

It's All About Marbling

Focus | Integrity | Performance | Profit | Commitment | Innovation

EDITORIAL

It has been an intense first half of 2019 for everyone in livestock who are experiencing adverse seasonal condition.

At Rennylea we have celebrated major family events and other milestones progressing the succession of the business to Ruth and Anthony. We feel immensely lucky that they have chosen to work with us.

Leading into the Angus conference in Albury in May we held a Genomics field day "Selecting for Success Unlocking the Power of Genomics". Since the advent of Single Step analysis at the beginning of 2018 there has been a dearth of information about its implementation.

Through the #Rennylea Research program we analysed the results of the transition from no genotypes in the estimated breeding values through different analysis to the single step results. We had some key questions to answer such as the following:

- i. How did the EBVs change as a result of the new method of analysis?
- ii. Which traits were most affected?
- iii. How did it improve the response to selection for the Rennylea breeding objective?
- iv. What do we understand about the changes to the accuracy of selection?
- v. What happens as more phenotypes are included in the results?

This has been a very useful exercise for our herd and business in understanding how we fine tune the performance of the cow herd in particular. The cows in the Rennylea herd have



Ruth and Anthony moving into the drivers' seats.

been consistently selected for our breeding objective for five generations. More than 80% of the cows now have genotypes included in their breeding values which is making a profound difference to our accuracy at a young age.

As a result of the studies in this herd we will in the future only consider bringing in genetics in the future where comprehensive genotyping and phenotyping has been completed, across the breeding herd.

I wrote at length about the changes in the breeding industry in various livestock species in our last newsletter. (The Editorial in the Summer 2019 edition has a comprehensive description of 'The Long Game' of breeding).

In late March I attended the Dairy Industry Herd 19 conference as a member of the board of Datagene, the company that delivers genetic improvement to the Australian dairy industry. There were a couple of sessions of interest to the beef industry.

continued over page

- i. GINFO is the national reference herd for the Australian dairy industry. It is a collaborative model where 100 herds collect the reference data for 3 breeds (Holstein, Jersey and Australian Red herds). This is being expanded to 200 herds. The herds have excellent records, the cost of genotyping and phenotyping is shared across the industry. This is a great model that could be replicated in the Southern Beef Industry and socialise the significant costs of data collection.

Valuing phenotypes in our national databases was the topic of a beef industry meeting in Armidale, NSW in February, which was addressed by Professor Ben Hayes, a genetics researcher who helped pioneer dairy's genomic breeding values.

Professor Hayes provided a review of 10 years of genomic breeding values in Australia at the Herd19 conference and concluded the industry had sped-up the dairy cow generation interval. One way this has been achieved was through decreasing the age of sires used to breed bulls for artificial insemination.

This age reduced from 7.5 years to two-to-three years. Professor Hayes said this indicated AI companies were "intensively" selecting sires of sons using genomic breeding values.

"The amount of genetic gain you make in any breeding program is the result of how intensively you select, times the reliability of the genomic breeding values, times how much genetic variation you have, divided by the generation interval," Professor Hayes said. That's how long it takes you to turn over a generation."

Other benefits from a large coordinated information nucleus are the opportunity to have enough data to develop breeding values for the future whether they be health traits, methane emissions or feed saved.

Professor Hayes also spoke about what is coming next in the world of Genomics. He made the point that large reference populations are the drivers of genomics with great trait records. What many people do not appreciate is that the reliability of the data erodes quickly if they are not updated. Australia was the first country to use cows for reference populations and that is a superior model. The other changes coming in the future are new reproductive technologies on the embryonic stem cells and whole genomic sequencing.

Finally, the point was made at the workshop that there is no differentiation in the market place between the tier 1 well recorded herds and the poorly recorded herds. A GINFO model would bring equity into the data requirements for the reference herds for the major beef breeds.

- ii. The second session of particular interest to the beef industry dealt with the issue of inbreeding. Visiting Dutch Geneticist Dr. Sijne Van Der Beek outlined some profound changes in international dairy populations as a result of the application of genomics since 2010. Genomics has doubled genetic gain in Holsteins, in production, fertility, claw health, ketosis and mastitis traits.

