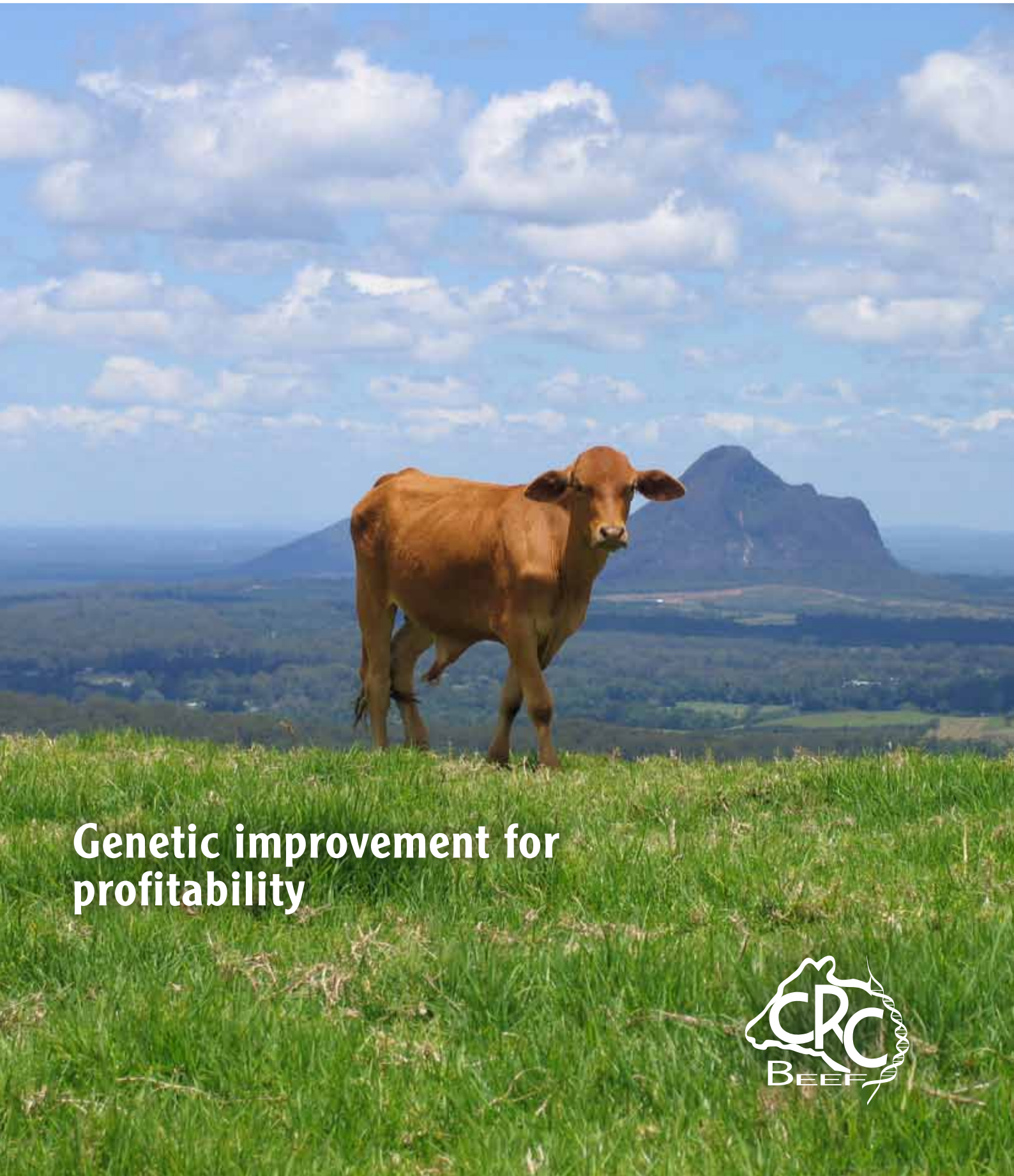
Beef Bulletin

December 2010



Genetic improvement for profitability

CRC Beef

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Dr Burrow has extensive research management experience and a quantitative genetics research background.

Mr Neil Scholes-Robertson, Company Secretary

Mr Scholes-Robertson holds a Bachelor of Business and is a qualified Chartered Accountant.

About the Beef CRC

The Co-operative Research Centre for Beef Genetic Technologies aims to add $179 million dollars to the value of the Australian and New Zealand Beef industries each year from 2012 through world-class gene discovery and gene expression research to improve profitability, productivity and animal welfare of beef enterprises.

MISSION

To capture the benefits of the human and bovine genome projects and the "Livestock Revolution" by improving the profitability, productivity, animal welfare and responsible resource use of Australian and global beef businesses through world class gene discovery and gene expression research and accelerated adoption of beef industry technologies.

From the CEO

In the last edition of the Beef Bulletin (September 2010), we looked at new and emerging gene technologies and beef genomics. In this edition, we present the latest results from the CRC's more traditional animal breeding (quantitative genetics) studies.

Genetic improvement remains a largely untapped opportunity for the Australian beef industry, except amongst a small number of dedicated breeders.

Over the past 50 years, the poultry, pork and dairy industries in Australia have benefitted greatly from traditional genetic improvement and are now starting to transform their industries through the use of genomic technologies. They have been able to achieve this as a result of their very strong focus on measuring a comprehensive range of traits of their animals.

Yet the vast majority of Australian beef producers do not know how their individual animals perform relative to one another. They do not have the data that will allow them to identify their best performers or worst performers, whether they be young growing herd replacements, breeding cows or the sires that are used to produce the next generation of calves.

To maximise the value of genetic improvement, large numbers of animals need to be measured for a range of economically important traits and compared directly with all other animals that have been managed identically. This is generally considered by the industry to be just too difficult and, in some cases, too expensive. The value proposition for accurate measurement is not well understood by the Australian industry.

Demand for greater genetic information from the commercial sector is not strong enough to pressure the seedstock sector to measure the animals they sell. Without this demand, things are unlikely to change as quickly as they need to.

Over the past two decades the Beef CRC has been undertaking collaborative research for Australia's beef industry. Our initial focus was on identifying all the factors that impacted on carcass and meat quality traits to determine whether it was possible to guarantee the eating quality of our beef. This research now underpins the world-leading MSA meat grading system.

One of the spin-off benefits from this research was that we were able to identify the good, the bad and the elite performers for the traits which influence these qualities – tenderness, yield and marbling, as well as feed efficiency.

Our subsequent research aimed to understand whether trade-offs had to be made in terms of female reproduction or adaptation, if producers were to deliver beef of guaranteed eating quality. These research programs are now concluding and some of the early results are featured in this edition of the *Beef Bulletin*.

We know we can change most economically important traits of animals through genetic improvement and measurements of all the important traits. This is where industry lags. If we are going to improve the balance of traits, we must also measure all of the traits.

The Beef Information Nucleus (BIN) herds

Dr. Heather Burrow

now being developed by MLA and several breed societies are one way of achieving measurement of economically important traits. However, the numbers of animals and range of traits that can be recorded by the BINs is way too small if the BINs are to become primarily responsible for genetic improvement in the whole of the Australian beef industry.

Individual seedstock herds and even some parts of the commercial sector will also need to start effective record-keeping if they are to contribute to the increased productivity needed to sustain the industry into the future.

The development of new genomic technologies will likely drive this in the future, as will the imperatives of meeting future demand for protein and climate change. But their development is also totally dependent on the use of animals with accurate measurements of phenotype.

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EBVs and how genetic improvement works

An animal's breeding value is an estimate of its genetic merit, half of which will be passed on to its progeny.

While we will never know the exact breeding value, for performance traits it is possible to make good estimates. These estimates are called Estimated Breeding Values (EBVs).

Calculating EBVs

In the calculation of EBVs, the performance of individual animals within a contemporary group is directly compared to the average of other animals in that group.

A contemporary group consists of animals of the same sex and age class within a herd, run under the same management conditions and treated equally. Indirect comparisons are made between animals reared in different contemporary groups, through the use of pedigree links between the groups.

EBVs are expressed in the units of measurement for each particular trait. They are shown as positive or negative differences between an individual animal's genetics and the genetic base to which the animal is compared.

For example, a bull with an EBV of +50 kg for 600-Day Weight is estimated to have genetic merit 50 kg above the breed base of 0 kg. Since the breed base is set to an historical benchmark, the average EBVs of animals in each year drop has changed over time as a result of genetic progress within the breed.

> "A recommended practice is to firstly select breeding stock based on EBVs and to then select from this group for visual traits."

The absolute value of any EBV is not critical. It is the differences in EBVs between animals that are important. Particular animals should be viewed as being "above or below breed average" for a particular trait.

