

#Phenotypes are King in the Genomic Era

Focus | Integrity | Performance | Profit | Commitment | Innovation

VISION

In the last few years we have lifted our heads from the daily and annual program, and taken note of global trends. This has been through a combination of attending national and international conferences, reading extensively and studying consumer and societal trends. In this issue we report on our recent visit to the World Angus Forum and pre conference tour through England.

There are big underlying changes that are disrupting business models, (think AirBNB, AirTasker and closer to our industry, Beef Central is disrupting the traditional media channels). There are profound changes in the way consumers access and consume products including food. The digital revolution in communication and technology is enabling new ways of collecting and analysing data. In Australia retail sector for many Fast Moving Consumer Goods are feeling the headwinds of disruption.

In early July Sprout X, the AgTech Accelerator held an information night where 11 new products were pitched for potential startup funds. A number of these have been developed with funding through the MLA Donor Company and at different stages of development. It is worth watching on Utube (SproutX AgTech Accelerator and Pitch Night) to see new ideas in controlling feral animals, remote tracking of cattle and monitoring animal health and welfare.

THE DISRUPTOR IN THE LIVESTOCK INDUSTRY IS GENOMICS.

As the technology has become proven and mainstream, for example in the dairy industry, bull proving is now based on the genomic data for between 30% and 50% of sires in Australia, and for a large proportion of young sires. Females are being tested throughout the commercial population, using the large amounts of data that literally flow, every day, into the milk vat. Superior animals are being identified at an earlier age, and from non traditional sources. "Progeny testing is dead in the water" with the new Genetic Evaluation System

currently being developed by Datagene, (the dairy industry genetics company formed by the membership of all players in the genetic improvement industry, of which Lucinda is a board member) is implemented at the end of the year.

However there is a massive challenge.

PHENOTYPES ARE KING, is the message that has come out very clearly from geneticists at The World Angus Forum and AAABG (The Association for the Advancement of Animal Breeding and Genetics), as paramount to using genomic information. The calculations that sit behind the genomic estimations are powered by the data we submit. Developing **trust in the genomic predictions** will only increase as the accuracy increases, in exactly the same way that trust developed in Breedplan over a period of 35 years. While genomics gives a low accuracy prediction on a young animal that has no previous performance information, in an impeccably recorded herd such as Rennylea, it raises the accuracy to an even higher level.

We have 160 bulls catalogued for our annual Spring On Property Sale on the 31st August. We are very confident about the quality assurance that accompanies their performance and the forensic checking that goes into presenting each animal for sale. Our breeding goal, clearly articulated on our website at www.rennylea.com.au describes the phenotype and genotypic profile of our herd. Please contact Bryan, Peter or Ruth prior to the sale if you wish to discuss the bulls. Remember Peter's favourite quote, "Quality genetics is always affordable."

PHENOTYPES - WHO COLLECTS AND WHO PAYS?

A few days after returning from the World Angus Forum, Lucinda travelled to Townsville on invitation from the Association for the Advancement of Animal Breeding and Genetics, AAABG's biennial conference. While very few producers attend, it is the most significant meeting of the animal breeding community in Australasia and one that assists us to stay up to date with the science and continue to lead the genetic improvement agenda in the beef industry. We think that Genetic Literacy is the key to understanding the new technology, whether it be the 'relationship matrix' in the implementation of 'single step' analysis or the significance of genomic testing throughout the pedigrees of animals to improve accuracy.

At AAABG Lucinda participated in a panel with scientists. The Q and A largely focused on improving adopting of genetic improvement and all the issues about data capture, sharing, ownership and payment. An important principle is that the way forward is collaborative sharing of data, within and across breeds, nationally and globally.

Thoughts leaders in the genetics industry have been discussing this issue since the start of Beef CRC III in 2005. Who collects phenotypes and who pays is the most pressing question to answer to ensure the accuracy of genomic predictions in the future.