But it has also doubled the rate of inbreeding. He explained that the databases identify the favourable markers in dominant families but are not as informative in finding the markers in outcross families. He gave an example of where that is not the case in the selection of 'grazing' Holsteins in New Zealand.

What is the solution for an optimum breeding population?

- i. Large and diverse reference populations
- ii. New methods for analysing reference populations
- iii. Stop just mating best with best.
- iv. A mating strategy that accelerates the mixing of outcross chromosomes in the population.

At a farm level this will mean that genomic mating will become more important, the selection of bulls based on their relatedness to the population.

Genetic literacy is an increasingly important area for the seedstock industry to understand, so the unintended consequences of adopting technology can be avoided. For this reason at Rennylea we attend a global genetics conference every year to stay close to the developments.

Lucinda



CSU graduate Jessica Hardie completed honours last year and is spending the year working with Dirk and the bulls at Culcairn.

SPRING BULL SALE PREVIEW by Bryan

The up and coming Rennylea bull sale will have 150 outstanding performance bulls offered in 3 age groups, rising 2 years, 18 months and yearlings. We are very pleased with the group of bulls.

We are using 4 bulls that are full brothers sired by HPCA Intensity and out of dam Rennylea H414. One of the bulls, Rennylea L519 was second top price at the 2017 Spring Bull Sale purchased by Booroomooka Angus. Industry reports on his calves have been very favourable and certainly the calves at Rennylea have been very good. I have noticed a few 2 year old heifers on the point of calving, udder quality looks very good.

The other 3 full brothers, L467, L505 and L508 are all still at Rennylea and used as AI and back up sires. All of these bulls have sons in the sale that are outstanding and also 2 sons of Rennylea E11 and dam H414 are standouts. H414 has outstanding feet and udder quality and the four sons have exceptional feet and structure. Temperament is also good with L519 being in the top 10% for docility.

Other outstanding sire groups in the sale include the bulls by Rennylea G420, Rennylea J937, Rennylea J178, Rennylea K178 and Rennylea L319.

I look forward to catching up with you on sale day.



High performing donor and dam of sires in the Spring Sale, Rennylea H414.

Paddock Talk by Bryan

The beef industry is facing a confronting challenge to recover from the widespread drought. The consequence of the reduction in the breeding herd is evidenced by high female slaughter rates. In Angus cattle live exports have again been a good outlet for heifers and heifer retention rates are lower than usual.

The challenge in sourcing feed continues, we trust that some relief will come in the spring, particularly in the worst affected areas.

No doubt pregnancy rates in breeding herds will also be challenged, producers with large feed bills stretched to the limits are forced to run their cows in less than ideal condition score. This returns to the discussion of how important is genetic fat in the cow herd. A response is possible with rib fat 45% and rump fat 32% heritable. Other carcass composition breeding values are also of medium heritability, IMF% at 32% and Eye Muscle Area at 34%.

Like most things in breeding, there are trade offs, if not kept in balance, retail beef yield will reduce. Fat can be manipulated environmentally, with cows being feed flushed prior to joining – an important management tool.

At Rennylea we do all of the above and we aim to keep the profile of the breeding herd slightly positive for fat, and as much muscle as practical with very high intramuscular fat. This

whole herd profile is very important for our commercial clients. The practical outcome is that the average calving day for 1500 cows in our herd is DAY 15 of the calving period with a focus on fertility.

At the Angus conference in Albury, the food service industry send a very strong message about the importance of meat quality in both grain and grass fed product. As Australia goes into the next herd rebuilding stage of the national cow herd when it rains, this is worth thinking about. Producing consistent and high meat quality has taken Rennylea at least 5 generations to achieve. The commercial industry can source superior marbling genetics that will kick start the meat quality across the herd.

The big challenge is to make consistency a norm, particularly in a grass fed product. Many consumers are making the choice to source grass fed product and marbling will be the insurance that ensures a great eating experience.

