SELECTING for *Feed Efficiency* to improve PROFITABILITY

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Selecting for increased production in beef cattle is often seen to be the best strategy. However, simply increasing outputs does not guarantee higher profitability. While outputs correlate with income, profitability also depends on efficiency and therefore inputs should be managed as well.

To optimize profitability, the focus should shift towards selecting animals that can convert feed into meat more effectively, rather than solely prioritizing maximum weight and growth. Research suggests that a 5% improvement in feed efficiency can yield an economic benefit four times greater than a comparable improvement in growth. Given that feed costs can account for up to two-thirds of beef cattle farming expenses, enhancing feed efficiency is a critical strategy. This consideration applies not only to feedlot animals but also to the cow herd, which typically consumes over 70% of feed throughout the year.

Understanding Feed Efficiency

Some animals have the genetic ability to utilize nutrients more effectively, thereby achieving better growth with a lower feed intake. Therefore, correctly identifying and then propagating the genetics of outstanding animals within the breed is crucial. However, accurately measuring feed intake in veld conditions—particularly for cows—poses significant challenges. To facilitate this, growth and feed intake are measured on young

bulls during specialized Phase C growth tests. This information is then used in genetic evaluation to estimate breeding values for the efficiency traits FCR (Feed Conversion Ratio) and RFI (Residual Feed Intake). Feed efficiency is therefore the genetic selection criteria that can be used to also breed feed-efficient cows on the veld.

Measuring Feed Efficiency

Accurate assessment of feed efficiency necessitates both growth and individual feed intake measurements. Potential breeding bulls is assessed through Phase C growth tests carried out in controlled environments with standardized growth rations at accredited testing stations nationwide. Minimum requirements involve a group of at least three—but ideally more—calves of the same breed, that are the offspring of at least 2 registered bulls. These animals, aged between 5 to 9 months old, should not differ by more than 100 days in age or 50 kg in weight. The standard duration for Phase C tests is 84 days (12 weeks), with weekly weighing of animals.

During these tests, each bull's feed intake is recorded using specialized equipment, allowing for precise measurement of feed efficiency. The average Feed Conversion Ratio (FCR) for all animals on test should be between 5 and 6, and the Average Daily Gain (ADG) should be in the range of 1.6 to 1.8 kg/day, aligned with breed averages. Additional measurements, including weight, scrotal circumference, shoulder height, and body length, are collected upon test completion, while carcass trait measurements through ultrasonic (RTU) techniques and skin thickness are optional. These results are processed and are used by breeders to select breeding bulls for the next generation.

The growth trait Average Daily Gain (ADG) which indicates kg weight increase per day, and the two feed efficiency traits FCR (Feed Conversion Ratio) which quantifies the amount of feed consumed per kg of weight gain as well as Residual Feed Intake (RFI) which indicate the difference between an animal's actual feed intake and its expected intake based on body weight and growth rate, are calculated. For both FCR and RFI, lower values are preferable, as they denote animals that require less feed to gain weight.

Results are presented in units of measurement as well as a phenotypic index, which simplistically ranks the animals and is used for inspection purposes. Phenotypic indices are relative to a baseline of 100, calculated based on a 10-year rolling average per breed and test centre at ARC test centres, or against contemporary group averages at the SA Stud Book test centres.

Example: Selecting for Feed Efficiency

An illustrative example of using feed efficiency data to select young breeding bulls can be drawn from a Phase C growth test conducted on Santa Gertrudis bulls at the ARC's Glen Test Station from July 17 to October 9, 2025. This group consisted of 18 bulls from 12 sires and 7 breeders, all aged between 6 to 9 months at the start of the test, with a maximum age difference of 76 days. Prior to testing, the bulls underwent an adjustment period on the same ration planned for the growth test, allowing rumen microbes to adapt. After two months of adaptation, when the bulls were gaining weight, the official growth test started.

