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Prepared by: SJ Lee and WS Pitchford
School of Animal and Veterinary Sciences
The University of Adelaide

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National Beef Genetics Extension Strategy

Beef CRC Extension Program (formerly Beef CRC Champions)

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Contents

Abstract

Increased knowledge of genetics underlying profit and functional traits in Australian beef cattle presents a significant opportunity to increase rate of genetic gain through extension and implementation of such knowledge in breeding programs. A key component of such a model is increasing the understanding and ability of beef cattle breeders to utilise knowledge and tools to cost effectively increase the rate of genetic gain. There is a clear need to have different strategies for seedstock and commercial producers. A strategy focused on effective extension to various segments within the beef industry is detailed for consideration.

Executive summary

The draft beef genetics extension strategy has been developed following a period of extensive research and development (R&D), particularly through the Cooperative Research Centre for Beef Genetic Technologies (Beef CRC) that has generated new understanding of genetics and association with economically important traits (Appendix 1). The challenge for the Australian beef industry is to effectively harness this knowledge and increase rates of genetic gain. Current rates of genetic gain vary greatly between seedstock breeders, both within and between breeds. This is partly attributed to variable (often non-existent) market signals from commercial producers with regard to preparedness to pay for bulls with higher genetic merit, particularly in northern Australia. Lack of commercial producer price signals is primarily associated with ineffective proof of profit messages and a low appreciation by commercial producers of the role genetics has for productivity, product quality and enterprise profitability (see Appendix 2 for detailed situation summary).

Over 40 stakeholders involved in beef genetics extension and implementation were interviewed by the project team during the consultation phase with additional opportunity for input at a facilitated workshop for beef genetics extension stakeholders (Appendix 3). The consultation focused on documenting current genetics extension and implementation efforts (Appendix 4), identification of gaps and opportunities and exploring strategies to address the gaps and harness the opportunities (Appendix 5). In addition to consultation, numerous industry reports of genetics implementation were considered in the development of the strategy.

The primary objective of the strategy is to increase the rate of genetic improvement and thus profitability, productivity and product quality for commercial beef producers. Focus is given to creating demand in the commercial sector and facilitating increased rates of genetic gain in the seedstock sector.

Major initiatives include

a) Demonstration and communication of compelling proof of concept and proof of profit examples drawing on both research and existing industry breeding programs
b) Creating demand in commercial sector for genetic improvement through clearer market signals from the value chain with a particular focus on the MSA Index
c) Continued engagement with influential bull breeding herds to ensure they are achieving high rates of genetic gain and are well informed advocates for genetic improvement
d) Advisory services and assistance to bull breeders, particularly in northern Australia who have, or are about to commence extensive performance recording to ensure data is being collected in appropriate method
e) Establishment of an active beef genetics extension network that facilitates training and dissemination of material that can be used in consulting with and communicating with breed producers
f) Market research, particularly in northern Australia focused on understanding the barriers to adoption (both by bull breeder and bull buyer) and development of communication and marketing packages to address this

Implementation of the strategy will be dependent on the resources available. Given limited resources from Meat and Livestock Australia (MLA) and state departments of primary industry, it is also recognised that it will be imperative to leverage investment and seek co-investment from value chain and outside partnerships.

Widespread stakeholder commitment is required to ensure effective implementation of the strategy. The success of the strategy will be measured by the following criteria By 2020:

a) Performance: 50% increase in rate of genetic progress as measured by weighted average of selection indexes for each breed society compared with 2012 base year
b) Penetration: 25% of bulls used in commercial matings in northern Australia and 75% in southern Australia have BREEDPLAN Estimated Breeding Values (EBVs)
c) Establishment of coordinated genetics extension and consulting network

Strategy objectives

Objective 1: 50% increase in rate of genetic gain measured by weighted average of selection indexes for each breed society compared with 2012 year-of-birth base year.

Table 1. Average increase in rate of gain for 2011 to 2012 born cattle for breed associations that are part of SBTS (southern) and TBTS (northern) respectively.

	2012	2020
North	$1.04	>$1.50
South	$4.68	$7.00

Notes: leading seedstock breeders are approaching rates of gain of $7.00/year. As more herds commence performance recording programs with BREEDPLAN, the breed average mean for genetic merit may reduce with flow-on impacts to rate of gain. Thus, rate of gain should be compared like for like, i.e. with adjustment made for involvement of new herds.

Objective 2: Increase number of bulls used in commercial matings with BREEDPLAN EBVs from 12% to 25% in northern Australia (maintain southern Australian market penetration at estimated 75%).