EBVs and different breeds

Whilst EBVs provide the best basis for the comparison of the genetic merit of animals reared in different environments and management conditions, they can only be used to compare animals analysed within the same analysis.

Consequently, BREEDPLAN EBVs for one breed cannot be validly compared with EBVs for any other breed.

Although EBVs provide an estimate of an animal's genetic merit for a range of production traits, they do not provide information for all of the traits that must be considered during selection of functional animals.

In all situations, EBVs should be used in conjunction with assessment for other traits of importance (such as structural soundness).

A recommended practice is to firstly select breeding stock based on EBVs and to then select from this group for appearance to ensure that the final selections are otherwise acceptable.

Measuring traits

EBVs are published for a range of traits covering fertility, calving ease, milking ability, growth, carcase merit and docility.

When using EBVs to assist in selection decisions it is important to achieve a balance between the different groups of traits and to place emphasis on those traits that are important to the particular herd, markets and environment.

One of the advantages of having a comprehensive range of EBVs is that it is possible to avoid extremes in particular traits and select for animals with balanced overall performance.

To improve animals, you must measure performance

Most beef producers still prefer to make selection decisions based on what an animal looks like, rather than a calculation of its genetic merit. However, this tradition may be undermining future profitability.

By Wayne Upton, Beef CRC extension specialist

Most producers buy bulls the same way they have done for generations.

Generally speaking, they will buy the biggest, fattest animal at a sale, and use their experience as third or fourth generation cattlemen or women to visually assess the genetic worth of an animal by what it looks like.

While tradition plays its part in keeping the status quo, another factor is that many commercial breeders do not have a strong understanding of how to use Estimated Breeding Values (EBVs) to improve the profitability of their selection choices.

"Most cattlemen and women buy bulls the same way they have done for generations - by visually assessing the genetic worth of an animal by what it looks like."

They are unsure what the difference between tools like EBVs, which have been around for some 30 years, and genomics (the newer DNA markers and panels) are. For many, genetics is 'gobbledegook'.

EBVs are calculated from information on the animal's performance and the performance of its relatives and progeny. This information is used to make a prediction of the genetic worth of an animal. The newer genomic DNA markers are developed from an analysis of the minute differences in the genomic sequences of different animals which may point to genes that impact on a desired trait. In the future it is planned that this DNA information will also be used to increase the accuracy of EBVs.

Although commercial breeders would like to have data on how well bulls perform for certain traits, they don't demand this information.

An example of some of the outcomes of selecting for traits using EBVs is profiled in the Southern Regional Combinations project (see pages 16-17).

This project involved three sets of Angus bulls: one group selected on EBVs for intramuscular fat (IMF), the second for EBVs for retail beef yield. The third group was selected for progress in both traits. These bulls were mated to a random sample of Hereford cows and the progeny measured for IMF and retail beef yield at slaughter.

The results demonstrated:

1. Clear responses to selection of sires on EBVs for specific traits.
2. Excellent prediction of effects on carcase traits in the progeny.
3. Producers can select to improve more than one trait at the same time (even if they are negatively correlated).
4. Responses were consistent across a wide range of environments.

Collecting measurements on individual animals and their progeny is often raised as a significant issue for the northern beef industry, where cattle run in extensive production systems and where producers have managed herds over generations without measuring the genetics of animals. This is not to say it can't be done.

In these extensive breeder regions, a renewed focus on heifer management, breeder performance and bull selection based on inherent fertility is imperative.

The beef industry is not taking as much advantage of genetic improvement as other livestock industries, although it s at a similar level to the wool industry and the lamb industry is making improvement.

Wayne Upton

Beef needs dairy-style model

The Australian beef industry should share EBVs between breeds – and other countries – in a model similar to the dairy industry, says genetic extension specialist from the University of California, Dr Alison Van Eenennaam.

"This is what occurs within the dairy industry," Dr Van Eenennaam said.

While the dairy industry has an advantage over beef in that the industry is made up of one or two predominant breeds, recording a wide range of phenotypic information puts the dairy industry at a distinct advantage with the future introduction of DNA markers.

Dr Van Eenennaam said the fragmented way that the beef industry in the United States collects and evaluates genetic data is not an optimal model for national beef cattle genetic evaluation.

"The beef guys are very much on their own while the dairy industry has a USDA-funded group in Maryland that does all their genetic evaluations," Dr Van Eenannaam said.

"It is difficult to find populations of beef cattle that have data on these different traits, and it is an expensive proposition to develop these populations. That's why pooling data from beef cattle populations in different countries offers such an opportunity to achieve this goal."

Beef CRC CEO Dr Heather Burrow said the Beef CRC had initiated collaborations with research organisations in the USA and Canada to develop the capacity to treble the size of experiments, as well as greatly reduce the time taken to deliver its results to industry (relative to the Beef CRC operating alone).

NAPCO targets genetics

NAPCO has some of the most extensive production systems in Australia yet undertakes comprehensive measurement of their animals to identify the top performers within their herds.

Cattle belonging to the North Australian Pastoral Company (NAPCO), one of Australia's largest cattle producers, need to survive the harsh conditions of northern Australia but also do well in the feedlot.

"Targeting the genetics of the animals has helped us do this," said Maurice Josey, animal breeding consultant with NAPCO, which has 30 years of cattle breeding experience.

Mr Josey said genetic improvement has helped NAPCO to market its product as a carcass.

"We are able to satisfy customers because we supply a more consistent article," he said. "Our tropically adapted cattle perform in the feedlots as well as, if not better than, some *Bos Taurus* cattle but also do well in extensive production systems."

Mr Josey said NAPCO takes a range of measurements on the cattle including birth date and birth weight, flight time (a measure of temperament correlated with beef tenderness), 400 and 600 day weight and mature cow weight. They also carry out ultrasound scanning on their young bulls to assess Intramuscular Fat (IMF), Eye Muscle Area (EMA) and fat cover.

"We virtually record everything we can on the female portion of the herd. We also bring 250 bulls from the Barkly Tableland and Kynuna properties down to our Wainui feedlot, near Toowoomba each year," he said.

"This helps us see which cattle do well in the feedlot. It also helps us make sure they don't fall down in the legs when fed grain diets. We identify the top bulls, which then go back up into the breeding herds."

For more than 100 years NAPCO's herd consisted of pure Shorthorns. But by the mid 1980s pressure from ticks, poor nutrition and the vast distances the cattle needed to walk to water meant NAPCO needed to explore other options.

"The Shorthorn cows were highly productive mothers, but the weaning rate was fairly low due to the extremes of heat and their inability to cope with dry times," said Mr Josey.

"If we were to improve the herd, we needed to use the genetics of different breeds to maximise the reproductive performance, maternal ability, growth rates, carcass characteristics and adaptability."

NAPCO began to introduce Bos Indicus genetics into their Alexandria herd on the Barkly Tableland.

More suited to the harsh inland tropical conditions, the benefits of the Brahman infusion soon became evident according to Mr Josey.

"The cattle grew faster, had a better frame and significantly reduced fat depth when compared with the pure Shorthorn," he said.

In the subsequent years, other breeds were introduced including Belmont Red (for high fertility, docility and meat quality) and Charbray (for a high yielding, low-fat carcass).

"If we were to improve the herd, we needed to use the genetics of different breeds to maximise the reproductive performance, maternal ability, growth rates, carcass characteristics and adaptability."

The final Alexandria composite is a mixture of five breed types: 5/16 Shorthorn, 3/8 Brahman, 1/8 Africander, 1/8 Charolais, and 1/16 Hereford. It has been a closed herd since 1990.

Development of NAPCO's second composite animal, the Kynuna Composite, began in 1996.

Mr Josey said the objective of this breeding program was more focussed on improving meat quality.

"We wanted to optimize growth rates, maximise reproductive rates and environmental adaptation as well as produce a carcass that would meet the higher quality meat market," he said.

The Tuli (or African Sanga) breed had been run on Kynuna since 1991, so it made sense to introduce these genetics into the Shorthorn cattle to increase the tropical adaptation and hybrid vigour.

"In addition to the Tuli, the Red Angus and Shorthorn breeds were utilised to increase marbling in the meat," he said.

The final breakdown of the Kynuna Composite was 1/8 Brahman, 3/8 Shorthorn, 1/4 Tuli, and 1/4 Red Angus. It has been a closed herd since 2002.

"By blending and matching the important traits of each breed we not only improved our weaning rate by 20-30 per cent but also lowered the age of turnoff."

Besides feedlot performance and meat quality Mr Josey said NAPCO values fertility and reproductive rate.

"In our top stud herds, every cow has to wean a calf every year to stay in the herd," he said.

"Out of 800 stud cows, we currently have more than 100 cows in the Alexandra Composites that have had at least 10 calves in a row. This is a pretty good statistic on the Barkly."

