

# MYOSTATIN GENE PROMISES HIGHER YIELD

*Brian Sundstrom*

Breeding to improve carcase yield is being studied in a number of experiments using traditional selection techniques. At the same time, scientists are searching for the genes responsible for the resulting yield differences.

One experimental herd carries a gene known as myostatin which has a substantial effect on yield. In both field and laboratory experiments, the CRC is examining how this gene might contribute to practical improvement programs in the future.

## **Current double muscling work**

The 'double muscle' condition in cattle (muscle hypertrophy) is well known and studied. While there are potential big increases in the percentage yield of saleable meat, there are many problems with the full double muscled animals for commercial production, including extreme leanness, poor temperament and calving difficulty. These problems have prevented their widespread use in Australia.

It is also known however, that a milder variant of the condition occurs where cattle carry only one of the 'double-muscling genes' i.e. are heterozygotes. (For simplicity in this article, hereafter termed mild-double muscling MDM).

MDM cattle display many advantages of

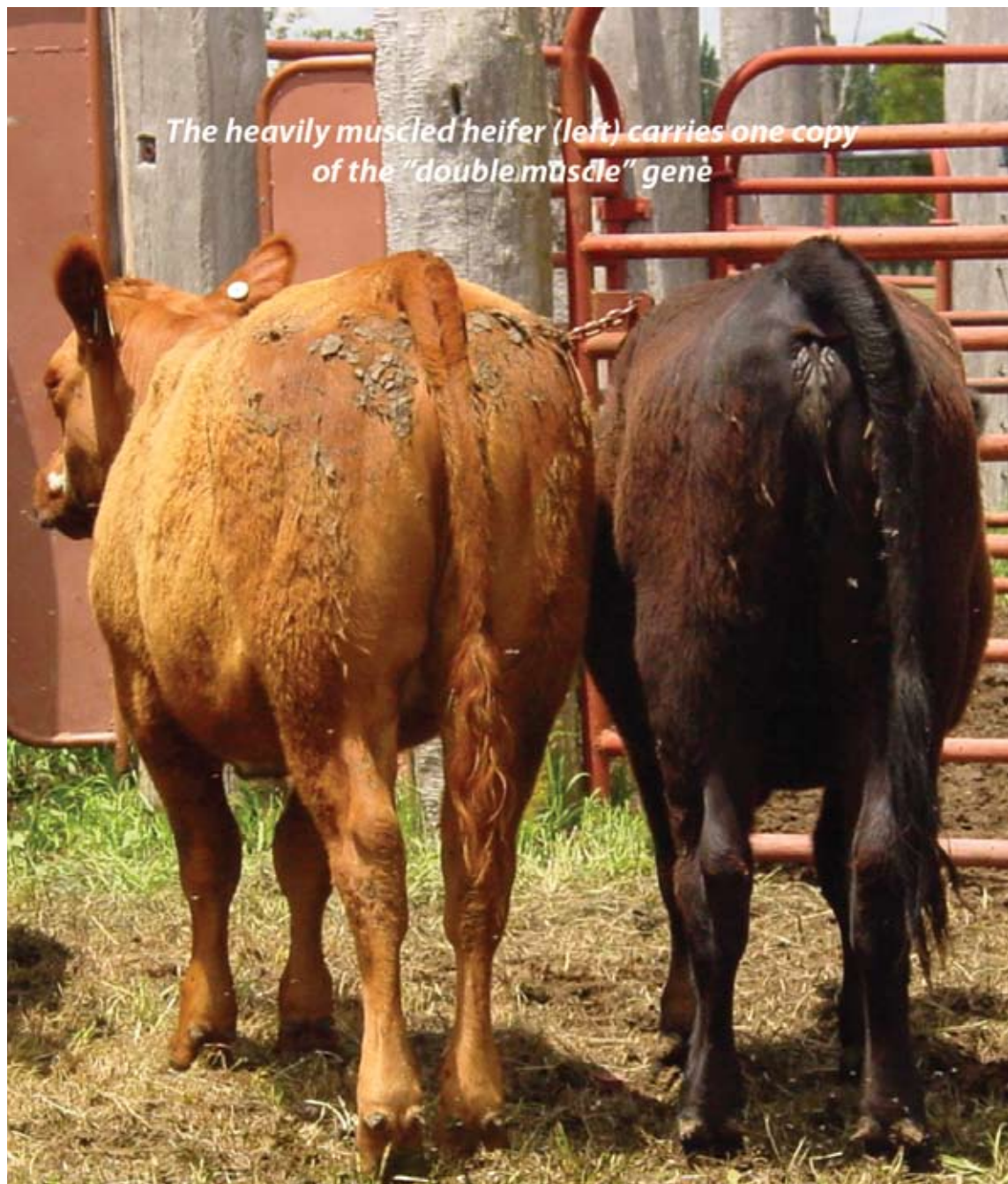
double muscling in meat characteristics but also carry subcutaneous fat and are just as functional as normal animals. For more detail on double-muscling and the genes involved, see the box story on the next page.