Having attended the Scottish conference and listened to these issues from other countries, it has become clear that genetic improvement is being disrupted. Trust is created in disruptive systems by transparent feedback that encourages continuous improvement. Renown speaker and academic Rachel Botsman articulates the issue of Trust in Institutions in the Digital Age. Watch her Ted talk on Utube, June 2016, it is a marvelous description of how trust enables change and innovation.

Before the panel we did a sort on the Angus website, bulls born in 2013-2015 and with top 10% performance in 6 traits of interest, Calving ease > 3.0, birthweight > 4.0, 600 day < 115, mature cow weight < 90, EMA > 7.0 and IMF > 2.9%. There were about 230 bulls that met this criteria. The following slides shows the variation in data that sits behind their genetic description. The first bull is a Rennylea sire and has full recording in large management groups. The data is trustworthy. The others have combinations of data submitted.

While out there in the market place these may be seen as having the same genetic merit, that is not the case. For some traits they may be reported on generations of mid parent values. The genomic estimations will have low accuracy for the hard to measure traits such as scanning for carcase traits.

Bulls ain't bulls.

Leadership of this issue is now paramount to continue to develop TRUST in genomic predictions and the genetic improvement system.



Dr. Dan Moser visited Rennylea with Andrew Byrne and Christian Duff from Angus Australia during May. Dr. Moser is President and Director of Performance Genetics at Angus Genetics Incorporated, US Angus Association.

TRUST IN BREEDPLAN

In the last newsletter we wrote about the change to single step analysis in the US.

This will deliver the following benefits to industry:

- i. Eliminates the need for periodic calibration, allowing constant inflow information into the database
- ii. Simplifies the model, eliminating unnecessary correlations that add noise (inaccuracy).
- iii. Allows incorporation of meaningful traits not previously incorporated such as weaning weight and yearling fat into the carcass model
- iv. An improved carcass model
- v. Eliminates a source of bias due to culling, because not all genotyped animals have progeny that are progeny tested.
- vi. Uses a more accurate relationship matrix based on actual genomic relationship of genotyped animals rather than pedigree estimates of inbreeding (see last issue on website for the explanation of how this works)
- vii. Eliminated yearling weight drift
- viii. Increase accuracies


At AAABG, Prof Heather Burrow delivered the John Vercoe memorial lecture. John worked for many years with tropical breeds in Australia and internationally. The fascinating part of Heather’s presentation was the opportunity for genomics to improve breeding outcomes for smallholder farmers in Sub Saharan Africa. And the missing part.....phenotypes.

TRUST IN BREEDPLAN

FIVE BULLS, similar EBV profiles, very different data recorded

NOR K835:	GL, CE, BWT, 200WT, 400WT, 600WT, SS, FAT, EMA, IMF, DOC, Genomics
XXX X4:	BWT, 200D, GENOMICS
YYY YYY6:	CE, BWT, 200, GENOMICS
ZZZ ZZ2:	BWT, GENOMICS
BBB B7:	GENOMICS

Think about the implications: who collects the Data and who pays?



In the sort mentioned on the previous page, five bulls were in the group of 230 with very different phenotypes recorded.

INSTITUTIONAL		DISTRIBUTED
Opaque		Transparent
Closed		Inclusive
Centralized		Decentralized
Licensed	TRUST	Accountable
Top-down		Bottom-up

“Trust in institutions has declined, distributed trust is the new digital paradigm.”

Paddock Talk by Bryan

The World Angus Forum is covered in detail in the newsletter. There is also an in depth account of how genomics are going to be a very big part of seedstock breeding in the future. The future of beef is quite different from the dairy industry in terms of using genomic tools for a long term breeding outcome.

In 1998, we revisited our breeding objective placing great emphasis on fertility and cow maturity patterns. These issues are incredibly important, many of the commercial herds I visit have six week joinings, calving issues in heifers generally in hand – we can all make progress in bull selection and management in this area. Average calving data is approximately optimum in many six week calving herds (at Rennylea our average calving date is Day 15). This helps greatly in turn off efficiency, average weaned weight, not to mention time efficiency at calving.