The other aspect of grass fed production is feed quality and digestibility. When the feed quality window is open, cattle need to gain weight and finish quickly expressing the meat quality genes. My conclusion is that balanced selection, can deliver a highly fertile, easy doing cow herd that delivers a product suitable for grass and grain systems. This also sets up the cow herd genetically to meet consumer demands.

ANGUS CONFERENCE IT'S ALL ABOUT MARBLING

The Angus conference in Albury focussed on the high end users of domestic beef consumption with guest chefs Anthony Puharich (Vic's Meats) and Adrian Richardson (La Luna Bristro). The discussions centred on improving meat quality both grain and grassfed value chains.

"There has been a spectacular increase in marbling in the US" said Dr. Kent Anderson from Zoetis, with increases in

genetic marbling and improvement in price grids that reward producers for marbling. "Beef grading has become much more objective and fair removing the subjective human component" he said. The measurements are based on camera images in most US plants



MLA butchers, Sam and Kelly, demonstrating new ways of preparing beef cuts at Angus Aus conference, pictured with Liz Pearson, Supply Chain Manager at Angus Australia.

RENNYLEA RESEARCH & DEVELOPMENT UPDATE

Rennylea continues to invest in and collaborate with a number of research projects. We have recently completed stage 2 of our work with CSIRO in a grass fed supply chain. We are collaborating with University of South Australia on research into the incorporation of MSA indices into Breedplan, we have Dung Beetle research commencing with Charles Sturt University and the Trans Tasman Maternal Efficiency project is nearing completion.

Trans Tasman Maternal Productivity – held its final workshop in New Zealand in early April. There are a number of recommendations that came from that meeting. The first is the inclusion of Body Condition Score into a measure of cow efficiency. The suggestion is a BCS EBV. It would be useful to know whether BCS as an added data point into the Mature Cow Weight EBV could improve its usefulness.

An in depth discussion was held of the role of BCS and its inclusion in a selection index to enable selection for cattle

that cope phenotypically with seasonal variation. For the cowherd this is useful when combined with fertility measures, Days to Calving. There is little point selecting for maturity pattern or feed efficiency if fertility is neglected.

The recommendations are:

- For more emphasis to be placed on Days to Calving.
- For half scores to be included in the recording of Body Condition Score
- The research work on early puberty didn't deliver any silver bullets in terms of selection.
- The reference populations will need to be robust to have accuracy for BCS and the trait will need to be standardised.
- There were no significant G X E interactions at the trait level between Australia and NZ.

There are ongoing discussions about the products and messaging to come from this research.

GENOMIC FIELD DAY

In May Rennylea held a Genomics field day the day before the Angus conference in Albury, "Selecting for Success Unlocking the Power of Genomics". In a first in Australia, we presented the within herd results of implementing widespread genomics in the Rennylea herd.

Till now, all the data presented has been at a breed level spread across well recorded and poorly recorded herds with varying levels of relationship to the reference population. Those results are not informative, when wanting to improve the response to selection, at a herd level.

In addition we were fortunate to have a great line up of speakers, Dr. Kent Anderson head of Global Genetics from Zoetis outlined the global picture of genomic testing in beef cattle. Dr. Shane Thomson from the Holbrook Veterinary Centre gave a hands on talk about protecting your investment in bulls and Clara Bradford from MLA outlined the industry developments. Ruth and Lucinda Corrigan covered genomic testing in the Rennylea herd and what we have learned.

The work at Rennylea has been through two projects with CSIRO, cofounded between Rennylea and Innovation Connections, a program aimed at Small and Medium Enterprises.

The first project looked at the changes in results from 1. Midparent EBVs/pedigree plus 1 phenotype, 2. Blended EBVs adding in Genotypes, 3. The addition of more phenotypes 4. Single Step analysis.

Our results showed that EBVs changed with the addition of information which was mostly favourable. In key traits in the Rennylea breeding objective, particularly mature cow weight and carcase traits (IMF% and EMA), the variation increased (standard deviation). This is improved by the more accurate estimation of relationships between animals with the genomic relationship used in single step. Accuracies changed, but the estimation of accuracy was different as the methods changed and not comparable.

