements is the (perceived) assumption that they reflect the differences in genetic merit amongst animals.

This is not true as it is well established that variations in measurements among animals are also mainly caused by their responses on the effect the environmental differences. Even if animals differ genetically, these genetic differences are of little value if they do not reflect performance differences in their offspring. For these reasons methodology was developed to predict the genetic merit of individual animals based on their phenotypic recordings relative to their contemporaries (other animals that are subjected to exactly the same environmental factors, such as birth place, year and season of birth, treatment, etc.), the part of the differences that can be ascribed to genetic merit that can be transferred to offspring (also defined as the heritability of such a trait) and comparing the phenotypic recordings of sibs of all animals in terms of their respective contemporaries. **These** BLUP breeding values therefore assist in comparing all animals on equal footing.

To return to the **pitfalls** of using phenotypic measurements in comparing cows for 'cow efficiency'. The **cow** weight **changes** as well as her **milk production** during each parity are depicted in **Figure 4.**

Figure 4. Changes in body weight and milk production of a beef cow during the first four parities.



Based on Figure 4, Figure 5 gives an example where the same cow is compared for 'cow efficiency' over the first three parities. Given that she calved the first time between two and three years of age, it is well known that she will only reach mature weight at the age of five to six years. The expectancy will be that her body weight (at a given body condition) will still increase as she becomes older. It is also known that generally calf weaning weights will also increase as a dam's milk production increases towards maturity. The three scenarios in Figures 4 and 5 depict the cases where the same cow weans calves during her first three parities and all weights were recorded when these calves were 205 days of age.

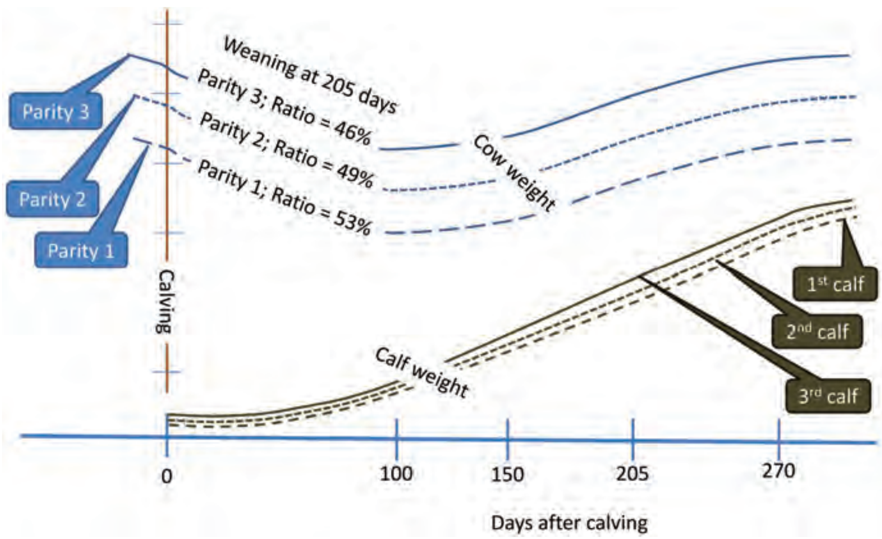


Figure 5. Calf:Cow weight ratios at 205 days calf age in the first three parities of the same cow.

As can be seen from **Figure 5,** differences in ratios are likely due to changes in the expected body weights of dams and their calves due to the age of these dams at calving.

Due to these differences, phenotypic ratios of 205 days of age calf to cow body weight are of little value when comparing the differences in 'efficiencies' among dams.