Mr Josey said NAPCO is currently using their own Estimated Breeding Values (EBVs) as the basis of their genetic selections. No selection for coat colour is practised.

But he added the company is also pursuing DNA marker technology.

"Every bit of additional information, as long as it is used properly and measured accurately, must assist your selection. Otherwise you are standing in the dark," Mr Josey said.

The need to measure

Lucinda Corrigan, a former Director of the Beef CRC, a member of the board of Meat and Livestock Australia and co-director, with husband Bryan, of Rennylea Angus, thinks cattle breeders are not reporting enough performance data, and the value proposition for why they should start recording traits needs to be better understood.

One of a few breeders using genetic improvement data to breed elite animals, Lucinda Corrigan is recognised in the industry as an advocate for improved accuracy of better recording of phenotypic information stored in BREEDPLAN.

At the start of 2010, Angus group BREEDPLAN results showed there was data for only about a third of the 60,000 2009-drop Angus calves that could be recorded.

"A lot of people equivocate, waiting to see which animals they will record, and the number creeps up as the calves get older," Ms Corrigan comments,

"But the more you record, the more accurate the performance is predicted at an earlier age. It will be the same when we start recording for gene markers. More data will give us more accuracy. But, at this stage, we're not necessarily getting the data."

BREEDPLAN's value is not in dispute at Rennylea. On virtually every profit indicator, the stud has either climbed ahead of the herd average, or remained level, since it began recording in the late 1990s.

"We're now the highest marbling Angus herd in Australia through our use of BREEDPLAN," Lucinda says.

"We have this cow, Rennylea W449, who is the highest performing carcase cow in Australia. She was discovered by data. When she was about two years old we began to see her potential; when she was four we knew she was pretty good; and now she's off the scale."

"We've seen the transformation, and we know that the BREEDPLAN system is a transformational technology."

And yet, she says, BREEDPLAN has not progressed as far as its potential suggests.

She has looked around at other industries, wanting to understand how transformational technology has taken hold elsewhere.

In the case of the minimum-till technologies used by the cropping sector, it reportedly took some 35 years between the appearance of the first tools and 95 per cent adoption.

Closer to home is LAMBPLAN, a performance recording tool that has transformed the lamb sector's breeding strategies and its profits.

Ms Corrigan thinks a key difference with BREEDPLAN is how producers use LAMBPLAN to enhance traits across the industry – particularly maternal and terminal selection - rather than focus on enhancing a breed.

"LAMBPLAN didn't go through breeds; it offered a service," she observes. "It's made the market signals much more immediate."

"Because of the way we commercialise, it's a more roundabout route to get market signals back through BREEDPLAN. The breed societies deliver the system, but they haven't seen genetic improvement as their core business."

However, she adds, this is changing with the establishment of the Beef Information Nucleus herds.

In 2006, Ms Corrigan and Peter Parnell of the NSW Department of Primary Industries reviewed seedstock producer attitudes to BREEDPLAN. Cost of recording emerged as a major blockage to greater uptake.

Much has moved on in BREEDPLAN in four years, Ms Corrigan said. However, costs remain an issue.

At the same time, Ms Corrigan argues, the entire industry needs to get more firmly behind performance recording, revising the delivery model if necessary, and pushing up recording levels across all sectors.

"You just have to look at the beef industry in northern Australia and think of the possibilities if we lift fertility there. What an opportunity—if only we can get it right."

New ways of looking at female reproduction

A suite of new research outcomes is emerging from a long-term northern beef CRC breeding project focusing on female reproduction.

Reproduction is a key profit driver for beef producers operating in northern Australia.

Female reproduction is a major focus of the third phase of the CRC for Beef Genetic Technologies (Beef CRC).

Led by Dr David Johnston, the female reproduction project builds on research initiated during CRC Phase II on the trade-offs between carcase and meat quality traits and female reproduction.

The earlier research found that when the first few years of calving data were analysed, some interesting results started to emerge.

For example in Brahman cattle, those females reaching puberty early got in calf early, but many failed to re-conceive.

The research team then realised that the breeding project needed to be taken out to at least six calving opportunities, to determine whether early puberty was simply setting the females up for a hit/miss pattern, or whether animals in fact could be selected to improve lifetime female reproduction.

What is also emerging from this work is that it appears to be feasible to breed for improved eating quality without compromising either reproductive performance or adaptation.

Recent CRC Phase III work has taken the female group through the six calving opportunities, while looking for early-life indicators of lifetime reproduction in females, or equivalent early indicators in bulls.

The entire trial involved 2200 cows, both Brahman and Tropical Composites (equivalent of Santa Gertrudis, Droughtmaster, Brangus, Belmont Red). The trial is drawing to a close, with only a handful of No. 3 drop heifers still to complete their sixth calving.

Many of the original females are now about nine years of age.

In an exhaustive and methodical process, a huge amount of data has been generated on the females, which have been measured since weaning on average every four to six weeks for key performance traits – both reproductive measurements, and body composition (weight, eye muscle area and fatness, for example).

The mobs have been running in four geographically contrasting locations, stretching from Toorak near Julia Creek and Swans Lagoon in the Burdekin in the north, to Brian Pastures, Gayndah and Belmont near Rockhampton.

About 40 to 60 progeny were generated from each sire, providing 20 to 30 daughters for use in the breeding herds across the four environments. Their steer cohorts were finished on grain and fully recorded for feedlot performance, carcase traits and meat quality.

"...the big breakthrough is that age at puberty, and post-partum reconception interval are remarkably heritable - better than 50%, which is regarded as 'about as high as they come."

Beef CRC CEO Heather Burrow said a whole suite of important new messages was emerging from the project, which would be of enormous value to northern beef producers.

"It is a massive story," she said.

A good example of this was the clear evidence that two component traits of female reproduction (age at puberty, and post-partum reconception interval - particularly in cows with their first calf at foot) are much more heritable than overall traits such as pregnancy rate, weaning rate or days to calving.

This is of great value, because traditionally, female reproduction has been regarded as extremely difficult to improve genetically, because of its low heritability.

However, the big breakthrough is that the component traits of fertility - age at puberty, and post-partum reconception interval - are remarkably heritable at better than 50%, which is regarded as 'about as high as they come.'

Industry use for both assessments could rely heavily on the use of ultrasound scanning technology:

- Age at puberty could ultimately be determined through the use of a single ultrasound scan into mating.
- Post-partum reconception interval could be determined through a single ultrasound scan at weaning of their calf to determine pregnancy status and age of the foetus.

Another part of the story to emerge from the research was different messages in terms of outcomes for the Brahman cattle and the composite animals, in terms of early life indicators, and how best to manage each group of animals for optimal outcomes.

Brahmans, for example, tended to use their fat depositions differently in both the wet and dry seasons than the trial cattle with higher *Bos taurus* content.

Another clear economic message to emerge from the research is the lack of value in persevering with late-calving heifers. Heifers born after January might as well be given-up, research indicated, because they were most unlikely to get in calf as two-year olds. And even if they did get in calf, they were much more likely to record a hit-and miss calving performance. The same applies to the late steer cohorts, which were much more likely to have to be held over for another year before they reached market weights.

"Apart from discussions with the project's collaborating breeders themselves, the Charters Towers Meat Profit Day in September was the first occasion many of these new outcomes were presented at industry level," Dr Burrow said.

Partners in this research include the northern breeding program collaborators (see page 10), the Animal Genetics Breeding Unit, CSIRO, DEEDI, CSIRO and MLA.

-This article is based on an article written by Jon Condon ('R&D Female Focus') in Queensland Country Life, 23 August 2010.

Northern beef industry must maximise profits

The Northern Australian beef industry comprises more than half the overall national beef herd in Australia and is a major provider of Australian beef products.

However, the industry faces major challenges to remain profitable and sustainable, according to a recent Northern Beef Situation Analysis 2009 commissioned by MLA. According to that report, major issues facing the industry include:

- Inadequate scale in the more closely settled areas.
- Significant cost escalations in overheads (up 54%) and direct costs (up 150%) over ten years.
- Doubling of debt per livestock unit over the last decade.
- Return on Assets (ROA) has declined to very low levels of around 1 to 2% on average.
- Problems with reproduction in the extensive breeder herd.

Many beef producers are spending more than they have earned over the past six years due to increased land values (and therefore higher debt), increasing overheads, below average rainfall and a levelling of beef prices since 2004.

The situation analysis report recommends that a cultural change from cattleman to business person is required in the industry.

The industry must lift the standard of management and control specifically in the areas of environmental management and herd biology, be open to change and be strategic in bull selection.

In the extensive breeder regions, the report identifies that a renewed focus on heifer management, breeder performance and bull selection based on inherent fertility is imperative.