We found unexpected benefits such as the identification of elite animals in a drop and also in the case of heifers, greater accuracy to cull animals before the first joining. There was some useful re ranking in the hard to measure traits.

It was very encouraging to have a strong attendance of more than 70 including a lot of young producers.



Dr. Kent Anderson addressing the participants at the May field day.

Progeny groups of calves born in spring 2018, s February 2019 and their EBVs with th

Tag	EBVs	Sex	CED	CED ACC	CEM	CE M Acc	GL	GL ACC	BW	BW ACC	200	200 Acc	400	400 Acc	600	600 Acc	MTW	MT Ac
P0554	May-19	MALE	4.6	68	2.1	59	-8.6	75	4.1	77	54	76	97	74	133	75	109	72
P0554	Feb-19	MALE	4.4	63	2	58	-6.9	72	3.1	77	43	73	77	72	100	72	85	70
P0555	May-19	MALE	5.7	68	2.9	59	-7.8	75	0.5	77	38	75	68	74	86	74	68	72
P0555	Feb-19	MALE	5.8	63	3.1	58	-7.8	72	0.9	77	38	73	70	72	89	72	69	70
P0562	May-19	MALE	3.9	68	1.5	59	-7.3	75	3.4	77	44	76	78	75	103	75	81	73
P0562	Feb-19	MALE	4.7	63	2.2	58	-7.1	72	2.6	77	42	73	75	72	98	72	82	70
P0576	May-19	FEMALE	4.8	68	2.2	59	-4.8	75	3.7	77	46	75	84	74	113	74	88	72
P0576	Feb-19	FEMALE	4.6	63	2.2	58	-7.1	72	2.6	77	42	73	75	72	98	72	81	70



Bryan explaining the progeny groups at the field day while Michael and Jess Campbell look on.



Lucinda with Clara Bradford, Genetics Extension with Meat and Livestock Australia.

Tag	EBVs	Sex	CED	CED ACC	CEM	CE M Acc	GL	GL ACC	BW	BW ACC	200	200 Acc	400	400 Acc	600	600 Acc	MTW	MT Ac
P0690	May-19	MALE	3.4	61	2.3	49	-4.7	73	3.5	76	44	74	80	73	103	73	62	69
P0690	Feb-19	MALE	3.4	54	2.2	46	-4.8	69	3.2	76	44	70	79	69	103	69	77	65
P0729	May-19	MALE	3.6	61	2.4	49	-7.4	73	2.3	76	44	74	80	72	105	73	73	69
P0729	Feb-19	MALE	2.4	54	1.7	46	-4.6	69	3.7	76	45	70	80	69	106	69	80	65
P0867	May-19	MALE	0.8	61	1	49	-2.9	74	6	76	52	75	88	73	122	73	108	69
P0867	Feb-19	MALE	-0.3	54	0.4	46	-3.9	69	5.4	76	49	70	86	69	115	69	93	65
P0926	May-19	MALE	1.5	61	1.3	49	-3.2	73	6.2	76	58	74	104	72	139	73	117	69
P0926	Feb-19	MALE	0.8	54	0.9	46	-4.1	69	4.8	76	48	70	84	69	112	69	88	65
P0748	May-19	FEMALE	2.9	61	2	49	-6.6	74	3.3	76	50	74	90	73	123	73	87	69
P0748	Feb-19	FEMALE	2.5	54	1.7	46	-4.6	69	3.6	76	45	70	80	69	105	69	79	65
P0777	May-19	FEMALE	2.8	61	1.9	49	-4.8	73	4.4	76	48	74	83	73	109	73	69	69
P0777	Feb-19	FEMALE	2.4	54	1.6	46	-4.6	69	3.7	76	45	70	80	69	106	69	81	65