Objective 3: Establishment of functioning genetics extension network

Additional targets for traits not included in current breeding objectives must also be considered. Areas for consideration include:

a) Routine recording of docility, use in BREEDPLAN EBVs and genetic trend in favourable direction for breeds with docility EBVs
b) Increased use of poll gene marker tests and reduction in proportion of horned animals through breeding
c) Increased use of full Bull Breeding Soundness Evaluation (BBSE) as part of bull selection and prior to mating for both seedstock and commercial sector

Major recommendations

1. Development of compelling proof of profit messages (and proof performance recording, genetic evaluation and selection based on EBVs is effective) drawing on R&D projects results, Beef Information Nucleus and examples from herds in industry

2. Focus efforts on increasing use of BREEDPLAN and BBSE for selection in northern Australia by working closely with seedstock breeders implementing and/or expanding performance recording programs

3. Maintain effort on assisting influential breeders to maximise rate of gain

4. Work with the beef supply chain to facilitate increase in price signals associated with traits of economic importance (i.e. higher c/kg carcass weight for carcass with higher predicted eating quality based on MSA Index).

5. Establishment of a livestock genetics extension network with regular e-communication (minimum every 3 months) and annual face-to-face updates/training.

6. Market research focused on identifying barriers to adoption and implementation and solutions to these through a communication program.

Demonstration that genetics works with compelling proof of profit

Objective: compelling proof of concept and proof of profit messages for production system to farm gate and for the entire value chain

Outcomes

a) Material developed that can be used to increase commercial beef producers awareness of the role genetic improvement has on enterprise productivity and profitability
b) Greater demand from bull breeder to objectively described bulls with superior genetic merit

Background

Throughout the consultation there was consistent feedback that the substantial value chain wide benefits from genetic improvement had not been as well or effectively communicated with commercial producers as they could have been. There was a need identified for development of compelling proof of on-farm profit messages. This need was also highlighted by Freer *et al*. (2003) and more recently by Fennessy *et al*. (2014) who recommended, "investment in generation of robust data to show the benefits of genetic improvement in commercial settings."

Approach

It would be ideal to see the recommendation of Fennessy *et al.* (2014) adopted but this will be accompanied by substantial cost and a time lag to demonstration (particularly for reproductive rate). Two alternative and complementary approaches are suggested, one utilising research herd data sets and the other working closely with existing breeders with demonstrable improvement in genetic merit.

Research herd data sets:

It is recommended that recent research outputs (including from Beef CRC) are reviewed and on-farm productivity and proof of profit messages established for model farms based on differences in weaning rate, growth rate, carcass quality (and feed intake where available) that were observed for animals differing in genetic merit (teams of sires, divergent selection lines etc.). This task should be undertaken by a small team with expertise in livestock genetics, agricultural economics, livestock extension, science communication and marketing. The following metrics should act as a base when developing the messages and examples:

a) Productivity (kg/Ha)
b) Cost of production ($/kg)
c) Turn off age
d) Quality (MSA Index and component traits)
e) Income per breeding cow
f) Return on investment (what is the to-farm-gate value of genetic improvement)

It is also suggested the messages could be framed in context of the financial cost to commercial producers' business for selecting the wrong genetics. This is aimed at trying to enhance the mobility of commercial producers to seek bulls from a different source if their seedstock supplier is not achieving documented genetic gain in a direction that is conducive to increased profit in their business and the value chain. For sheep, the approach of increasing commercial producer mobility was predicted to have substantial industry benefits (Atkins 1993).

Industry case studies:
The use of the industry based case studies is focused on a producer advocate approach. This approach will help facilitate the communication of messages and outcomes to commercial beef producers. These case studies will involve the development of detailed productivity and profitability outcomes through improvement in genetic merit with a longitudinal component (i.e. not once off). Case studies would ideally document the change in genetic merit achieved and associated increases in productivity (e.g. increased weaning rate, shorter time to turnoff, improved carcass quality) and income. Where possible such case studies should be undertaken in multiple regions and breeds to overcome any suggestions that the results are not applicable to particular geographic regions or breeds. Case studies would ideally also detail the bull selection strategy employed by the seedstock enterprise to achieve the gain they have.

Assistance and advisory to (northern) seedstock breeders

Objective: greater use of performance recording and genetic evaluation and BBSE in breeding program.

Outcomes
Assistance in early stages of collecting performance records for genetic evaluation and use in sire selection is important. It is essential to ensure that seedstock breeders are encouraged and aided in their efforts towards more comprehensive performance recording and use of genetic evaluation in selection decisions. There is a significant risk that seedstock breeders become disillusioned with performance recording and genetic evaluation through either unrealistic expectations or poor data quality leading to poor evaluation outcomes. Breeders that 'try' BREEDPLAN and become disillusioned represent a significant loss and risk for rather than these people being advocates of the technology they will likely be detractors.