The report also calls for the industry to "dramatically" lift the use of objective measurement and use of estimated breeding values (EBVs).

Both producers and research institutions should seek to analyse, benchmark and continue to build management skill and capability.

The report also identified ten high priority RD&E issues to be addressed for the northern beef industry, including the following which are part of the CRC's portfolio:

- *Change the focus in the institutions and industry from profit to production* - now being addressed through the CRC's 'Beef Profit Partnerships';
- *Urgently influence the focus and output of the industry to dramatically lift inherent fertility* - being addressed through the CRC's industry delivery activities;
- *Determine if possible to establish genetic markers for degree of lactational anoestrus and/or days to calving* - CRC marker results will be released over the next year;
- *Urgently attempt to partition the influences of genetics, nutrition and timing of activities. This is needed to organise effective and targeted extension programs* - the CRC's results relating to these different areas are now starting to become available and will be released to industry over the next year and beyond; and
- *There are very few extension agents, consultants and economic professionals available to guide the northern grazing industry through a paradigm shift of production-focused work to growing profit* - now being addressed through the CRC's 'Beef Profit Partnerships'.

Northern pastoral group contributes data the 'envy of the Western world'

(L-R) John Halberstater (Mandalay), Ken Warriner (CEO, Consolidated Pastoral Company), Dr Guy Fitzhardinge, Beef CRC Chair, Don McDonald (Principal, MDH Pty Ltd), Beef CRC CEO Heather Burrow, John O'Kane (General Manager, Properties, Stanbroke Pastoral Company), Carolyn Briggs (Cona Creek), Pat Dempsey (General Manager, Wholesale Beef, Australian Agricultural Company). Absent were: Jennifer McCamley (Tartrus), Greg Campbell (CEO, S. Kidman and Co), Nigel Alexander (CEO, North Australian Pastoral Company) and Tom Mann (Hillgrove).

A group of cattle producers who have been an integral part in the Beef CRC's northern Australian beef research program for nearly 20 years were recognised at an awards ceremony at the Red Meat Industry awards dinner in Brisbane in August.

In presenting the group with the award, Beef CRC CEO Dr Heather Burrow said the group had contributed to datasets on carcass and reproductive traits that were "the envy of the Western world".

"A huge amount of data has been generated and there have been some really major outcomes, with big new developments in reproductive performance still to come."

Dr Burrow said that over different research phases of the Beef CRC research program, the northern Australian producers contributed through donations of specifically generated steers and heifers, and access to feedlots for grain finishing programs.

"This work has underpinned the Beef CRC's straightbreeding and cross-breeding programs in Northern Australia," she said.

"It has also been used in other major research activities in the Australian beef industry like the development of Meat Standards Australia (MSA)," she said.

Recently the group helped achieve another world first – the development of a DNA test of the poll gene in Bos Indicus for Australian cattle breeds.

The group include Australian Agricultural Company; Carolyn Briggs, 'Cona Creek', Springsure; Consolidated Pastoral Company; John and Sue Halberstater, 'Mandalay', Jambin; S Kidman and Co; Tom Mann, 'Hillgrove', Charters Towers; Jennifer McCamley, 'Tartrus', Marlborough; MDH Pty Ltd; North Australian Pastoral Company; and Stanbroke Pastoral Company.

Many in the group also bred and retained ownership of specifically designed Brahman and Tropical Composite steers and heifers. The heifers were retained in the breeding herds on four Northern research stations and followed through for up to six calvings, providing critical research data on many cattle production traits.

When the first few years of calving data were analysed, some interesting results started to emerge. For example in Brahman cattle, those females reaching puberty early got in calf early, but many failed to re-conceive.

Dr Burrow said the northern Australian group's research contribution was of enormous value to northern beef producers and is directly helping shape ongoing research in southern Australia and internationally.

Data collection in the long-term program is now close to complete and the Beef CRC was keen to ensure the support received from these producers was recognised.

"With genetics you have to keep with it," one of the producers, Mr Tom Mann, said. "Rome wasn't built in a day."

The economics of female reproduction

A Beef CRC project underpinned by very significant contributions from the Northern Pastoral Group of Companies, and funded by Meat & Livestock Australia and ACIAR which aims to increase weaning and branding rates in Queensland cattle herds could add more than $1billion to the value of the Queensland beef industry by the year 2040.

Dr Rachel Hawken from CSIRO Livestock Industries is leading a Beef CRC project to identify the gene markers which control age of puberty and post-partum anoestrus in tropically adapted cattle.

The ultimate aim of the research is to develop a DNA-based selection tool that producers can use to find those heifers which mature more rapidly and conceive calves earlier.

"One of the biggest inefficiencies in the northern beef industry is the fact that many cattle and Brahmans in particular, don't have a calf every year," Dr Hawken said.

"It will be a big help to industry if we can find the genes which control that," she said.

A comprehensive study conducted by the Queensland Primary Industries and Fisheries examined the effect of improving reproductive rates in four typical beef production systems.

Mr Bill Holmes, a Principal Economist with the Queensland Government's DEEDI in Townsville, said the report concluded that improved reproductive performance leads to higher gross margins in each particular beef production system.

"Even under a conservative model, increasing branding or weaning rates is going to put more money back into the pockets of producers," said Mr Holmes.

"If every cattle producer increases weaning rates by just five per cent for first- and second-calf breeding cattle and 1 per cent for mature cows, the gross margins of beef cattle production could increase by approximately $28 million each year in Queensland alone."

Although the benefit to producers in far north Queensland (from Mt Isa to Townsville; including shires of Cook, Mareeba, Etheridge, Croydon, Dalrymple, Burke, Carpentaria, McKinlay, Richmond and Cloncurry) is estimated at $7M annually, Mr Holmes said the region expected to benefit most from the genetic marker technology is the Fitzroy, Mackay and Southwest region of Queensland.

"In this area alone, the expected increase is $11.6 million per annum in gross margin," said Mr Holmes.

But it is unlikely to happen overnight. As with most genetic improvements it is likely to take several years before cattle with the desired traits are available in commercial quantities.

"If every cattle producer in Queensland alone increases weaning rates by just five per cent for first- and second-calf breeding cattle and 1 per cent for mature cows, the gross margins of beef cattle production could increase by approximately $28 million each year."

The report found the full economic benefit of reducing the age of puberty and post-partum anoestrus won't be realised until sales occur of grand-progeny of bulls purchased with the elite genotypes.

"This is not expected to be achieved until at least eight years after the technology first becomes available," said Mr Holmes.

"In that time, the cost of identifying the sires with the desired genotype will outweigh the benefits. But after that point, the technology will rapidly start to have substantial positive and permanent effects on the profitability of the Queensland beef herd."

But as with anything, unless the technology is adopted by industry, it will be worthless.

The Beef CRC is realistic about the uptake of this gene marker technology. Believing it will be embraced slowly at first with just 10 per cent of producers seeking bulls with a desired genotype in the year after the DNA markers are made available.

"Seedstock producers have to see a value in it and be convinced there is a market for cattle with the selected genetics," said Beef CRC CEO, Dr Heather Burrow. "It also takes time to increase the numbers of elite breeding animals."

"But after that, adoption rates are set to escalate, peaking at 80 per cent after about 15 years."

This cow and calf above are part of a Beef CRC research program to improve the female reproductive performance of tropically adapted cattle.

Sins of the fathers

A Beef CRC project is investigating whether a high sperm count in a bull's semen might be an indicator not only of the animal's own fertility, but also the fertility of its daughters.

Measuring scrotal circumference in bull calves

What can bull semen tell us about the fertility of the bull's daughters?

The answer to that seemingly odd question isn't clear yet but the early indications from a multi-year Beef CRC project is that bull semen really might offer a guide to cow fertility.

Beef CRC researchers hope that an answer isn't too far away.

Last month (October 2010), the last set of measurements on bull calves from six joinings of Brahman and Tropical Composite research herds was taken, and researchers have begun a long examination of what the data reveals.

They are hoping that a clear signal will emerge, showing that some easily-measurable traits in young bulls can be linked to increased fertility in their daughters.

This is not just wishful thinking, according to Dr Dick Holroyd, leader of the Beef CRC's 'Male Indicator Traits' circumference project.

Researchers did some preliminary number-crunching on the first three drops of bull calves and found "enough in the data to get excited about", Dr Holroyd says.

One of the most promising lines of enquiry is the percentage of normal sperm in a bull's ejaculate.

Not only is this a reliable indicator of the bull's calf getting ability in multiple-sire matings but there are also intriguing signs that it may be a guide to some key indicators of fertility in his daughters.