Our other key decision is 1998 was to place great emphasis on eating quality and striving to eventually be in a situation where every Rennylea bull sold has the genetic profile to improve meat quality in every herd they go into. These decisions have been very beneficial to both our clients and

ourselves in favoured supplier preference. Eating quality and consumer satisfaction are certainly topical.

It is very important to understand that going forward genomics is a very helpful tool, but it will be a hindrance if phenotypes are not collected. Genomic enhanced EBVs will have very low accuracy in reality unless phenotypes are collected and will be detrimental to bull selection for commercial operations.

One of the obvious advantages of Rennylea genetics, has been highlighted with the wagyu industry becoming an important player in Australian beef exports. Whether the heady predictions about projected growth becoming reality is yet to be seen.

What we do know is the industry will grow on the back of Angus cows – Angus cows with generations of top 5% + IMF bulls in their pedigrees will deliver a much more consistent marbling F1 progeny. We are certainly getting strong signals at Rennylea that this is the case.

I think that in the future, there will be very good opportunities and premiums. Watch this space!

WORLD ANGUS FORUM

Bryan and Lucinda joined the World Angus Forum tour in Southern England for 5 days prior to the conference in Scotland. It was a wonderful way to see some Angus herds and farms and to understand different breeding goals and market drivers. The forum was then based in Edinburgh for a week with more farm visits, the Royal Highland Show and the two day conference at the beautiful old Assembly rooms.

Firstly and importantly, the hospitality was wonderful. On the bus trip we were accompanied by the Alex Sanger, Chairman of the Forum and the UK Angus Society. With his band of fellow organisers, including Vice Chairman, Angela McGregor, we were shown wonderful places, great food and a lot of good humour.



Bryan with Angela Macgregor and Alex Sanger, Vice Chairman and Chairman respectively of UK Angus and wonderful hosts of the forum.

The animal industry is secure due to strong and unmet demand from the UK and Europe for breeding animals. Phenotype is everything from the farms we visited, and the discussion usually started with cow families.

Commercial beef producers have serious challenges, with limited scale and difficulty in expanding. It requires lateral thinking to increase scale, much more so than in Australia or New Zealand.

As visitors we were all very interested in hearing about BREXIT and what that would mean for the industry. The Irish seemed to be very glad they weren't BREXITING, although Northern Ireland is! One can foresee some border anomalies quickly developing as values are effected by EU or non EU membership.

We met a small number of lateral thinkers who were excited by the new opportunities and who doubted that EU subsidies could last forever with the pressures caused by ageing populations and the geopolitical changes occurring in the EU. A key question was how will the consumer be affected by the changes in the UK itself, and how would that be translated back down the value chain?

There were three questions that I posed at every visit:

- i. How do you define the role of genetic improvement?**
 - ii. What do you understand about meat quality?**
 - iii. How are you dealing with genomic disruption?**
-

The answers to all three present opportunity, strategic opportunity for the breed and industry and obviously individual business opportunity at a herd level. While there was a focus on tenderness, there did not appear to be an appreciation of meat quality as understood by the consumer, tenderness, juiciness and flavour. In Ireland, all genomic testing is subsidised, again by the EU.



On the Scottish border at Duff Burrell's cow and calves brought to view.

DAYLESFORD ORGANIC FARM – AN EXTRAORDINARY EXAMPLE OF HIGH END MARKETING

The Daylesford Organic Farm in Gloucestershire is an inspiring and large scale, integrated organic farm. It is owned by Lord and Lady Bamfield whose global machinery company JCB, sets a high standard in manufacturing excellence and employee loyalty programs. The Organic market in Europe is growing very quickly, predicted to reach 320 billion euros by 2025.

