

Genetic Effects on the Mature Weight of Cattle

A. Phillips, formerly Principal Animal Production Officer and J. Coventry, Pastoral Production, Alice Springs

INTRODUCTION

Mature weight is an important trait in beef cattle. Mature weight of breeders is important because larger cows require more feed for maintenance. This means that running large mature size females results in higher grazing pressure than running an equal number of small or medium mature size females. Cattle that need more feed to maintain body weight also tend to be less drought-tolerant.

Higher growth potential is correlated with heavier mature weights. A consequence of selection for higher growth rate is therefore generally heavier mature weight. Within reason, higher steer growth rates are desired:

- to reach heavier turnoff weights; or
- to reach market weights earlier.

Producers are faced with a balancing act. Most producers would like to turn off high weight-for-age steers **and** have moderate sized breeders. There are numerous other pros and cons of heavier mature weights. This Agnote concentrates on the genetic effects on mature weight.



WHEN IS MATURE WEIGHT REACHED?

Mature size is reached when any further increase in liveweight (other than gut fill) only results in increased fatness. Across different breeds, it is generally accepted that breeders reach their mature weight by five years of age. Most steers are turned off before they reach mature weight. To accurately compare mature weights of different cattle, they must have reached their mature size, be non-pregnant, have the same level of gut fill and be at the same level of fatness. Comparisons can be made accurately by measuring rump fat depth (P8 site), or, less accurately but more simply, by comparing cattle in the same body condition, e.g. at the same AUS-MEAT Fat Score.

HOW HERITABLE IS MATURE WEIGHT?

Mature weight is a very highly heritable trait, being 50% heritable in *Bos taurus* cattle. Although fewer studies of *Bos indicus* cattle have been undertaken, they indicate that the heritability of mature weight is even higher; most estimates range from 55-85%. This means that at least 50% of the mature weight of cattle depends on their genes, and by default, mature weight is also 50% (or less) dependent on the 'environment'. 'Environment' covers *all* of the non-genetic factors influencing the mature weight of cattle. These include management and natural factors, such as seasonal conditions, the type of country on which cattle are being run, the quality and quantity of available feed, stocking rate plus exposure to parasites and diseases.

In males, castration reduces mature weight. For example in the Victoria River Districts castration of Brahman weaners resulted in steers that were 15% lighter than bulls at the same age and fatness. Castration is an 'environment' factor. One of the effects of testosterone is to limit the growth of long bones in the limbs, and because bullocks produce less testosterone, they continue to grow for an extended period. This allows bullocks to eventually grow taller but not heavier than bulls.

In both sexes, poor environmental conditions (e.g. poor nutrition due to prolonged drought or other reasons) can cause permanent stunting. Affected animals never reach their genetic potential for mature weight. Females are more vulnerable to stunting than males, especially in situations where heifers and young cows are raising or attempting to raise calves under tough conditions.

Because mature weight is very highly heritable, cattle breeders can change the mature weight of their cattle rapidly by selecting breeding stock with heavier or lighter mature weights. If selecting breeding cows on mature weight, it is important not to confuse lower mature weights due to genetics with low mature weights that have been affected by the environment. To make valid comparisons, the cattle being compared must have been subjected to exactly the same conditions.

THE RELATIONSHIP BETWEEN MATURE WEIGHT AND GROWTH RATES

As mentioned in the introduction, higher growth rates generally lead to heavier mature weights. This happens because the genes that contribute to high growth rates also lead to heavier mature weights. For example, cattle that have the genetic potential to grow rapidly throughout their first three years will have heavier mature weights than cattle with growth rates that slow down after two years.

THE EFFECT OF MATURE WEIGHT ON CARCASS CHARACTERISTICS

Cattle with heavier mature weights generally have less body fat at a given weight or age. A good way to illustrate the general concept of maturity pattern is by comparing different breeds. A 500-kg steer from a large mature size European breed will almost certainly be leaner than a 500-kg Brahman or British breed steer. However if large mature size breeds like Charolais, Simmental and Friesian are grown out to their maximum possible weight, they will have the same percentage of body fat as any other breed. Their fat will just be deposited in different locations. European and dairy breeds have a greater percentage of internal fat while other beef breeds have a greater percentage of subcutaneous fat (fat under the hide).

It is easy to illustrate differences in mature weight by discussing differences *between* breeds. However, it is the differences *within* breeds that are of critical importance to commercial producers. Although usually smaller, mature weight differences within a breed enable producers to select for mature weights that suit their production systems and target markets. Examples of a difference in mature weight within a breed are seen when comparing Australian cattle breed strains with larger overseas breed strains—such as North American Angus and Poll Hereford cattle or Indu-Brazilian Brahmans. Importation of these strains and cross breeding has introduced higher growth rates and mature weights in Australian cattle.

THE EFFECT OF MATURE WEIGHT ON BREEDER FERTILITY

The genetic correlation between mature weight and cow fertility (measured in days between joining and calving) is unknown at this stage but is probably quite low. However, many producers consider heavier mature weights to be detrimental to cow fertility; they believe larger, heavier cows to be less fertile. This observation seems to make sense because heavier mature weight breeders require more feed, without which they cannot achieve the same body condition and same chance of producing as many calves as lighter mature weight cows. In practice, at a given stocking rate (breeders per unit area), smaller mature size cows appear comparatively more fertile because it is easier for them to meet their nutritional requirements and attain adequate body reserves to minimise the inter-calving interval.

As a corollary, mature weight is 50% (or less) influenced by the environment, so producers can also influence the mature weight of breeders through management, and high breeder fertility (more pregnancies and lactations) can result in cows with lighter mature weights. Consider two five year old cows with the same genes for mature weight, run under the same conditions, with cow A having raised four calves and cow B having raised only two calves. Cow A will have a lighter mature weight than cow B because she has used more nutrients on pregnancy and lactation than on her own body growth during the critical first five years of life.

BREEDPLAN EBV'S FOR MATURE WEIGHT AND FAT DEPTH

Most breed societies enrolled in Group BREEDPLAN are producing, or in the process of producing, mature weight estimated breeding values (EBVs). These are based on the weight of cows at the age of five years. As with all BREEDPLAN EBVs, mature weight EBVs have allowed for the environmental effects by only directly comparing like-treated cattle. BREEDPLAN does not currently take into account cow condition score at weighing, but many stud breeders are recording it in the hope it will be included in future.

Lower and more moderate mature weight EBVs are generally considered more desirable because they result in lighter mature breeder weights, but there are implications for steer weights. This may be addressed by use of BREEDPLAN's fat depth EBVs in order to find breeding cattle with carcass maturity patterns that are suitable for the desired weight and fat depth specifications of target markets.

CONCLUSION

Mature weight is just one of the many traits beef producers need to consider when selecting breeding stock. Producers are faced with a trade-off between high steer growth rates and high breeder mature weights. Mature weight is very highly heritable, so cattle breeders can make changes to the mature weight of breeding cows relatively easily by selecting heavier or lighter mature weight stock for future breeding. Management can often moderate the mature weight of breeders to an extent by retaining the most productive breeders.

REFERENCE

Phillips, A. (2001). 'Beef Cattle Genetics Applied to Extensive Herds', Northern Territory Department of Primary Industry, Fisheries and Mines. Incidental Publication No. 8. ISBN 0 7245 3086 X

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