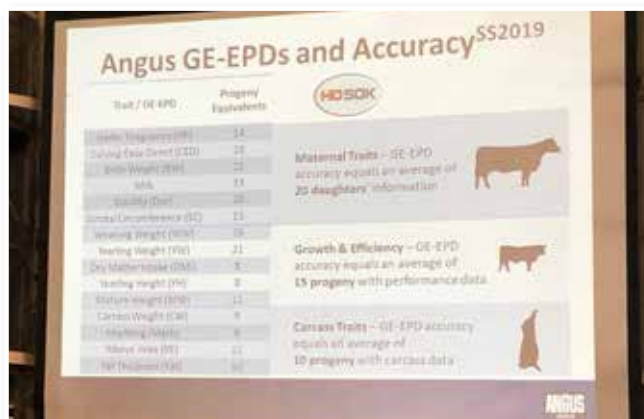
showing their mid parent EBVs (including BW) in the addition of genotypes in May 2019.

H414 x E11

W c	Milk	Milk ACC	SS	SS Acc	DTC	DTC Acc	CW	CW Acc	EMA	EMA Acc	Rib	Rib Acc	Rmp	Rmp Acc	RBY	RBY Acc	IMF	IMF Acc	ABI	DI
2	21	69	1.8	72	-8.5	58	76	71	6.6	70	1.7	72	0.6	70	-0.2	68	3.4	69	163	132
0	14	67	1.8	70	-9.4	56	57	69	6.3	63	1.8	70	1.2	68	-0.6	66	3.8	62	144	122
2	17	69	2	72	-10	58	53	70	8.8	69	3.2	71	1.2	69	-0.3	67	3.1	69	133	117
0	16	67	1.7	70	-9.4	56	52	69	6.3	63	2.1	70	1.4	68	-0.7	66	3.8	62	137	118
3	17	69	0.9	72	-9	58	65	71	6.6	70	1.5	72	1	70	-1.1	68	4.7	69	150	122
0	14	67	1.8	70	-9.4	56	56	69	6.3	63	1.9	70	1.2	68	-0.6	66	3.8	62	143	121
2	20	69	3.2	72	-9.4	58	63	71	6.9	70	1.1	72	1	70	-0.3	67	4.4	69	162	130
0	14	67	1.8	70	-9.4	56	56	69	6.3	63	1.9	70	1.2	68	-0.6	66	3.8	62	143	121



Dr. Kent Anderson from Zoetis R & D with Jasmin Green from Teys Australia.



After 540,000 tests in US Angus, the accuracy of the genomic results is equal to the following number of progeny for each trait.

K723 x G420

W c	Milk	Milk ACC	SS	SS Acc	DTC	DTC Acc	CW	CW Acc	EMA	EMA Acc	Rib	Rib Acc	Rmp	Rmp Acc	RBY	RBY Acc	IMF	IMF Acc	ABI	DI
0	22	63	2.1	71	-8	47	57	66	15.7	66	0.7	68	0.3	66	1.8	62	3.4	64	163	140
5	17	59	1.4	67	-6.4	42	59	63	13.2	63	0	65	-0.7	63	1.5	60	3.2	55	149	130
0	17	63	1.3	70	-4.9	47	65	66	13.4	66	-0.2	68	-2	65	1.9	62	3	64	145	130
5	17	59	1.4	67	-6.4	42	61	63	13.2	63	0	65	-0.7	63	1.5	60	3.2	55	150	130
0	18	64	2.3	71	-6.5	47	65	66	13.6	66	-0.2	68	-1.1	66	2	62	3.2	65	159	132
5	15	59	1.6	67	-6.4	42	65	63	13.2	63	-0.3	65	-0.9	63	1.7	60	3.2	55	153	130
0	15	63	1.7	70	-5.6	47	79	65	13.2	65	-1.6	68	-1.9	65	1.9	62	3.9	64	179	148
5	16	59	1.6	67	-6.4	42	64	63	13.2	63	-0.2	65	-0.9	63	1.6	60	3.2	55	152	130
0	18	64	1.7	71	-5.5	47	68	66	15.8	66	-0.5	68	-2.9	66	3	62	2.7	64	166	142
5	17	59	1.4	67	-6.4	42	60	63	13.2	57	0	65	-0.7	63	1.5	60	3.2	55	149	130
0	20	63	2.2	70	-7.2	47	58	66	14.6	66	0.2	68	-0.4	65	2.3	62	2.8	64	159	138
5	17	59	1.5	67	-6.4	42	61	63	13.2	57	-0.1	65	-0.7	63	1.6	60	3.2	55	151	130