The farm enterprises include 100 Angus pedigree cows, a smaller South Devon herd, a 130 cow dairy which uses an ancient breed the Gloucester, 1,500 ewes of a number of different British breeds, 6,000 hens, 1000 turkeys and 500 geese at Christmas. In a high end value chain, and including 120ha of vegetables, the products are marketed through 4 outlets, in the form of a farm shop and outlets in London including Harrods. There are two farms in total of 5,000ha and the abattoir where the stock are processed is also owned by the Group.

Unashamedly, the target customer is very wealthy and chooses organic produce for a range of ethical and personal motivations. The shop and the farm reflect a philosophy where absolutely nothing is left to chance, and very different from any organic operation we had seen in the past. The range of food and its visual appeal, including a wide range of ready meals reflects this approach and has to be seen to be believed.

For example in the Daylesford shop we saw rib eye on the bone roasts for L99 (pounds) per kilogram. The cheese shop, laden with boutique and mouth watering soft cheese, blues, traditional aged hard cheeses and cheddars enhanced the beautiful presentation. Add to this an extensive restaurant and free farm tours for the urban food tourist.



Eye fillet for £99 per kg and a cheese with a wonderful name.

Energy is generated by solar and a biomass digester (recently installed to produce one megawatt of power) so that the farm and Daylesford village contained within the estate are self sufficient for energy.



Gloucester dairy cows at Daylesford.

Also impressive is the national leadership on sustainability. To this end, a website www.agricology.co.uk is a one stop shop to share and promote practical information about sustainable farming, regardless of labels.

We could get into a debate about what the definition of sustainability is as the Daylesford example may not fit the definition of open or closed sustainability as described in reviewed literature. For example, pastures are managed with great precision, are stocked lightly, dry stock are moved from one farm to another as required, the availability of machinery means that weeds are controlled by regular topping, wastes from overwintering in barns are spread on pastures and other wastes brought in to provide the full nutrients removed. However there were many interesting features of the production system and in a short few hours visit our impressions were:

- *the rotations and animal cycles were clearly planned so that the large, mobile poultry sheds, (similar to smaller ones we have seen in Australia), were followed by pastures to utilise the nitrogen and produce silage to finish stock.
- *the silage system is based on Sainfoin, a Mediterranean legume with very high productivity per ha. It looked like a very interesting option for high protein fodder production.
- *the productivity of the Gloucester dairy herd makes an interesting case study, around 6-7000 litres per annum with high milk solids and longevity of production of up to ten years. Longevity was raised as a trait that requires improvement in angus and dairy breeds that we visited in the UK as a way of addressing losses in fertility, structure and productivity.
- *the influence of European policy with subsidies for energy, laneway and forest plantings, and landscape design is profound. It raised many questions for the Southern hemisphere delegates about how such systems will function post EU in Britain.

The investments in infrastructure including massive barns for the livestock over winter, commercial kitchens and dairies for cheese and meal production, the energy infrastructure and 100s of acres of vegetable production was the initial visual impact.

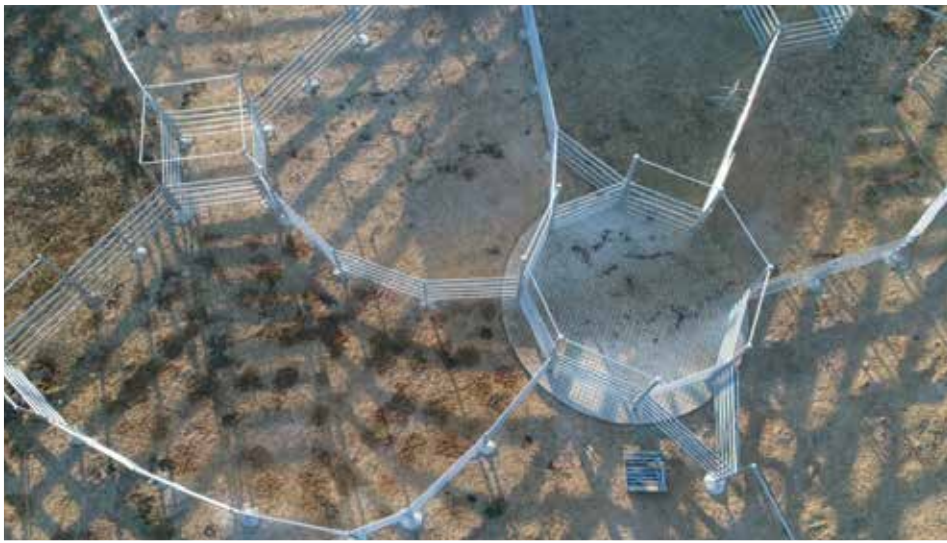
However, we were equally impressed by manager Richard Smith and livestock manager Phil Gordon Jones' meticulous approach to every challenge including biosecurity within the animal systems to maintain the organic certification.

