Greg Chappell on GeneSTAR Molecular Value Predictions in the Dulverton Herd

MVPs

GeneSTAR® MVPs™ represent a new era of genetic evaluation with a focus of identifying the markers that control the expression of the performance enhancing traits. The combined tally of markers for the three traits is now 56 which means that real progress for genetic gain can now be made by using the MVPs for these traits. To date, the range in trait units that is explained by these markers is shown below.

	Feed Efficiency (kg/day)			**Marbling (AusMeat MS)**			**Tenderness (Shear Force)**		
	Min	**Average**	Max	Min	**Average**	Max	Min	**Average**	Max
All Breeds	-1.15	-0.12	1.14	-0.99	-0.05	1.11	-0.47	0.09	0.93
Angus	-0.90	-0.09	0.77	-0.52	0.06	0.88	-0.47	-0.06	0.69
Dulverton Angus B&C Bulls plus reference sires	-0.77	-0.07	0.56	-0.36	0.07	0.59	-0.36	-0.06	0.29

In the Dulverton herd 31% of the reliability for Feed Efficiency is now explained. For Marbling, yes that's right Marbling as measured on the carcass, not IMF% by live scan is 28%, and for Tenderness the amount of reliability explained is 39%. These reliability figures indicate that reasonable genetic progress can be made by selecting for these traits.

Feed Efficiency

What is Feed Efficiency?

Feed Efficiency is the difference between an animals actual and expected feed intake based on its body weight and growth rate. Feed Efficiency is measured in kilograms/day, a negative value meaning that the individual has eaten less than expected in order to achieve his/her growth rate. For example C100 (Lot 1) who has a feed efficiency MVP of -0.53 has to consume 530grams less feed per day than projected, to achieve his growth rate of 1.16kgs/day. When compared to C014 (Lot 3) who has a feed conversion MVP of -0.71, C100 is 180 grams/day less efficient yet when compared to C118 (Lot 17) who has a feed conversion MVP of 0.00 he is 530grams/day more efficient. Consider the following example comparing C100 and C118. The genetic difference between the two is 0.53kg/day:

- assume a B3 feeding interval of 300 days =159kg (i.e. 300 x 0.53kg/day)
- feed cost @$240/tonne x159kg =$38.16
- assume in working lives both bulls get 80 steer calves to the B3 intake specification
- the actual sire effect needs to be halved (do not know cow effect) = $19.08 per steer fed for 300 days
- therefore the genetic advantage C100 had over C118 (life time progeny evaluated in dollar terms) is $19.08 x 80 = **$1,626.40**

The other advantage, not calculated, is the benefit the female progeny add to the equation. The steers' heifer siblings stay in the system eating grass and producing calves for 10 years. It is not possible to calculate the feed efficiency for the heifers/cows given that the grass intake isn't directly compared to those of the grain rations in the feedlot. It follows there is a likely positive relationship which is yet to be quantified.

What Do We Need to Know About Feed Efficiency In Order To Select For It?

The physiology of feed efficiency is complex and as with most traits to select for maximums leads to 'conflict'. Put simply feed efficiency physiology is a function of protein synthesis. Proteins are the 'building blocks' for muscle, our primary focus in producing the meat we eat. Animals that are better able to convert, using lesser amounts and lesser quality feed ration components, to body mass protein

(muscle), possess more of a specific set of 'enzymes', than animals not so capable. *Bos Indicus* are known for their ability to convert feed to animal protein more efficiently than their *Bos Taurus* cousins. N.B. this doesn't mean they grow heavier or faster.

These enzymes that are responsible for some animals exhibiting superior feed efficiency are also known to have noticeable negative effects on Tenderness. Tenderness is the single most important trait consumers identify as influencing their overall liking of beef. To reduce tenderness is not a desirable outcome. So on the one hand while these enzymes have a positive effect in terms of efficiently converting feed/rations to protein, on the other they have a negative effect on the denaturing of that protein, its ageing and so the ultimate Tenderness sensation.

It's our suggestion to include Feed Efficiency in the trait list. Be mindful of the fact though that to be too single minded and so head too far towards maximising Feed Efficiency will lead to reductions certainly in Tenderness. Note the contribution of Hyline Right Time 338 to Feed Efficiency; 9 of his 11 sons on offer will positively influence Feed Efficiency. In total, 35 bulls on offer will have a positive effect on Feed Efficiency.

Marbling

What is Marbling?

There are two parts to Marbling:

- The amount of fat in the eye muscle, which is measured as a percentage of total fat in the eye muscle at the quartering site; and
- The fineness of the fleck of fat and the evenness of the distribution of that fine fleck in the eye muscle. The fat flecks (globules) occupy the space in the eye muscle between the muscle bundles.

Why is marbling such an important trait?