Following his many years of studying the effects of increasing muscling through visual selection, as described elsewhere, Bill McKiernan has become interested in this 'mild double muscling' as a tool to speed up progress for some

specialist producers. He and colleagues in NSW DPI with funding from MLA and close CRC links, are now studying the effect of this condition over and above that effect of visual selection for muscling in their selection lines.

## **Two herds**

Two herds are being studied, a 300 cow NSW DPI research herd at Glen Innes, and a commercial pure-bred Angus herd in the Hunter Valley. Both herds are carrying



Steers	Carcase Wt (kg)	EMA (cm <sup>2</sup> )	P8 Fat (mm)	Rib Fat (mm)	Fat Trim (%)	Yield (%)	H'quarter (%)
11 MDM	357	85.0	24.1	16.4	14.5	66.5	24.8
14 HIGH LINE	360	76.9	21.2	16.2	17.1	63.0	23.1
17 LOW LINE	359	70.4	24.3	18.7	18.3	61.8	22.1

a number of animals with the myostatin gene.

**Early results**

Results and observations to date:

- In both herds eye muscle area is higher in MDM cattle by 12 to 20 % at the same age and muscle score by almost one full muscle score. These cattle were already known for high levels of muscling.
- MDM cattle were only slightly leaner and slightly smaller in stature or height than normal cattle.
- MDM cows and heifers in both herds were the same weight and condition as normal animals. Records indicated they were equally productive in maternal traits.
- The most dramatic result so far has been the enormous impact a single copy of the gene had on carcass traits. 40 steers from the Glen Innes herd were slaughtered

in 2006 and assessed for carcass traits. The carcasses were boned out and meat yield information collected. 11 MDM steers were compared with steers from the High and Low muscle selection lines. Full detail is in the table above.

- ◆ MDM steers dressed 1% more than High line steers and 2% more than Low line steers.
- ◆ All steers had the same fatness at the P8 and rib sites (24 and 16mm respectively).
- ◆ Once boned out however, both higher muscled groups had less total body fat percentage.
- ◆ MDM steers yielded an extra 5% of retail cuts compared to Low steers, with High steers intermediate.
- ◆ Finally and very significantly, there was a 2.5 % advantage to the MDM steers over Low steers in the proportion by weight, of primals in the

hindquarter. High steers were again intermediate.

**Future application**

Summing up at a recent field day, Bill McKiernan stated; "With careful planning and DNA testing now offered by the Genetics laboratory at NSW DPI's Elizabeth Macarthur Agricultural Institute, self-replacing breeding programs can be designed to take full advantage of these improvements. Incentives for producers to make these improvements to meat yield need the support of processors by implementing systems of better carcass feedback and price incentives on percentage yield.

He also sounded a word of warning. "This technology is not for everyone. It is only for producers prepared to instigate a rigorous breeding program using DNA testing to ensure the deleterious full double-muscled (homozygous) form of the condition does not occur".

**Double-muscling genes**

A single gene, myostatin, has a major effect on the regulation of skeletal muscle development and normally inhibits excessive muscle growth. A mutation in this gene reduces its powers, resulting in increased muscularity or muscular hypertrophy. There is an increase in both the number and size of muscle fibres, particularly in the hindquarters or the extremity muscles.

There are six known different myostatin mutations, each having a slight variation in their effect. All cattle have two copies of the myostatin gene and animals without a mutation exhibit normal muscling. Those with a mutation in each copy of the gene (2 copies) exhibit the extreme 'double' muscled phenotype and depending on the mutation, can experience production problems.

Animals with one copy of the myostatin deletion mutation (heterozygotes) offer superior muscling advantages over cattle without a mutation, including increased muscle mass, increased rib eye area (EMA) and a small reduction in fat.

A DNA test to determine the number of copies (0, 1 or 2) of any of the six known myostatin mutations causing muscular hypertrophy is offered by the Genetics laboratory at NSW DPI's Elizabeth Macarthur Agricultural Institute.