WYUNA YARDS

During the autumn Rennylea embarked on another building project, a new set of yards at Wyuna on the Billabong, 2 kms east of Ellerslie Park. The yards were built by Holbrook Engineering, with the internal race and working area from Thomson Longhorn near Warwick in Queensland.

These set of photos, taken from a drone, show the progress of the yards from commencement. Holbrook Engineering is owned by Cam and Wendy Mackie and the team did a fantastic job.







WORLD ANGUS FORUM CONFERENCE - what we learnt

The week of the conference was peppered with kilts, bagpipes, haggis and whisky with time to attend the Royal Highland Show and dinner at Murrayfield, home of Scottish rugby. The two day conference was held in the beautiful Assembly Rooms in the centre of Edinburgh. Raconteur James Playfair - Hannay introduced the conference theme, from consumption to conception with the focus on food.

- i. Amanda Brown, from the Kantar WorldPanel presented the global and UK trends and insights in protein consumption based on their 'continuous consumer panel' research.

She detailed three areas of concern, in the competition in Grocery Retail, the rise of E Commerce and the reinvention of retail. Fast moving consumer goods are falling in volume globally while value remains strong. Korea is the fastest growing home of E commerce in the food sector (20% of total). Shoppers have high expectation which they are happy to share, and stores are catering to the need for theatre, authenticity and connectivity in addition to being quick and convenient. There are food stores now that don't have a shop front and this is growing. Amazon is using drones to deliver goods the same day as they are ordered.

In the UK the situation with red meat, is that the market grew strongly until 2013, and has pulled back since then. There has been more price inflation, while products such as pork, bacon and yogurt have had price decreases. There has been a lower spend on promotions by grocery and that is affecting meat consumption and category strength – giving away a share of profits.

New players are growing strongly; Aldi and Lidl (10.8% pa) while the biggest are Tesco, Sainsbury and Asda in a 100 million pound market pa.

Consumer Needs: have a smaller basket with less frequent shopping, 1 person households 43% up from 33% in 1980, ageing population, consumers have more money but less time cooking. Spending ½ hour doing evening meal compared with 1 hour 20 years ago. Buying for convenience and new items, chicken is doing better than lamb, pork and beef. There is also growth in ethnic and continental dishes, with a split of 50% traditional dishes to 50% new. Beef and chicken have more cooking choice than pork and lamb for convenience. In the beef category, mince and stewing steak are increasing in relative price while roasting is less popular and the comparative price is falling.

The new word in health is flexitarianism, people who choose not to eat red meat 1 or 2 times a week. To 'win' in the market place beef needs to embrace innovation, quick and easy with minimum cooking skills, focus on dishes and the health message. The importance of Iron in the diet, the battle for the consumer

choices of women of all ages, are areas where red meat can gain traction.

- ii. Tom Spay from Marks and Spencer outlined the five macro trends in food
 - a. TRADITION e.swaldale lambs, and heritage pigs
 - b. VEGETARIAN/ VEGAN, natural and simple
 - c. FOOT WASTE, consumers more aware
 - d. TIME/CONVENIENCE
 - e. HEALTH for EVERYONE

To address these trends M & S aims to be the most sustainable retailer in the world, where employees are evaluated on how they measure up to the company values.