Marbling is important because sensory research has shown that flavour and juiciness, two of the three components determining consumers overall acceptance of beef, are largely influenced by marbling as defined above. The AusMeat marble score required to satisfy the 'western palate' for steak and roast preparations is in the order of 1.4 to 3.2. This score correlates to a total fat content of 3.5% to 5.5% which is well under the National Heart Foundation recommendation of less than 10%.

IMF% measurements which are about the total amount of fat in the eye muscle don't include the palatability determinants of fleck size (fine) and fleck distribution (even). Therefore IMF% measurements can only guarantee that the consumer will ingest some mouthfuls that contain no fat and some that contain too much. The result is that the consumer is left with either a dry unpalatable sensation (no fat) or a furry lingering unpalatable sensation (too much fat).

How is Marbling Measured?

Marbling is measured by trained grader/assessors assigning a marble grade to the carcase at the recognised quartering site. There are a set of standards against which the grader/assessor is trained to make their calls or judgement. The AusMeat standards have ten major divisions, these major divisions represented on the scale 0 – 9 are further sub-divided into another ten groupings. Typical Supermarket type beef in Australia ranges in Marble Score from about 0.5 to 1.4. Long fed Japanese (British breeds) range from 2.0 – 6.0 and as already stated the preference for the 'western palate' is 1.4 – 3.2.

How Should the MVP Be Used?

In the Dulverton herd within the Angus breed about 28% of the contribution that the genes make to the total amount of the expression for marbling can be explained by the markers identified to date. That is, the MVP currently explains about one third of the genetic contribution which is estimated to be about 30% of the Total Amount of variation. The other 70% of this variation is attributed to the combined environment effects. These environmental effects include age, nutrition, stress, meat temperature when the assessment is made etc.

Put simply these MVPs represent about 30% of the total genetic contribution which contribute 30% to the total of the measured outcome for marbling.

It's not anticipated that genetic progress for a trait like marbling will be all that rapid, for example bulls such as C021 (Lot 6) and C063 (Lot 11) who have MVPs of 0.40, placing them at the very top of the marbling scale, will only increase marble scores in their progeny across average Angus cow herds of 'unknown' (not measured for the trait) by 0.2. This maybe economically significant if it were to move the slaughter progeny from AusMeat scores of 0.8 to scores of 1.0 and therefore put them within the specification requirement. Improvement will be a slow process. However progress can now be made given that marbling as measured on the carcase is the trait being targeted.

We have 20 'C' sale bulls who have scored +0.20 and above for marbling, we would suggest these potential sires have the ability to improve the marbling trait amongst commercial Angus cow herds.

We have an additional 20 between the Angus breed average (MVP +0.6) and +0.19. These sires should be able to:

- maintain and/or marginally increase marbling in commercial Angus cow herds,
- improve the marbling trait in cross bred cow herds containing some Euro, some *Bos Indicus* and/or some tropical adaptor infusion.

Tenderness

What is Tenderness?

Tenderness, flavour and juiciness are the three factors that collectively determine consumers overall liking of beef. Tenderness is a consumer response to eating cooked beef and can be described as the amount of chewing work necessary to physically break down muscle bundles; it is about the resistance to the bite/chew.

Why is Tenderness Important?

Cuts of beef are composed of muscle bundles that comprise protein strands or fibres and a 'skin' that provides the bundle its form/shape and rigidity. This skin and the 'bands' that provide the connections between fibres are composed of compounds such as collagen and elastin, collectively known as connective tissue. Muscle groupings with higher contents of connective tissue tend to be those associated with the most work e.g. silverside, topside etc. these are the tougher muscles. Those muscles with lesser amounts of connective tissue are the 'posture muscles' e.g. the 'eye muscle' (striploin, cube roll), these are the more tender muscles. Tenderness variation not only exists within the individual beast due to muscle function, it also occurs amongst like muscle groupings (cuts) between beasts. This variation between beasts occurs because of genetic and environmental effects.

The chemistry of protein accretion which ultimately results in muscle formation is partially controlled by groups of 'enzymes'. The concentration and activity of these enzymes has a genetic component and is almost certainly related to at least the efficiency and maybe the rate of growth.

The ultimate tenderness expression, as measured by the consumers 'Liking of Eating Response' also depends upon;

- Beef processing factors e.g. levels of stress pre-slaughter, blood sugar reserves pre slaughter, hang method, management of the temperature decline profile pre rigor and ageing.
- The selection of the appropriate cook method for the individual 'cut' of beef, (don't grill silverside or topside) and implementing that cook method correctly (degree of doneness etc.)

How is Tenderness Measured?

Consumers eat beef, as producers we must never loose sight of this most important premise. The Meat Standards Australia Model is such a powerful tool because it has evaluated its samples as per consumer response. Consumer response while accurate is time consuming and expensive, to offset this problem

science has developed tests to test specific contributors to consumer response. The Warner Bratzler measure for Tenderness is one such test, it is internationally recognised as an objective test for tenderness and involves a standardised procedure for preparing portions to be sheared (torn through). The shear force as it is referred to is designed to as closely as possible resemble chewing. It is measured in kgs of force needed to shear through the cooked samples.