On one hand, Dr Holroyd says, it seems that a high percentage of normal sperm points to daughters that reach puberty faster than heifers born of bulls with lower levels of normal sperm.

The same measurement also seems to point to lactating first calf cows who are ready to mate at a shorter interval after calving (post-partum anoestrus interval).

"That's a particularly important trait, so long as it doesn't compromise survival of cows who reconceive early after calving," Dr Holroyd says.

"I spent 20-odd years looking at managing this problem through weaning and nutrition. But here's a process that is not only beneficial in selecting the bull, but in genetically improving the fertility of his progeny."

What's also attractive about the "percent normal sperm" measurement is that it doesn't need new technology.

"The measurement is already a component of the breeding soundness examination of bulls conducted by veterinarians," Dr Holroyd observes. "It is currently available as a test from a number of morphologists through an accreditation scheme conducted by the Australian Cattle Vets Association.

Another indicator showing promise is IGF (insulinlike growth factor), a protein circulating in blood. Preliminary results showed a good genetic relationship between IGF levels in a bull calf, and early puberty in females.

If these relationships hold true, then IGF levels taken from a young bull calf might become a valuable guide to whether the calf should be castrated or culled at weaning, or left entire as a potential sire.

The protein might also be an indicator of how efficiently an animal uses feed.

"Some of the other promising traits associated with male and female fertility might be things like flight time – a measure of temperament, or the age at which bulls reach 26 cm scrotal circumference," Dr Holroyd says.

"Or we might find that scrotal circumference at 12 months is a predictor of sire fertility later on, or even of the fertility of that sire's female offspring. It's a matter of crunching the numbers."

Even where relationships are found, that is not a guarantee of a useful industry tool. Dr Holroyd says cost-benefit analyses will have to be applied to ensure that a strategy's potential earnings outweigh the cost and inconvenience of testing.

Ultimately, the Beef CRC researchers will look at rolling useful relationships into BREEDPLAN, to make them readily available with all performance recorded bulls.

If several useful relationships between a bull and the fertility of his offspring emerge, they may be better expressed in indexes that weight the different traits according to their heritability and economic value.

But faced with a huge volume of data to crunch and results to validate in other populations of bulls, Dr Holroyd suggests the beef industry needs to have a little more patience.

"In all these studies, there's a lead time between getting a result and working out how it is best applied to the industry," he says. "However, all our results will be made available to industry over the next year or so."

Selecting for easier calving females

Benchmarking his cattle has enabled South Australian stud breeder Kevin Johnson to reduce calving difficulties in his herd.

"Statistics show that up to 40 per cent of two-year old British bred heifers need to be assisted in having their first calf," said Mr Johnson.

"By selecting cattle with a pelvic area of more than 160 square cms at 12 months of age, and using Estimated Breeding Values (EBVs) for Calving Ease, Birth Weight and Gestation Length, we have reduced that to less than 10 per cent. That's pretty empowering."

The decision to select cattle with a certain pelvic area came about 10 years ago when the Johnsons moved from Autumn to Spring calving.

"Calving down two-year old heifers with increased weights, higher body scores and better feed caused us a lot of grief with dystocia," said Mr Johnson.

"We'd been measuring our bulls for another BREEDPLAN program aimed at validating pelvic area. The program never went ahead, but we kept the data."

He said they discovered they'd been using certain bulls as link sires that, although they were high performing, produced progeny with small pelvic measurements.

Originally they began selecting heifers with a pelvic area of 140 square centimetres at 12 months of age.

"The area can be adjusted by 10 square cms each month. So if they were 11 months, they had to have an area of at least 130 square cms. If she was 13 months she'd have to be 150 square cms."

Through selection and culling low pelvic area animals, they eventually settled on 160 square centimetres. Since then they have reduced calving difficulties significantly.

With 70 per cent of their bulls sold into pastoral country, Mr Johnson said the traits his clients are looking for in an animal have changed over time.

Ultimately his clients are not selecting the so called 'high performance' cattle with a high 600-day weight.

"They want a hardy animal that can walk a long way and doesn't need high amounts of feed to maintain its condition. Calving ease and fertility are also highly valued among our clients," he said.

With this in mind, Mr Johnson said any cow that needs assistance to deliver a 50+ kilo calf is culled and if her progeny is a daughter, she goes too.

"Cattle in the pastoral country don't have the luxury of seeing somebody twice or three times a day. They're lucky if they see someone once a year," said Mr Johnson.

While many people in the industry are chasing increased growth rates, Mr Johnson said it is only half the equation.

"Many people believe the industry's key performance indicator (KPI) should be kilograms of beef produced per hectare," said Mr Johnson.

"But as far as I am concerned, the real KPI should be fertility and the number of live calves on the ground. If you don't have the calves on the ground in the first place there's no way you can put meat on them."

Mr Johnson said the cost of raising a heifer and her progeny illustrates just how important fertility is to the industry.

"By the time you sell a six month old calf from a two-year old heifer, she has cost you roughly $1600," said Mr Johnson.

"Therefore, an 80 per cent calving rate is just not good enough. If we are to make money, we need 99 per cent of our cattle having a live calf and improved genetics is one way to achieve that," he said.

But despite the fact the Johnsons have made significant improvements in the genetics of their cattle, he is quick to point out there is not always a financial benefit.

With the society fees, the costs associated with BREEDPLAN, the cost of feeding the bulls and the opportunity costs, Mr Johnson said it costs about $100 per month to produce each bull.

"If you're selling two-year old bulls you need to get at least $2500 to break even. But at our last auction, our bulls only averaged $3000 each," he said.

"That's not a big margin especially if we're to be rewarded for all of the effort we make in the area of genetic gain."

"At the end of the day my passion for genetic improvement does drive us to continue to do it. But we still watch the cost of production pretty closely."

"Through selection and culling low pelvic area animals, they eventually settled on 160 square centimetres. Since then they have reduced calving difficulties significantly."

Mr Kevin Johnson

Getting more from the animal, not the land

Without measuring cattle properly, you can't control the direction in which you go or take corrective measures if something goes wrong, says Gyranda's Burnett Joyce.

"I believe we have come to the point where we can't squeeze much more out of the country in terms of what we produce," says Burnett Joyce of Gyranda Santa Gertrudis stud in Central Queensland.

Mr Joyce believes the next frontier will be genetics.

"If we are to continue to improve our productivity we need reliable animals to produce from. Genetic improvement and genetic monitoring are vital if we are to be successful."

Without measuring the cattle properly, he maintains you can't control the direction in which you want to go or take corrective measures if something goes wrong.

"I think as more and more people chase growth, we'll run into birth problems," he said.

"If we're not measuring animals, we won't have a benchmark on which to look back and say 'this is we're we were OK and this is where we need to get back to'".

Although Gyranda first began monitoring the herd to improve growth rates and carcass traits including muscling, their direction has now shifted.

"We don't believe we need to push for any more growth as it is often too high for the environments we're producing in and selling bulls into," Mr Joyce said.

Today the focus is on maintaining growth rates at the same time as improving reproduction and fertility.

Mr Joyce said reproduction is important because the more cattle you have the more you have to select from and the more you have to sell.

"Better reproductive traits also means tighter calving intervals making it easier to market them and manage the groups because they're closer in age," said Mr Joyce. "Ultimately it gives the processors a better article to work with."

Mr Joyce said there is also some emphasis on finishing ability.

"It's a fine balance, but we need carcasses which finish easily and this also helps animals survive in harsh conditions. However we must also meet muscle specifications".

Mr Joyce said Estimated Breeding Values (EBVs) are used to select bulls to be run in their multiple sire herds.

Bulls are selected not only to maintain the good traits of the cows but improve the weaker traits as well.

"If we've got fertility issues we put high fertile EBV bulls with them. If we have cattle that are weak on finishing ability we put bulls with strong finishing ability with them," said Mr Joyce.

Mr Burnett Joyce and steers

"But we continue to measure and monitor the herds to ensure we're not losing the good traits that we've achieved along the way."

Mr Joyce said his main aim is to raise the average of the herd, rather than promoting the top 10 per cent.

"This business is a numbers game, and there is no point having 10 per cent of your herd that is outstanding and the other 90 per cent below average," he said.

"It is much more productive to continue to cull the bottom 10 per cent each year and promote the traits you are chasing by that means."

The benefit of performance recording to industry is immense, according to Mr Joyce. He said it allows much higher adherence to market specifications and more predictability in outcomes from different management practices.

Mr Joyce said the cost benefit from the measurements they take will always be debated. However nothing successful comes without effort and cost.

"It's true that that money we spend on research and development is disproportionate to the returns we get, but I wouldn't be prepared to do things by half measure," he said.

"There is a large block of our clients who use the information we give them. But then there is another block who don't use it because they know we do it and keep a close watch on the genetics we release to them."