In a retail environment where **VALUE = SATISFACTION – PRICE**, constant innovation is a given, to keep up with 2million google searches per second and heated competition. We were introduced to some new concepts, such as 'chickenability', how to make beef as convenient as chicken, including cooking methods such as 'sous vide' – precision temperature in a resealable bag in circulating water.

- iii. Professor Julie Fitzpatrick focussed on **the role of livestock in global food security**. This was an outstanding high level address which addressed the planet's big issues, including climate change, the environment and the millennium sustainable goals.

She highlighted important issues including that of food waste. There are 100kgs per person of food lost per year in developed countries, and 30% world wide of the food in production. Much of it is wasted prior to entering the value chain, on farm and in transit.

The important point about ruminants is that they turn grass into edible products for humans. The answer for food security is sustainable intensification, more food from fewer inputs and waste, utilising technology. And she gave a definition of what that would include, improved reproductive performance, reduced mortality, morbidity and improved nutrition.

She gave a wonderful example of a new vaccine for Barber's Pole worm, developed in Australia and made in Albany in collaboration with the Moredun Institute. The vaccine antigens are isolated from the lining of the worm and then kills the worm from inside (like a Trojan horse). It also works in Boer goats in Africa and Nelore cattle in Brazil.

Zoonoses are another area of concern in the food system, such as E. coli pathogens in food where humans can suffer nasty outbreaks from contaminated food. Some cattle are super shedders and these need to be identified and managed. The Institute also looks at water and soil born pathogens as well to protect food chain. Genomics is very important in identifying these pathogens and selecting for animals with resistance of other health benefits.

Internationally Biosecurity is a major concern and major funders such as the Bill and Melinda Gates Foundation are funding work in In developing countries, to diagnose and quarantine disease outbreaks and track animal movements. Diseases of interest include TB, BVDV, IBR and leptospirosis.

Finally is the issue of over- and under- nutrition in developing countries, poor and unbalanced diets the cause of obesity on one hand and malnutrition on the other.

iv. A group of speakers discussed the future of **whole of life traceability**, food safety, consumer concerns and trust in the food system and animal welfare.

Consumers are confused, for example 66% of French beef is finished in Italy, greater transparency will see consumers vote with their euros. On line beef selling platforms are becoming more common and the system is like all other disruptive models – it will be based on trust, underpinned by stringent traceability, DNA technologies and animal history.

DNA is now collected at birth using a ONE SAMPLE FOR LIFE approach, stored in liquid and used to generate data for traits across all the production, health and welfare traits. Added to the new tools of digital monitoring for reproduction, cycling, dystocia, onset of disease, feeding and nutrition data, systems become more precise and tailored to the end product.

Scots Beef 1,800 farmers supply Marks and Spencer Angus and other high end Angus brands. In conjunction with the UK Aberdeen Angus Cattle Society and IdentiGen, they are developing a ‘proof of breed’ project with angus cattle into these value chain. The verification will ultimately protect the Angus brand which has strong consumer loyalty in the UK. Robust traceability underpins price premiums.

v. Some new work in feed efficiency at the Scottish Research Institute has been working on proxies for feed efficiency. Recognising the immense cost of putting large numbers of cattle through feeders, the work is focussing on the rumen microbiome. The work recognises that 60-75% of the variable cost of production in the UK is feed.

Research has found that 88% of efficiency (correlated with feeder studies) is explained by the DNA of 49 SNPS in the rumen microbes. A simple DNA test on rumen microflora may in the future enable selection for feed efficiency on concentrate diets, given that cattle in Scotland spend around one half of the year inside.

vi. The genomic update commenced with the terrific precis’ of the history of the advances in genomics for the beef industry. Dr. Stewart Bauck from Neogen has been a leader in the field for 20 years.

Since the Bovine Genome Project was completed December 2005, global advances in genomic technology are accelerating. Robotics are used in genotyping labs, the 3,000 bulls project in dairy has enable SNP based parentage to 5 generations at birth, and parentage in multi sire matings. There are now 600,000 stud and commercial dairy heifers being DNA tested per annum.