ICMJ CREATING A COMMUNITY OF LEARNING by Ruth

Each year in July leading into the ICMJ (Intercollegiate Meat Judging Association) competition in Wagga we host a group of students at 'Ellerslie Park' from CSU, as well as internationals from the United States, Japan and this year Pakistan. We have sponsored the CSU team since the relocation of the competition to CSU and have developed a great relationship with our local university through this involvement as well as hosting many practical students during the year and through our annual livestock scholarship.

The ICMJ competition celebrated its 30 year milestone this year, and you may have read some of the commentary on Beef Central. It was founded in 1990 by John Carter following his Churchill Fellowship in the US where he saw the enormous value of the programme to the US meat industry. It has grown and changed remarkably since the first competition, and now encapsulates a week long conference with industry leading speakers from the red meat and pork industry, as well as a careers fair which hosted over 40 companies this year!



Ruth with Dr. Mark Miller, Texas A. & M. University.



Prof. Peter Wynn

It is now much more than a meat judging competition, and much of this is due to the foresight of Prof. Peter Wynn from CSU who originally proposed the change from a one-day competition into a week long career development programme. The ICMJ committee who run

the programme are almost entirely voluntary, and over the years many individuals have given serious amounts of time and energy organising the event, as well as training and coaching the Australian team.

Having been involved with ICMJ since 2010, first as a competitor and later on as a committee member I think it is the passion and the generosity of everyone involved in this organisation which make it so successful. The event is partly funded by MLA and AMPC, and the remaining by companies which see the value in ICMJ including Teys Australia, Australian Pork limited, Coles, Hancock Agriculture, NH Foods Australia, JBS/Andrews Meats, AA Co, Gradlink, AMIST, and Fletchers International.



Visit to Ellerslie Park from the competitors from Charles Sturt University, United States, Japan and Pakistan.



Ruth explaining the breeding program to ICMJ students.

There are now over 2500 ICMJ alumni, many working in the red meat industries. This year 150 students from 12 Australian universities and 3 international teams competed in the competition. Of these 23 Australian students have been selected to participate in an industry training week in Brisbane in September where they will visit processors, value adders, retailers and others in the supply chain.

Dr Dave Pethick from Murdoch University addressed students this year at ICMJ and told them that the biggest

change he has seen over the last 30 years has been the shift to our industry being consumer focussed. Throughout the week student's eyes are opened up to the opportunities that exist throughout the supply chain, they get the opportunity to meet companies who want to employ ICMJ grads now and make a lifelong network of fellow meat industry enthusiasts. It really is a great event to be part of!

RENNYLEA CSU SCHOLARSHIP 2019



**Liam Mowbray with Sarah Ansell,
Director of Advancement and CEO of
the CSU Foundation Trust.**

Each year Rennylea gives a scholarship to a final year student at Charles Sturt University who is studying a discipline in livestock science. It is always humbling to hear from the awardee each year and the difference the scholarship makes to financing the final year of university. This year's recipient is Liam Mowbray a final year student in Veterinary Science.

He says "Receiving the Rennylea Future in Livestock also means I can focus more time on my honours research trial and thesis. This will help me build incredibly valuable networks within the livestock industry and will put me in good stead to secure a better job within the industry."

FOOD AND AGRICULTURE ORGANISATION (FAO) STUDY

A new FAO Study indicates that livestock primarily consume foods not fit for human consumption and meat production requires less cereals than generally reported.

In 2050, the world will count 9.6 billion people, 70% living in cities with an average income almost twice as high as today. As a result, global demand for animal products will continue to grow and play a critical role in global food security and nutrition. But livestock use a large share of agricultural land and are often considered a resource drain. Particularly criticized is the low efficiency of livestock to convert feed into human edible protein and the competition for the use of cereals as livestock feed or for direct human food.