Although Mr Joyce said they have watched the development of gene markers with great interest, he doesn't believe there is enough accuracy at the moment for the industry to put any time or effort into using them as a selection tool.

"That's not to say that we shouldn't pursue the technology in the future, because I think it will help us refine our selection techniques," said Mr Joyce.

Want to know more about DNA markers and genomics?

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4 May 2011: Applications of genomics in livestock agriculture
Industry applications and potential: Beef cattle, Dairy cattle, Sheep, Poultry. Future developments.

5 May 2011: Industry Training and Early Scientist Day
Guidance in the application of genomics to the livestock industries and direction on future applications of genomic research. Learn Genomics 101 and hear from breeders, extension specialists and scientists, with concurrent sessions for beef, sheep and dairy.

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Profitable southern beef systems

The Beef CRC's Regional Combinations project has identified the best combination of genetics, nutrition and management for cattle production in southern Australia. The combined effects of different growth paths, diverse genetic potential and time of calving on performance and carcase traits were examined in detail at sites across southern NSW, western Victoria, south-east SA and south-west WA over a number of years to identify the most profitable and biologically efficient systems in these environments.

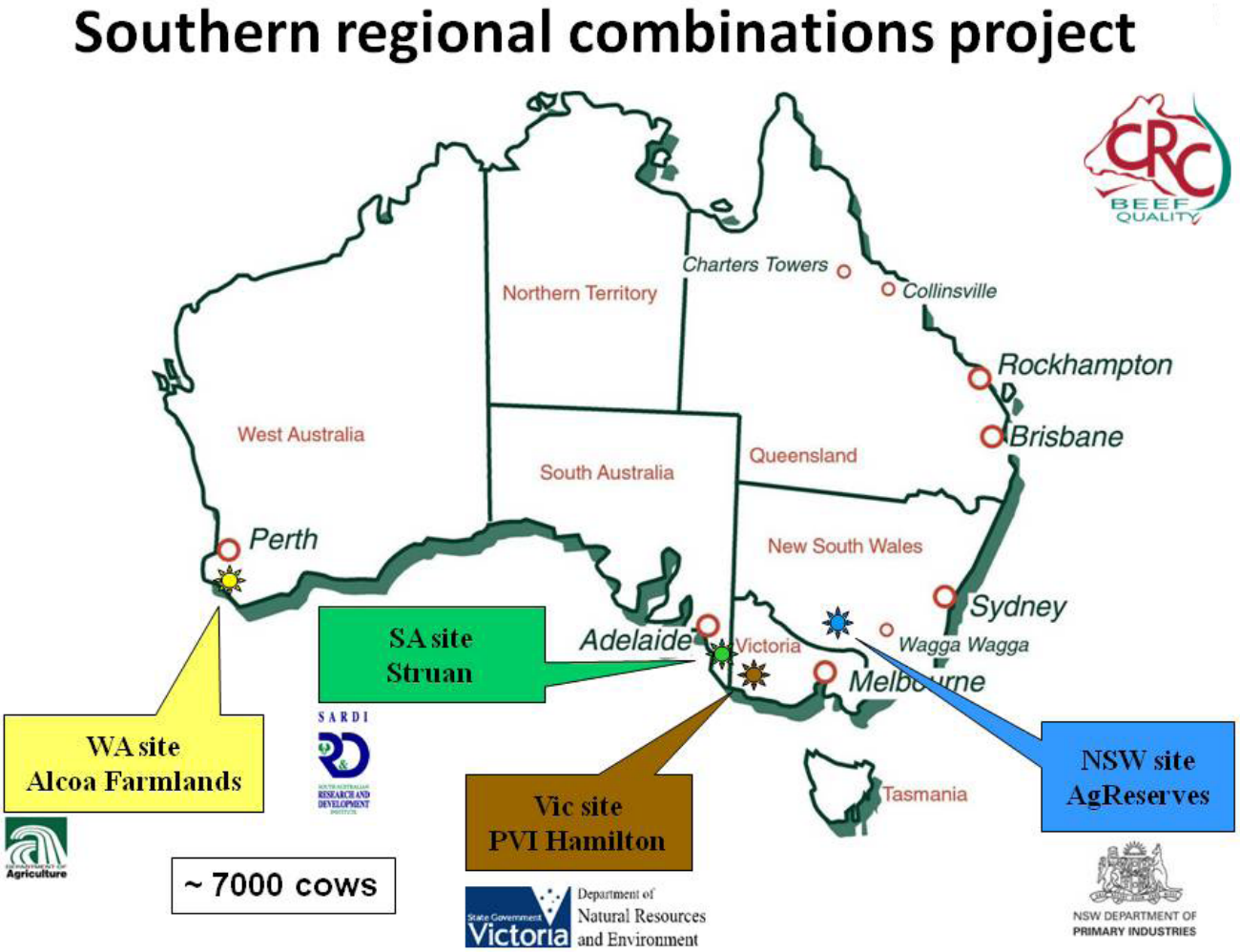
The Regional Combinations project has identified the best combination of ingredients for southern cattle production which includes genetics, nutrition and management. But like any recipe, the outcome depends on the mix.

According to Beef CRC Research Leader, Bill McKiernan of the New South Wales Industry and Investment, Regional Combinations developed management and precision breeding strategies tailored to specific regional or market specifications.

"For example, if a producer supplies the local trade, not only do they have to maintain a high level of retail beef yield (RBY) and beef eating quality, but they must also ensure they are growing stock as efficiently as possible," Mr McKiernan said.

"Tailored management and breeding strategies will guarantee cattle producers, feedlotters and processors can meet their specific requirements in the most cost effective way."

"With operating costs increasing by the day, profit margins are under pressure. So allowing the industry to consistently produce a tailored product with a higher value, will create significant economic gains," Mr McKiernan said.



Approximately 2,500 steers and heifers across four southern states were assessed in the exercise and according to Mr McKiernan, early findings are looking very positive.

The project compared three sets of Angus bulls:

1. One group was selected for EBVs for high intramuscular fat (IMF) or marbling
2. Another group was selected for high EBVs for retail beef yield (RBY)
3. The third group was selected for high EBVs for both IMF and RBY.

The project also compared the different Angus sire types with breed carcass types for high marbling (Red and Black Wagyu) and high yield European breeds (such as Charolais and Limousin).

Results have found large effects from the genetics and smaller but important effects from growth rate.

"For instance, we've done an analysis of different growth paths which show there is a small but significant effect on final eating quality in favour of animals that grew fast after weaning compared to those that grew slow over the same time period," Mr McKiernan said.

"Additionally when we looked at the economics, the fast-grown animals were vastly better economically than slow-grown - especially at the New South Wales site where there was still a substantial margin, even after adjusting for the extra costs involved in growing pastures to achieve the increased growth rate," Mr McKiernan said.

According to Mr McKiernan, the NSW and Victorian sites identified clear differences in the eating quality between carcase types and between carcase classes which favoured high intramuscular fat (IMF)-sired progeny.

"These findings were also supported by similar trends in the Western Australian data," Mr McKiernan said, "and clearly suggest that selection of sires should be made with specific importance placed on the desired final carcase outcomes required like high RBY or high IMF."

"The results also demonstrate that it is possible to select for both RBY and IMF simultaneously. But because of the positive association of fatness with eating quality, care should be taken when selecting sires of high yield potential (or with high RBY% EBV's), not to unduly decrease fatness." Mr McKiernan said.

Background

The Regional Combinations project investigated the combined effects of different growth paths, genetic potential and time of calving on performance. Carcase traits were examined in detail for different sites across to determine the best regional combinations to meet targeted market specifications.

Two different growth treatments were imposed following weaning (Fast ≈ 0.8 kg/day, Slow ≈ 0.6 kg/day, and for the WA site only, Compensatory ≈ weight loss and then reclaimed) to animals of diverse genetic potential for carcase traits (retail beef yield and intramuscular fat).

The consequences on carcase and meat quality were then examined. Data were analysed to examine the effects of growth treatment post weaning and both sire carcase type (defined by either breed type or Estimated Breeding Values (EBV) for carcase traits) and sire carcase class (sire type grouped into high yield, high intramuscular fat or combined high yield and high intramuscular fat classes). The effects of calving seasons were also analysed for VIC and WA, and in SA for one season.

The implications of these experimental outcomes for a commercial producer were then calculated by incorporating the key results into regionally-representative cattle enterprise models using the Beef-N-Omics software package.

NSW

At the NSW site there was a large ($176/ha) difference in the gross margins for pre-feedlot production between the Fast and Slow treatments favouring the Fast grown animals, even after accounting for the higher cost of producing pasture capable of sustaining faster growth.