The relationship between the measurements and phenotypic index, as illustrated in Figures

1 and 2, shows a near perfect correlation, as the phenotypic index ranks only one specific trait as measured in this specific test group. Given that

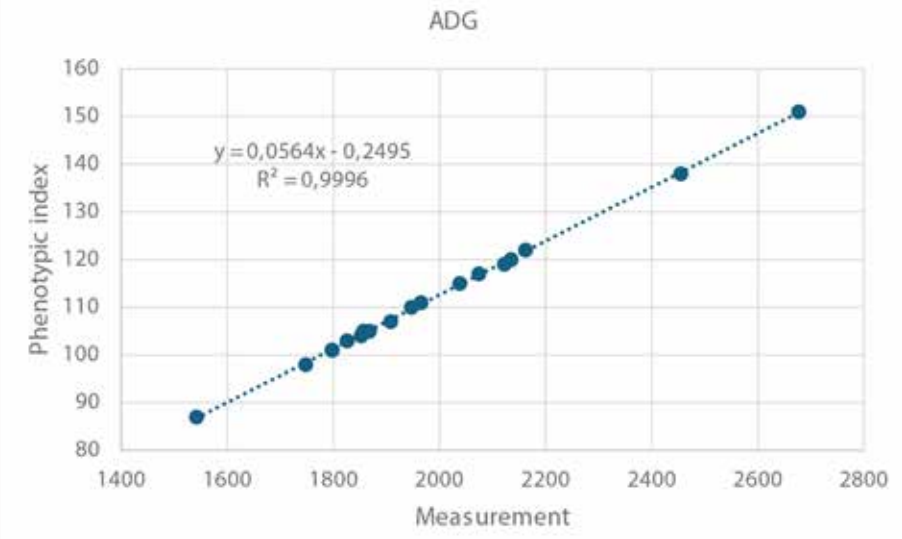

Figure 1: The phenotypic index ranks the animal based on their measurements.

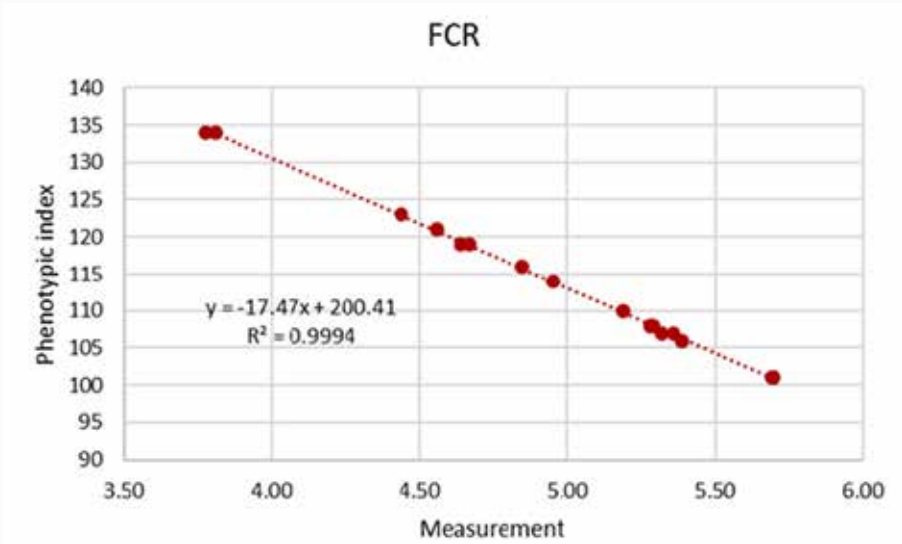

Figure 2: Lower values for FCR and RFI is preferable, as it indicates that the animal ate less to gain weight.

the phenotypic index at ARC test centres is anchored to a 10-year rolling average, most animals had ADG and FCR indices above 100.

In contrast, breeding value estimation incorporates a broader range of information, including genomic information, necessary corrections, genetically correlated traits measured for the individual bull, and data on his family members. GEBVs are expressed relative to the average genetic level of the live animals in the breed. As a result, some re-ranking occurs when comparing phenotypic measurements or indices with the genomic estimated breeding values (GEBVs) for Average Daily Gain (ADG), Residual Feed Intake (RFI), and Feed Conversion Ratio (FCR) (see Figures 3a, 3b, and 3c). Although the correlations between phenotypic indices and GEBVs are around 75% in this test, selection based on breeding values will be more accurate. Female relatives of these bulls can also be selected on GEBVs.