A new study by FAO and published in Global Food Security found that livestock rely primarily on forages, crop residues and by-products that are not edible to humans and that certain production systems contribute directly to global food security, as they produce more highly valuable nutrients for humans, such as proteins, than they consume.

"I came to realize that people are continually exposed to incorrect information about livestock and the environment that is repeated without being challenged, in particular about livestock feed," says Anne Mottet, Livestock Development Officer at FAO. "There is currently no official and complete international database on what livestock eat. This study contributes to fill this gap and to provide peer-reviewed evidence to better inform policy makers and the public."

Animal food sources make a vital contribution to global nutrition and are an excellent source of macro- and micronutrients. Livestock products make up 18% of global

calories, 34% of global protein consumption and provides essential micro-nutrients, such as vitamin B12, iron and calcium. Livestock use large areas of pastures where nothing else could be produced. Animals also add to agricultural production through manure production and drought power. Further, keeping livestock provides a secure source of income for over 500 million poor people in many in rural areas.

This study determines that 86% of livestock feed is not suitable for human consumption. If not consumed by livestock, crop residues and by-products could quickly become an environmental burden as the human population grows and consumes more and more processed food. Animals also consume food that could potentially be eaten by people. Grains account for 13% of the global livestock dry matter intake. Some previous studies, often cited, put the consumption of grain needed to raise 1 kg of beef between 6 kg and 20 kg. Contrary to these high estimates, this study found that an average of only 3 kg of cereals are needed to produce 1 kg of meat at global level. It also shows important differences between production systems and species. For example, because they rely on grazing and forages, cattle need only 0.6 kg of protein from edible feed to produce 1 kg of protein in milk and meat, which is of higher nutritional quality. Cattle thus contribute directly to global food security.

The study also investigates the type of land used to produce livestock feed. Results show that out of the 2.5 billion ha needed, 77% are grasslands, with a large share of pastures that could not be converted to croplands and could therefore only be used for grazing animals. Livestock production is growing fast because demand for animal products is rising, particularly in developing countries. FAO estimates that we need 70% more animal products by 2050 to feed the world. Therefore, the area of land needed to raise animals will also increase if feed conversion ratios (FCR) are not further improved.



Highly marbled Rennylea grass fed beef.

Steps have already been taken through feed formulation, genetic selection, and better veterinary services to improve FCRs over the last 30 years. An improved (more efficient) feed conversion will also reduce livestock's environmental footprint, but continued progress is needed to make the system more sustainable. In addition, it is essential to improve the recycling of food wastes and by-products into livestock feed as well as to increase feed crops yields.

"Animal production, in its many forms, plays an integral role in the food system, making use of marginal lands, turning co-

products into edible goods, contributing to crop productivity and turning edible crops into highly nutritious, protein-rich food. Quantifying the land and biomass resources engaged in livestock production and the food output they generate, but also improving our modelling capacity by including trends in consumer preferences, shifts in animal species, climate change impacts, and industrial processes to improve the human edibility of certain feed materials is arguably basic information needed as part of further research into the challenge of sustainably feeding 9.6 billion people by 2050," concluded the authors.

BULLS IN FORTHCOMING SALE



Lot 2 - Rennylea N503



Lot 4 - Rennylea N820



Lot 21 - Rennylea P44



Lot 23 - Rennylea P183



Lot 27 - Rennylea P387



Lot 114 - Rennylea P132

Focus | Integrity | Performance | Profit | Commitment | Innovation



www.facebook.com/RennyleaAngus



twitter.com/CorriganLucinda



JBAS8

BRYAN & LUCINDA
CORRIGAN
"OLD RENNYLEA"
BOWNA VIA ALBURY NSW 2642
MOBILE 0409 038 993
BRYAN'S 0429 038 993
email:
rennylea@bigpond.com

SUE GOVAN
MOBILE
0427 038 993

RUTH CORRIGAN
MOBILE
0400 302 629
ANTHONY CORRIGAN
MOBILE
0437 043 443