Conversely, there was a considerable advantage to the Slow treatment animals for weight gain in the feedlot (Compensatory growth) compared to the Fast, which resulted in higher gross margins for Slow treatment animals ($29/steer). However, the difference in the feedlot phase was much smaller than the difference pre-feedlot hence insufficient to outweigh the economic advantage of the Fast growth treatment overall.

Victoria

Results from the Victorian site further demonstrate the importance of finishing cattle on a Fastgrowth path to enable quicker turnover, ensuring that periods of higher stocking rates while finishing cattle prior to slaughter are kept to a minimum. The highest gross margin per hectare was achieved using a Fast growth treatment, post weaning.

Western Australia

Economic analyses of post weaning production for the WA experiments were heavily influenced by finishing regime, since Fast growth treatments were feedlot finished compared to pasture fed for the other treatments.

The Slow and Compensatory treatments in the winter calving management group were more profitable than the Fast growth treatment. The advantage to the grass fed alternatives was mainly due to the lower cost of feed. The reverse was true for the Autumn calving treatment where the Fast growth treatment was the most profitable option. In this case there was little difference in the cost of feed and the animals in the Fast growth treatment achieved greater income from sales.

Summary

The results from this experiment are not prescriptive but can give guidance on the expected biophysical outcomes and on the expected economic impacts.

However, regional cattle producers need to have a good understanding of their whole farm system when considering the appropriate combinations of breed type and growth path that is best for them.

For example, while there may be large differences in mean gross margins between the Fast and Slow treatment groups, there may be significant differences in individual farm businesses in relation to input requirements and availability, and pasture types and growth rates through the year and consequent implications for stocking rates at different growth rates.

Sale weights and prices received for both weaners and finished cattle will also vary through the year as will supplementary feed requirements, availability and price. A specialised software package like Beef-N-Omics makes consideration of all these various factors formal and explicit.

Fear of genetics hinders profits

Cattle producers don't often trust genetics because it is a complex subject, says Tom Gubbins of Te Mania, an early adopter of genetic improvement.

One of the greatest challenges the beef industry faces is demonstrating to the average cattle breeder that genetics can actually increase the profitability of their herd, says Tom Gubbins of Te Mania Angus, a long time proponent of genetic improvement.

"In our case, improved genetics has decreased the turn off time of our steers, decreased the time it takes for the cattle to be sent to slaughter and increased marbling," he said.

"Since 1992 we've also shortened the gestation period of our stud herd by five days and significantly improved growth rate, all while maintaining birth weight."

Founded by Edwin Wilding, the Te Mania Angus story began on the South Island of New Zealand in 1928. In 1971, the gene pool was extended to Australia when two young sires and 58 females were imported into the country.

Since then the stud has become a driving force in the stud stock industry.

"We don't subjectively choose the traits, we allow the market that we're supplying dictate what traits are important," Mr Gubbins said.

Mr Gubbins said they use dollar indexes as a basis for selection decisions.

"A dollar index is an amalgamation of all the

traits that are objectively measured," he said.

"The traits are weighted depending on the economic importance of the trait in achieving a certain quality of animal for a certain market while considering environmental constraints."

A selection index is a formal method of combining Estimated Breeding Values (EBVs) for different traits into a single $ Index Value.

Breeding Angus bulls for clients who supply long-fed feedlots and the short-fed high quality restaurant trade, the key focus for Te Mania is meat quality traits including marbling and growth.

"If a lot feeder buys a steer for between $700 and $1000 and feeds that steer for 200 days at between $3 and $5 dollars per day, it costs them between $600 and $1000 on top of what they paid to buy that steer," he said.

"So if that animal doesn't comply with the specifications for the target market and they have to sell it into a lesser value market, then the lot feeder ends up losing money."

Mr Gubbins said it is important their animals comply at a higher rate than the average. And the only way to do that is through genetics.

"The lot feeder is already feeding them as well as he possibly can. The client is already creating the best environment to get an animal to marble and to have a higher meat quality," he said.

"That's why we need to target genetics, because it gives our clients confidence their cattle will perform well."

But while Te Mania puts upward pressure on marbling and growth, they have to be careful not to negatively affect other traits.

"There are all sorts of correlations between the traits. That's why you need to record the performance of the herd to ensure you aren't undoing the gains you have made."

Mr Gubbins said Te Mania have always been early adopters of performance recording. In the 1950's his grandfather and uncle in New Zealand started weighing cattle to monitor their progress. And measurement continues as a cornerstone of what they do today.

While the benefit of measuring animals is not always obvious, Mr Gubbins maintains it gives them an objective way to select the bulls they wish to breed from.

"We can use the information and compare it to the performance of its parents and offspring. We can then get a better idea of its genetics and how those genetics are influencing the phenotype (genotype plus environment) of the animal," he said.

"In our case, improved genetics has decreased the turn off time of our steers, decreased the time it takes for the cattle to be sent to slaughter and increased marbling," he said.

"If we understand as much as we can about the genotype, then our clients can make better economic choices about which animals they choose to use in their breeding programs."

Mr Gubbins said one key trait the beef industry needs to measure is Net Feed Intake, even though the expense of collecting phenotypes means very few animals are currently being recorded.

"It costs between $300 and $500 to measure the animals and with significant numbers needed to make the data worthwhile, the cost is prohibitive," he said.

"NFI is one of those traits that you can't ever see the positive or negative effect because unless you measure the amount of feed going in and the weight being gained it becomes intangible," said Mr Gubbins.

"But that's not to say that it won't be feasible to measure it in the future especially if there is a molecular method or a highly correlated trait that we can measure instead."

Mr Gubbins said they have looked into using DNA markers but he doesn't believe they explain enough of the genetic variation to warrant their use at the moment.

He said marker-assisted EBVs, where DNA information is incorporated into EBVs will be of most benefit to the industry.

"Any other way and it will be far too complicated for most of the beef industry to understand," said Mr Gubbins.

"It's hard enough for me to understand let alone a novice who has to wade through some 40 pieces of genetic information to work out the best economic scenario for him and his breeding program."

Tom Gubbins

Producer : Tom Gubbins, Te Mania Angus, Lake Victoria
Type of cattle: Angus
Operation : 2800 cattle including 1400 cows and 500 bulls
Markets : Supplies bulls to clients producing cattle for the long fed feedlots and high quality restaurant trade.
Type of country: Basalt
Average rainfall: 680mm
Key genetic focuses: Marbling and growth rate
Measurements: Birth weight; 200, 400 and 600 day weight; Front foot claw set; Front foot angle; Rear foot claw set; Rear foot angle; Hind leg side view; Hind leg rear view; Cows get measured for udder retention, teats etc; Mature cow weight; Ultrasound scans for Eye Muscle Area (EMA), Intramuscular Fat (IMF), P8 and rib fat

How now green cow?

By Dr Heather Burrow, CEO, Beef CRC, based on a presentation on practical abatement and mitigation for livestock to the NFF Modern Farmers 2010 National Congress, 6 September 2010.

Even without climate change, Australia's future food security is under pressure to meet the demands of a population set to increase by 60 percent in just over four decades.

By 2060, the United Nation predicts the world population will grow from the current seven billion to 11.4 billion.

Livestock is critical to ensuring global food security. Rapidly growing developing countries want more livestock while people in poorer countries use livestock as their bank. These people need their livestock and the rest of the world cannot avoid this.

Meeting the world's future demand for protein will only be achieved by using less water, land and grain to produce more products from livestock.

However, similar to the IPCC reports about the Himalayas melting in the next decade, some incorrect information about the environmental impact of livestock production has gained currency in consumers' minds.

These myths include the statement that it takes 50,000 litres of water to produce a kilogram of beef, and that livestock are responsible for as much greenhouse gas production globally as the stationary energy and transport sectors.

The FAO's 2006 Livestock's Long Shadow report was highly influential in fuelling this latter myth. The report was widely criticised for arriving at this assumption using figures based on a lifecycle analysis of livestock emissions but not using a similar lifecycle analysis to calculate the emissions of the transport and stationary energy sectors. The FAO confirmed this error in 2009 but the damage was done.

In addition, livestock are targeted by animal welfare and vegetarian groups on the issue of intensive production systems. What is missing in this debate is a broader discussion of the issues surrounding food supply. What are the sustainable alternatives to not producing faster-growing livestock, bred to emit less methane and grown in environmental-and welfare-friendly, high-tech production systems? There is no real discussion of the affordable, sustainable alternatives that are being developed to benefit the wider Australian population now and in a few short decades, when the population has nearly doubled.