Figure 3 a, b & c: Added information from other traits as well as family performance is used to estimate GEBVs, which changed the ranking for some animals.

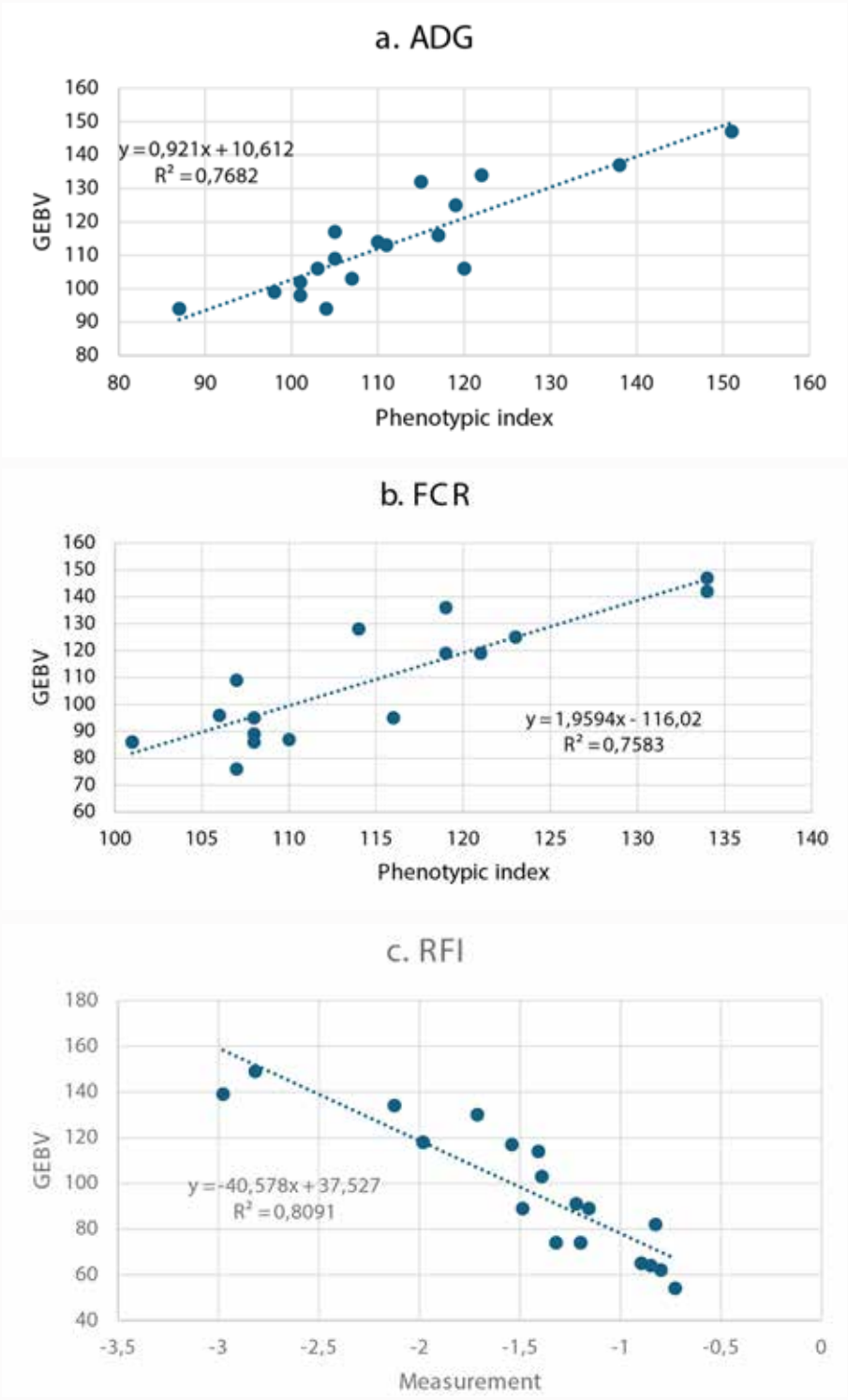

Figure 4 displays the GEBVs for ADG, FCR, and RFI for each bull evaluated in the test. Bulls 1 to 7 are identified as genetically superior, exhibiting both high growth capacity and feed efficiency, as all GEBVs are above the breed average (100). While all 18 bulls in this test demonstrate sufficient genetic ability for growth, evidenced by ADG GEBVs greater than 90, not all exhibit the same degree of feed efficiency.