In beef, US Angus is the leader in adoption of genomic technology. The transition to single step analysis this July is improving accuracy. The proliferation of data, the ability to identify pedigree and analyse phenotypes with genotype is called PHENOMICS. It is an area of research growing very quickly. Next generation sequencing, is bringing the cost down, and sequencing power internationally is growing very quickly.

Advanced reproductive technologies are being widely used in dairy and beef, however there is a question mark over gene editing, which is regulated by the Food and Drug Administration. Scientists have successful ‘edited’ the Friesian genome to remove horns, where 80% of US dairy cows have their horns removed as calves. The acceptance of this by the public will be an important test case.

Low cost tests will provide the information we need. Provided the industry can resolve the issue of who collects phenotypes, and who pays, especially on the hard to measure traits. **“#phenotypes are king in the genomic era”** Beef does not have the luxury of daily data like dairy where progress has been very fast.

vii. There was a very entertaining presentation from an Irish/ Scottish producer, Michael Shannon who had ventured into setting up his own store and online outlet, called DAMM DELICIOUS.

Motivated by his vision of being to operate in the beef and lamb business with EU subsidies, Michael described his journey as a first generation farmer. His business provides 250 grass fed angus and 400 lambs which he buys in, as traditional meat, pie and meal solutions.

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WORLD ANGUS FORUM CONFERENCE cont.

He became fascinated with advances in efficiency and grazing technology in NZ. The diet is 100% forage based, Swift and Marast kale and fodder beet with silage, except at lambing. After meeting NZ farmers focussed on cost of production, he came home with a strong economic focus, new grazing systems and a different way of looking at his business. His eureka moment came when he realised the cattle did not need to be fed in barns and he went about developing a system to rotationally graze and eliminate vehicle movements in the paddocks in winter.

Michael calls his product 'GREEN BEEF', 100% grass fed, 100% angus, aged 3 weeks, no interventions such as antibiotics. He was passionate about the high omega 3 fats, the traceability and food safety story.

The other fascinating part of his talk was about his large family of 8 children, developing a successful business that pay tax, all on 207 acres! Have a look at his website: www.dammdelicious.co.uk

The only other international producer speaker was Tom Gubbins from Southern Victoria who presentation on their large, family seedstock operation in Australia was very well received and produced much food for thought.

It was a great opportunity to meet and mix with delegates from 24 nations, discuss the challenges and opportunities of the genetics business across nations.

RENNYLEA E176 - A PERFORMANCE AND MUSCLE POWERHOUSE

Rennylea E176 is a very high performance cow by VTM Africa A217 and out of a BR New Dimension daughter Rennylea B124. She has had 99 progeny and her performance is confirmed as the data of her progeny enter the Breedplan system.

E176 is the leading Eye Muscle Area cow or bull in the Angus Australia database. She has 49 progeny with an EMA estimated breeding value greater than 15.0. In the spring sale she has 6 sons, Lots 4, 20, 31, 101, 107 and 107.

As a group they have very high docility EBVs, immense eye muscle areas, moderate maturity pattern and low birthweights. Lot 4 is the highest EMA bull offered this spring at auction. Lot 20 has the highest overall performance of her sons, reflected in his

market indicies. Rennylea E176 has a lot to offer the commercial producer of high quality carcasses.



Cows at Fordel Farm near Edinburgh.

INTERCOLLEGIATE MEAT JUDGING VISIT

In July each year we sponsor and host the Charles Sturt University Intercollegiate Meat Judging team. Teams converge on CSU from most Australian universities and some international teams.

This year we were honoured to also host the Japanese team, coached by Professor Keigo Kuchida, very well known for his research into marbling and meat quality in Japanese Wagyu cattle.



Ruth explaining the finer points of the Rennylea breeding program with the Japanese ICMJ team.



Bryan and the Charles Sturt University ICMJ team.



Dr. Peter McGilchrist with the Japanese ICMJ team.

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