Summary: increase the number of seedstock breeders:

- with appropriate performance recording practices
- that possess working understanding of use of genetic evaluation in animal selection
- achieving higher rates of industry genetic gain
- that are advocates for the technology rather than detractors

Background
For seedstock breeders considering performance recording or recently started performance recording in BREEDPLAN, there is a clear need to provide follow up assistance to increase likelihood of successful adoption and utilisation of BREEDPLAN. This was noted by Freer *et al*. (2003) and was a common theme from stakeholders in northern Australia. Is it expected that bull breeders new to BREEDPLAN will need assistance in understanding important aspects of performance recording and genetic evaluation including genetic linkage, defining contemporary groups and the importance of recording all animals. Whilst much of this material can be readily found on Southern Beef Technology Services (http://sbts.une.edu.au/, SBTS) and Tropical Beef Technology Services (http://tbts.une.edu.au/, TBTS) websites, it is essential to ensure seedstock breeders embarking on performance recording do not become disenfranchised early due to suboptimal recording methods. This need is unlikely to be seen to the same extent in southern Australia to the same extent due to higher current rates of adoption.

Approach
Several steps are involved in this process:

Using material developed in above major recommendation 1, demonstrate and convince the on-the-fence seedstock breeder that genetic gain can be achieved through performance recording and genetic evaluation. Moreover it will be important to demonstrate that such selection leads to greater profit throughout the supply chain and demand for such bulls with documented genetic merit is increasing.

Support from TBTS and local industry service providers: it is thought phone support from TBTS and putting the seedstock breeder new to performance recording into contact with a livestock genetics consultant/advisor and a more experienced breeder in performance recording will help. Much of this will need to be on-the-ground (and recognising on-the-ground visits take time in preparation and travel) with follow up phone &/or online support. Concepts that will need to be discussed include:

contemporary groups, effective records, data integrity, methods for performance recording (where possible see how it can be integrated with current production system).

It is also important to manage expectations given that rate of gain depends on accuracy of breeding values (and other components e.g. selection intensity) which depends on quality and quantity of informative data in genetic evaluation system.

Requirements for implementation

There is a dearth of sufficiently experienced and available people in northern Australia to undertake this work at a local level and support the work of TBTS. Currently in northern Australia this is limited to a portion of the single FTE with TBTS (Paul Williams), a small component of time from Animal Genetics and Breeding Unit (AGBU, Matt Wolcott and David Johnston), 1 or 2 private consultants with appropriate expertise and a small component of FTE in state and territory departments of primary industry. Current total FTE operating in this area is likely under 2. Through the genetics extension network (see Major Recommendation 5) people will be identified and trained so they can fill the role of local service provision for this recommendation.

Influential breeder support

Objective
Ensure influential breeders are achieving the highest rates of gain possible

Outcome
The value of genetic gain from influential herds multiplies through the beef industry. By ensuring the relatively few 'nucleus' herds that supply genetic material to multiplier seedstock breeders and commercial producers are achieving very high rates of the rest of the industry will benefit.

Background
When investigating population structure within breed, Amer (2014) identified that there is evidence of declines in rates of importation of genetics for some major breeds in Australia (Angus, Hereford and Brahman were investigated). In addition, approximately 60% of herds do not supply sires to other breeders but those herds that do disseminate genetics tend to have higher genetic merit. It is the herds with major influence on rate of genetic gain in the breed (high gain and dissemination of genetics) that should be targeted.

Approach
Engagement of nucleus breeders in R&D and the AGBU Influential Breeder Workshops is common practice. It is recommended that on a periodic basis (e.g. 3 years) an analysis is undertaken to identify which herds within each breed are contributing the most genetics and genetic gain to multiplier bull breeders within each breed (i.e. identification of nucleus herds). It is these supplier or nucleus herds that should be targeted.

Two complementary approaches to engaging with these breeders are outlined, 1. Ensuring 'nucleus' herds are involved in genetics research and development; 2. Maintaining the AGBU Influential Breeder Workshops.

a) Involvement in R&D: Many influential herds are already involved in R&D. Where possible this should be maintained and/or expanded. There are industry benefits observed with this:
   - influential breeders tend to be excellent advocates for BREEDPLAN and genetic evaluation
   - they have extensive client training initiatives to highlight the benefits of genetic gain for beef producers
   - animals in nucleus herds can inform genetic evaluation for other animals in the breed for new traits developed from R&D

b) Involvement in AGBU Influential Breeder Workshops: herds that are contributing the most genetic gain within a breed (factor of rate of gain and dissemination of genetics to multiplier herds) should continue to be involved in the AGBU Influential Breeders Workshop to ensure the breeders are up-to-date with current R&D outcomes and understand how they can best utilise new technology. In addition they can discuss with other breeders practices and approaches for i) achieving highest rates of gain possible and ii) communicating the benefits with their commercial client base.