There are four critical issues arising from climate change as it impacts upon livestock and livestock production in Australia. They are:

1. **Water:** Water will become scarcer and more expensive. A 2009 lifecycle study undertaken by the University of New South Wales found between 27 and 540 litres of water was required to produce 1kg of beef, depending on the production systems used.
2. **Grain:** Livestock industries such as pig and poultry are dependent on grain, while dairy and beef use grain strategically to maximise productivity and product quality. Climate change will reduce the amount of arable land available to grow grain. There will be growing pressure to redirect grain for livestock feed to feed starving people around the world. As well, grain may also be needed to produce bio-fuels.
3. **Methane emissions:** Methane emissions from the livestock sector dominate agricultural emissions and make up a significant proportion of Australia's national greenhouse account (11 percent). Methane is the end product of fermentation and improving

the animal's productive capacity reduces the amount of methane produced. Current estimations of livestock methane emissions in Australian production systems are obtained by measuring individual animals in respiration chambers under controlled conditions. It is unlikely these measurements can be simply transferred to grazing livestock that interact with the air, plants and landscape. It is also difficult to measure the full range of carbon capture and sequestration activities undertaken by farmers.

4. **Climate-change adapted cattle:** If the climate is to become hotter, we need cattle that are better adapted to a harsher, more variable environment. Livestock will have to withstand stressors such as drought, heat and parasites. Genetics, and the sequencing of the bovine genome along with the sequencing of parasite genomes like the cattle tick, offer important new tools to increase the precision of the millennia-old practices of breeding animals for important traits and improving disease resistance.

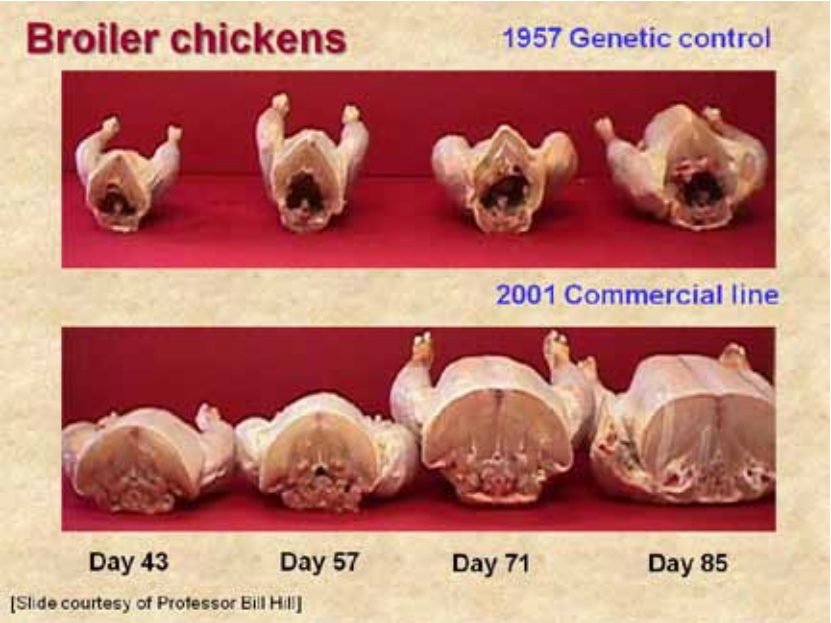
What is required to meet these challenges is a mix of practical on-farm action and new high tech approaches. The value of technology in achieving climate mitigation is often overlooked.

The impact of technology on farming systems is highlighted by a study undertaken in the United States dairy industry comparing the resources required to produce a kilogram of beef in 1944 and in 2007.

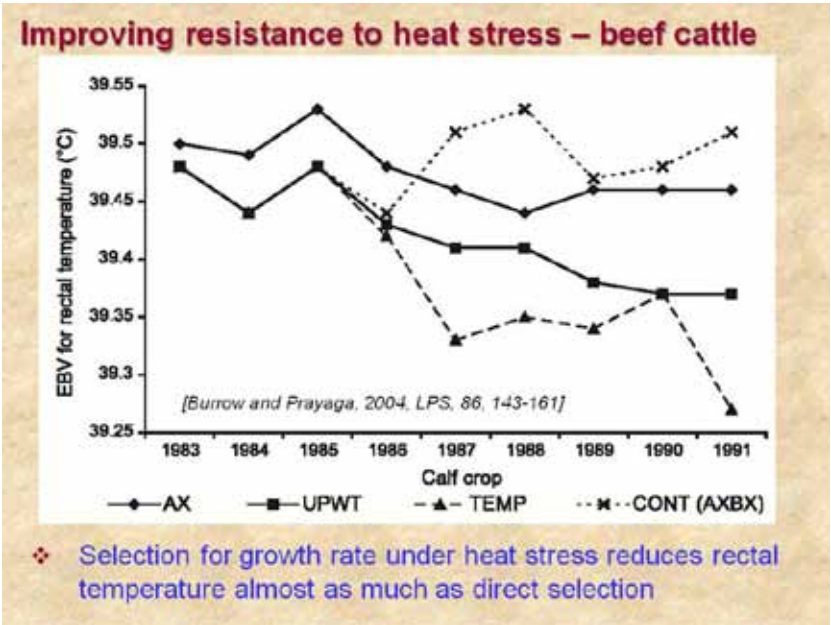
It showed that modern dairy farmers now require 21% fewer cows, 23% less feed, 65% less water and 90% less land to produce the same amount of milk as in 1944. These improvements were achieved with very significant reductions in the amount of methane and waste produced from the cattle.

Better genetic management of animals, more efficient crops and pastures, sustainable production systems and improved consumer understanding about food production is critical to meeting the future demand for protein under the climate change scenarios of a hotter, wetter North and harsher, drier South.

Australia must continue to invest in R&D research to meet these future challenges.



In poultry, the evidence of the impact to profit of genetic improvement is clear. This image shows a comparison of 1957 genetics with a 2009 commercial line bred chicken. The success of genetic improvement in the poultry industry is sometimes wrongly attributed to hormones, which are not used in poultry. The poultry industry has raised on-farm and off-farm productivity over several decades through a combination of genetic improvement, economies of scale and mechanisation in processing.



Direct selection for reduced rectal temperature does significantly reduce rectal temperature and, therefore, resistance to heat stress. Selecting for this trait also led to significant improvements in female reproduction. The good news, though, is that selection for growth in a heat susceptible breed also indirectly improved both resistance to heat stress and female fertility without compromising other economically important traits. There is evidence genetics works in a number of livestock species, not only for simple traits like growth rates but the more complex traits like heat stress and resistance to ticks.

Bernadett in the bushfire

'Bernadett in the bushire' was an entry into the Beef CRC 2010 photo competition run in August and submitted by Sharon Jordan at Ten Rose, Longwarry, Victoria. The picture was taken on the day of the devastating Victorian bushfires.

Sharon writes:

"Dear Beef CRC,

This is a photo of our much loved cow Brenair Park Bernadett, taken during the devastating bushfires in Victoria in 2009.

We breed stud Simmental cattle. Our property is at Longwarry and the fires jumped the highway and came to within a kilometre or so of us.

This older cow, Bernadett, never got upset with all the events going on and this contributed to keeping the other cattle calm.

Bernadett is an interesting matron. She was bred by Don Mathieson at Drysdale Victoria, from German imported genetics. The cow is now 15 years of age and was 14 at the time of the photo.

The older cow has a lot of history and we have had several offers from other breeders wanting to purchase her, but she will always remain here. We have always liked her and the previous owner would not sell her, not until he had a dispersal sale a few years ago and we were lucky to buy her. No one knew she had record figures for marbling, tenderness and feed efficiency at the sale. It was not until some time after we got her home and tested her that the results came through.

Bernadett has the world record of the highest DNA cow on record for Simmental for marbling, tenderness and feed Eeficiency. She has also calved every year with all registered progeny and has survived three homes and a bushfire.

I took this photo (above) on the morning of the bushfire. There was a lot of smoke; you could not see the sky. The smoke crept in through the trees, much like the fog that we get coming in some winter nights.

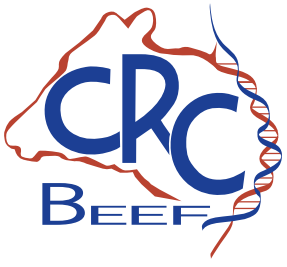
The sky on the day was very orange and grey, and the smoke filtered out the sun. It was all very eerie. Embers were flying around the town and they thought we would have to evacuate. Farmers refused to go and remained with their animals. We bought the cattle up near the home for what protection we could give.

We were fortunate that we never lost any cattle, but very sadly, hundreds of other farmers did."

Photo competition entries can be viewed on our website -

http://beefcrc.com.au

Finalists will be included in the next edition of the *Beef Bulletin*. Pictured below: Bernadett aged 15 years iafter the bushfire - still looking cool, calm and collected.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