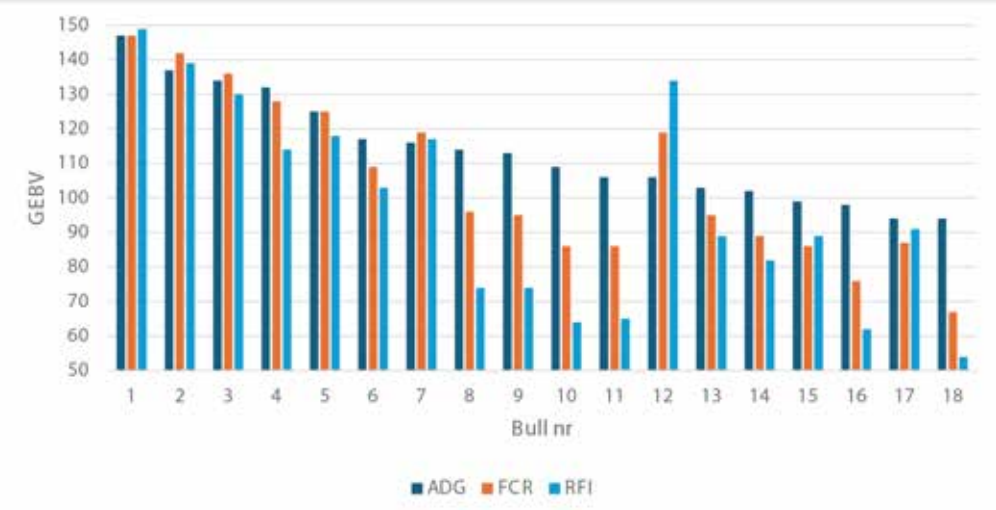

Figure 4: Although all 18 bulls in the growth test had GEBVs for ADG >90, which is acceptable GEBVs for growth, a third of them had both efficiency GEBVs below 90, which is generally considered to be too low.

Consider the cases of Bulls 11 and 12, both with identical genetic growth potential (GEBV ADG = 106). However, their efficiencies differ significantly: Bull 11 has GEBVs of 86 for FCR and 65 for RFI, indicating he requires a substantial amount of feed to achieve his growth. In contrast, Bull 12 shows superior breeding values of 116 for FCR and 134 for RFI, revealing that his feed intake is well below what would be expected for his growth. Thus, Bull 12 stands out as the better candidate of the two for breeding, specifically concerning feed efficiency.

As these values are GEBVs, the performance of Bull 12 is corroborated by the performance of family members. Although most bulls in this test exhibit a strong genetic ability for both growth and feed efficiency, a significant proportion—about one-third—demonstrated efficiency GEBVs below 90. This underscores the critical need to incorporate feed efficiency trait measurements into selection practices, ensuring that only the most efficient breeding stock is chosen, thereby maximizing the potential for profitability and sustainability within beef production.

Conclusion

It is important to select for feed efficiency in beef cattle breeding instead of merely focusing on maximum weight and growth. Feed efficiency can lead to greater profitability, especially considering the high costs associated with feeding cattle, which can represent up to two-thirds of beef production costs. To measure feed efficiency, growth and individual feed intake are evaluated in controlled Phase C growth tests. The tests provide valuable data on traits like Average Daily Gain (ADG), Feed Conversion Ratio (FCR), and Residual Feed Intake (RFI). This allows breeders to make informed decisions and select for animals that present the best potential for efficient production, reducing feeding costs and increasing overall profitability of beef production.