Many studies have been conducted around the world to correlate consumer response to tenderness with Warner Bratzler kgs of shear force. One of the most important findings of this consumer research is that the Tough and so totally unacceptable occurs at 5.3kg of shear force and that Tender and so totally acceptable occurs at 4.3kg of shear force. Varying degrees of consumer 'acceptability' for Tenderness occur between 4.5 to 5.0kg of shear force. The fact that a number of researchers have found that consumers are only capable of picking differences for Tenderness of about 1kg of shear force helps explain this zone of acceptability between Tender and Tough. Interestingly work at UNE which was supported by MSA consumer ratings indicates consumers have problems liking Tenderness with ratings of under 3.0kg shear force.

How Should Tenderness MVPs be Used?
The current range in the Angus breed for genetic tenderness with about 40% of the reliability of the overall expression of the trait explained, is 1.16kgs of shear force. This is 0.16kgs of shear force greater than the amount of difference consumers can reliably detect. Remember consumers can detect a difference of 1kg of shear force within the boundaries of 3.0kg – 6.5kgs. The range in measured shear force that can be attributed to the genetic make-up of this set of Sale Bulls at Dulverton is 0.59kg.

We would expect that a bull such as C78 (Lot13) with an MVP of -0.26 should, if joined to commercial Angus cows with no known Tenderness measurements, increase the average Tenderness of his off-spring in that herd by 0.13kg of shear force. Put into perspective that would mean he could shift the average shear force from say 4.5kg, somewhere in that questionable zone of acceptability, to 4.3kg - totally acceptable. We would expect all bulls in the top 70% band of this sale catalogue to maintain or increase Tenderness if joined to Angus cows, there are 47 of these in the Sale Catalogue. They can be identified by selecting those sires with 0.00 to negative values for kgs of shear force.

How Have We Used The MVPs in Our Sire Selection?
We are convinced the three traits currently being measured by markers are of great economic significance to the beef industry. Therefore in our own replacement sire selection we have attempted to find bulls that perform across the three traits. Also included in our assessments has been the performances of the previous sire battery (see table re MVP repeatability), because we have daughters by these sires retained in the stud. The two bulls we have retained for Stud Sire use are;

Dulverton Blaster B111

	FE	**Marb**	**Tend**
MVP	-0.45	0.02	-0.06
% Rank	20	40	30

Dulverton Corker C199

	FE	**Marb**	**Tend**
MVP	-0.21	0.09	-0.12
% Rank	40	50	40

Both these bulls carry favourable copies of the genes that will contribute to all-round performance for all three traits. Note how difficult it is to find sires that combine both Feed Efficiency and Tenderness. We have weaned a set of B111 calves, he has ratioed a creditable 106 male and 109 females amongst contemporaries including 338 and U91.

MVPs: Are they Repeatable? Are There any Trends?

This table compares the 4 common main sires' GeneSTAR MVP performance 2008 Sale Group and 2009 Sale Group or B bulls and C bulls. It shows that 12 of the 13 338 sons offered for sale in 2008 would maintain or improve feed efficiency and 9 of the 11 338 sons would achieve a similar outcome in 2009. In other words the data illustrates repeatability and indicates 338 to be a bull to improve feed efficiency. U91 appears to be amongst the better sires to improve marbling with 13 of 14 sons last year and 6 of 7 this year improving or maintaining marbling. The Z51 bull is the tenderness sire with 10 of 11 last year and 13 of 15 this year maintaining or improving the trait. Y25 combines both marbling and tenderness, an honour he shares with A079 who of course had no progeny last sale. The Designer Genes bull who like A079 had no sons in last years sale is the best 'all–rounder'; his progeny combine all three traits well. 338 is the best 'all-rounder' when both drops are considered.

Sire	**338**		**Z51**		**Y25**		**U91**		**1119**
Year Progeny Offered	2008	2009	2008	2009	2008	2009	2008	2009	2009
Total No of Progeny Offered	**13**	**11**	**11**	**15**	**7**	**10**	**14**	**7**	**10**
Number of progeny with **Feed Efficiency maintained or improved**	12/13	9/11	4/11	5/15	3/7	6/10	6/14	5/7	8/10
Number of progeny with **Marbling maintained or improved**	8/13	8/11	2/11	6/15	7/7	8/10	13/14	6/7	7/10
Number of progeny with **Tenderness maintained or improved**	7/13	6/11	10/11	13/15	6/7	5/10	8/14	4/7	6/10

A Pfizer staff member will be available on sale day to answer any questions on the use of GeneSTAR MVPs. For more information please contact Pfizer Animal Genetics on 1300 768 400 or visit our website, www.pfizeranimalgenetics.com.au .

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