SOME MORE COMPLICATIONS

Although some of the major complications of using the calf to dam's body weight in the calculation of cow efficiencies were described, even **more factors contribute towards wrong assumptions when a simple division of two weights are used.**

These include:

- **Sex of the calf.** Bull calves are heavier at weaning (and birth) than females. Differences can not be linked to efficiency of the dam.
- **During the first 100 days or so,** the calf is basically a monogastric that gradually changes into a ruminant. Young calves therefore rely purely on their dam's milk whereas older ones must rely on their intake of other feed (mostly grass). Irrespective therefore of the age effect at weight recording, as described earlier, this furthermore complicates efficiency comparisons among cows. Figure 6 depicts the effects of the dam and the calf's own growth ability on the calf's weight. Even after the calf is weaned, the dam's contribution can be seen as a 'carry over effect'.

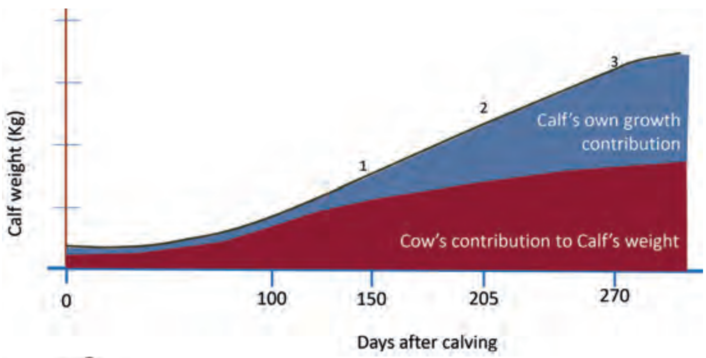


Figure 6. The contribution of the dam and the calf's own ability on the calf's weight change during suckling.

- Ratio values are complicated. The 'cow efficiency' definitions usually work with the division of one value by another. Generally, the 'winner' in terms of the biggest contribution towards differences among animals (their ranking), will be the factor with the biggest variation. This is illustrated in Figure 7.

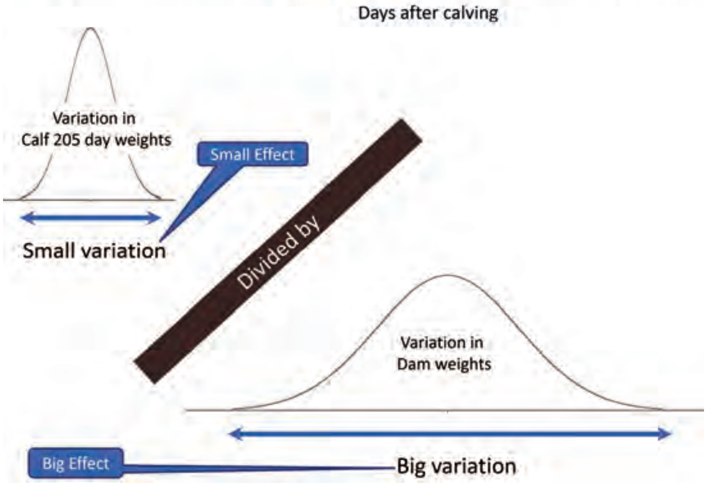


Figure 7. The impact of dividing with cow weight in differing body weight variations in 205 days calf weights and cow weights.

This implies that 'cow' efficiency values will, in the biggest majority of cases, simply favour dams with lower body weights. Given the earlier descriptions, this is not always true.

- Real efficiencies are driven by reproduction efficiency. **Basically, the biggest loss in terms of maintenance will be barren cows.** They are still consuming feed to maintain themselves without producing any products. Simple differences in calf to cow weight ratios can not make up for these losses.

COMBINED SELECTION INDICES, THE BETTER SOLUTION.

Although outside the scope of this article, the combination of traits contributing towards profit and loss in beef production included in a selection index is a much better solution to distinguish between the efficiency levels of different cows. The logix Beef COW VALUE is such an index. It uses BLUP breeding values of beef cattle in combination with the relative economic value of the included traits to predict the genetic merit of cows and bulls to produce efficient offspring. Values are basically expressed in Kg or Rand per Hectare.

Given the pitfalls of using simple ratios in determining 'cow efficiency', the use of the defined property should be discouraged. There are more **appropriate** and more accurate (and therefore safer) measures to be used for this purpose. ■