

Selection for CARCASS TRAITS

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INTRODUCTION

In South Africa most beef calves are rounded off in feedlots. Carcass weight and fat cover are therefore important factors in determining profit per animal. These traits are under genetic control and can therefore be successfully selected

for, provided that it is accurately measurable on a live animal. Carcass data was historically collected with progeny testing, where a potential stud bull's calves were placed in a feedlot and carcass and meat quality traits were measured on the carcasses of the offspring. This is however a very expensive and slow way of evaluating bulls, resulting in only a few bulls' genetic ability for carcass traits being measured.

RTU (Real Time Ultrasound) scanning is currently the most common method used worldwide to measure carcass traits on live cattle. The traits that are measured using RTU scanning include EMA, which is the eye muscle area of the longissimus dorsi (ribeye) muscle; subcutaneous fat thickness and marbling (intramuscular fat). These traits are measured on the back of the animal between the 12th and 13th ribs. Rump fat thickness is also measured.



FIGURE 1 & 2: RTU (Real Time Ultrasound) scanning

One of the advantages of the accurate measurement of carcass traits on live animals is that many more animals can be measured, thereby improving selection accuracy and thus genetic progress. RTU scanning is relatively inexpensive

and the device is easily transportable even to remote farms. There is also no radiation involved and animals do not need to be sedated. However, RTU scanning cannot directly measure meat tenderness. Meat tenderness is considered the

most important quality challenge for the beef industry, as it plays a key role in consumer satisfaction. Meat tenderness is objectively measured with a Warner-Bratzler apparatus as the force needed to cut through a sample of meat. Meat tenderness can however only be accurately measured after the animal is slaughtered.

SELECTION FOR CARCASS TRAITS

RTU scanning has been used to measure carcass traits in South Africa for many years. Apart from carcass traits, age, weight, growth, height, length as well as intake (some tests) of young bulls are measured in growth tests. These traits influence red meat yield, and are therefore linked to optimal production and profit. Scientifically, animals with a larger eye muscle have been found to carry more red meat. Back fat thickness is a good indicator of fat coverage on the carcass while rump fat thickness is beneficial when scanning very lean animals and can be used to improve the overall fat coverage estimate.

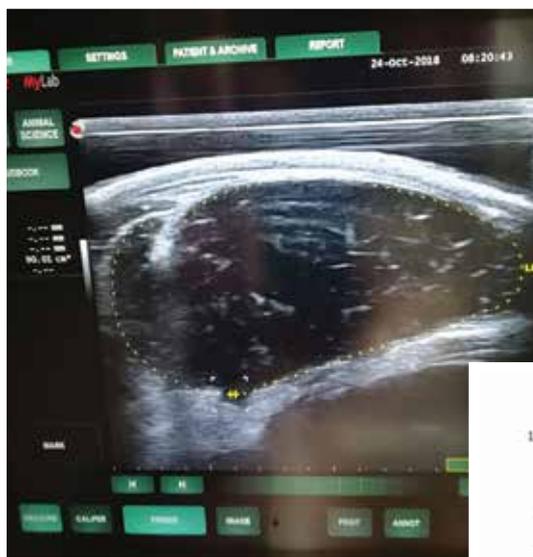


FIGURE 3: Eye muscle area (EMA)

Consumers prefer soft, juicy and flavourful meat without visible fat. Therefore, if breeders select for the market, it should be for animals with less subcutaneous fat and more marbling. However, due to the underlying genetic correlations, selecting for less fat will decrease marbling. According to the literature, selection for reduced fat can also negatively affect female fertility. It has been shown that the daughters of bulls selected for less fat often

show delayed puberty, have difficulty in becoming pregnant and also have a longer gestation period which may increase birth weight and calving problems.

A good fat layer around the carcass is beneficial as it protects the carcass against weight loss and cold shock during cooling and thus prevents the meat from getting tougher. In addition, high subcutaneous fat is well correlated with early sexual maturity, and also beneficial for carcass traits (including marbling), but it is negatively correlated with weight gain and consumer preference. Fat thickness is therefore an attribute with an intermediate optimum - both extremes are undesirable. Bulls with desired performance levels for both less fat and higher fertility should be selected by using breeding values.

GENOMIC SELECTION

SNPs (pronounced 'snips') are genomic markers on the animal's DNA which cause variation between animals. SNPs act as markers for different genes. By determining the correlations between SNPs and production traits one can determine which SNPs influence specific traits.

For example, if the SNPs for meat tenderness found on animals measured for the trait are included in routine genetic evaluations, then unmeasured live animals may be selected for it.

Genomic testing can also be used to identify potential replacement heifers with a greater genetic potential for beneficial carcass traits. SNP information for RTU-measured traits is already included in SA Stud Book breeding value estimations (GEBVs) for some breeds.

Although genomic technology is currently being refined by researchers, many interesting results have been published in recent years. For example, one study found 43 markers for eye muscle area, 65 for back fat and 53 for rump fat, while another 73 found SNPs for weight-related traits only on chromosome 6. Significant SNPs have also been found to differ between studies, which probably mean that markers and genes are breed or environment specific, and that each breed and country should undertake its own genomic studies, because SNP information is not necessarily transferable between breeds and countries.

SUMMARY

Selection for carcass and meat quality traits is possible because it can be measured on live animals using RTU technology. Genomic markers are already being used as an additional source of information to further strengthen breeding values for meat quality traits. However, it is important for different breeds to determine their own genomic markers, as there is evidence of breed differences.

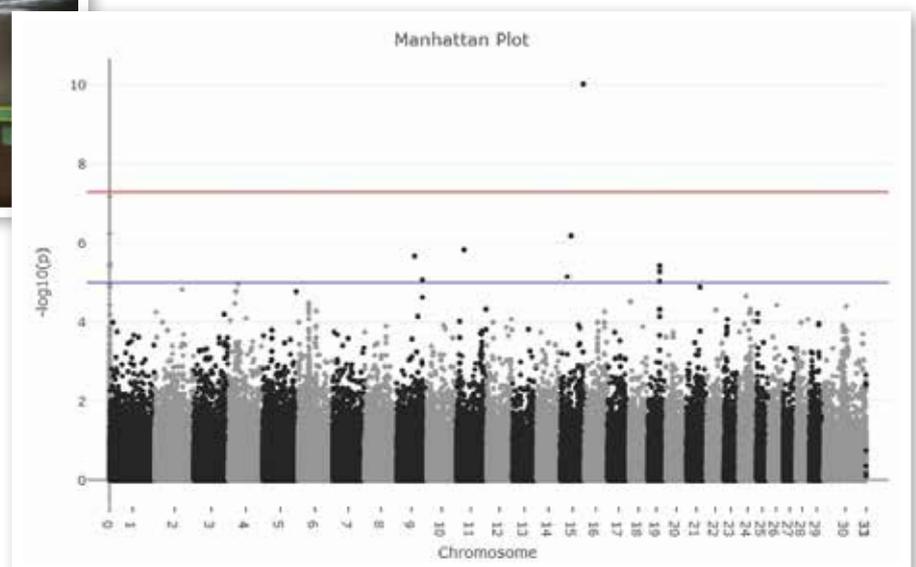


FIGURE 4: A Manhattan plot of GWAS results illustrating SNPs for slaughter weight. Each dot represents a SNP, with the X-axis showing the chromosome number on which the SNP resides and the Y-axis showing the association level (de Vos, MSc(Agric) thesis, UP, 2018).