Enhanced value chain partnerships

Objective
Price signals to commercial producers based on product quality

Outcome
Commercial producers able to observe higher price received (c/kg) for cattle of higher carcass quality and able to understand and value the contributions of genetic improvement to increased carcass quality.

Background
Parnell (2007) suggested an emphasis on value chain partnerships to help facilitate increased demand for adoption of beef genetics. This would occur by way of price signals (higher c/kg) for carcases with higher Meat Standards Australia (MSA) Index. Some value chain price signals exist for quality. For example, beef consumers in Australia were prepared to pay an extra 30c/kg (carcass weight equivalent basis) for meat that was MSA compliant compared with non-MSA compliant meat and 14c/kg of this was returned to producers (Griffith and Thompson 2012). Given the recent launch of the MSA Index (see http://www.mla.com.au/News-and-resources/Industry-news/MSA-Index-hits-the-mark; accessed 15/09/2014) and potential for price premiums to commercial producers associated with MSA Index and carcass optimisation, there is scope to further enhance supply chain relationships and thus price signals. For example, a major beef processor in NSW is offering premiums of 20c/kg for cattle with MSA Index >61 and AUS-MEAT marbling score 2 (approximately equivalent to MSA marbling 400 and above). Such price signals can then act as a catalyst for commercial producers to assess performance of their cattle and determine the likely proportion of cattle that would attract premiums if sire with superior genetic merit for traits such as intramuscular fat EBV were purchased.

Approach
The MSA Index provides a mechanism by which commercial producers can evaluate the economic importance of genetics and management in their production system on price received (direct consignment only). Given the recent developments in MSA, it is recommended that major market programs be updated to include content, tools and links to MSA Index information (including information on accessing MSA Index and feedback for their animals).

In time, current R&D project outcomes will allow clearer quantification of the effect of genetic merit on MSA Index. This will allow commercial producers to quantify the benefit of improved genetic merit for MSA compliance and also MSA Index. It is suggested that producers are actively encouraged to access information on MSA compliance and quality for their animals so that they can begin to assess the potential opportunities for greater price received for higher quality carcasses in future. This can (and is) being achieved through various initiatives including More Beef from Pastures (MBfP) and the Victorian Better Beef Network in southern Australia. Agricultural value chains are also an area where several state governments have interests in further development.

Continued work with major beef processors to quantify and capture economic benefit from carcasses with higher predicted eating quality is essential. It is understood this is already occurring through the introduction of MSA Carcass Optimisation.

Establish a livestock genetics extension network for training and coordination

Objective
Industry service providers engaged in beef genetics extension are active participants in genetics extension and training network

Outcomes
The purpose of the network would be multifaceted and include:

a) Training opportunity (train-the-trainer) for people involved in direct-to-producer beef genetics extension
b) Greater awareness/coordination of the range of direct-to-producer activities occurring that have a genetic component
c) Greater awareness of the R&D and tool development occurring
d) Mechanisms for forming and checking common messages, providing updates and delivery material
e) Greater facilitation of feedback from bull breeders and commercial producers to extension agents and those undertaking R&D (recommendation from Moreland and Hyland 2013)
f) Planning and implementation forum

A well-functioning genetics extension network should lead to the following amongst participants:

a) common understanding
b) common material to use
c) consistent messages to industry
d) common delivery of programs (saves preparation time), product can be refined on an as needs basis
e) enhanced cooperation

An overall aim is that there is a high likelihood that someone in the genetics extension network would provide the same advice and recommendations to a seedstock or commercial producer regarding breeding program or bull selection as the next person (or be able to identify the appropriate person for the producer to contact).

Background
There are many parties involved in beef genetics extension and associated services including MLA, SBTS, TBTS, Agricultural Business Research Institute (ABRI), breed societies, More Beef from Pastures deliverers, Future Beef, livestock consultants, scientists, seedstock breeders and other industry service providers including veterinarians, ultrasound scanners and livestock agents. There are some efforts at coordination between stakeholders in beef genetics extension (primarily facilitated through SBTS and TBTS). However, a very strong message from consultation was the clear need for national coordination of beef genetics extension. It is also important that there is some development of capability at a local level. For example, the 1 FTE in TBTS is likely not sufficient to meet on-the-ground advisory requirements for beef producers in northern Australia.

Approach
It is suggested that a national genetics extension network be established encompassing individuals who fit into any of the groups mentioned above and provide direct-to-producer genetic extension, advice or services.

The primary network activity would be an annual workshop to provide genetic updates and also to explore opportunities for collaborative/coordinated extension efforts. Regular communications and webinars (quarterly) on important topics (recorded) would also occur.

It is expected that such networks require external funding. Although networks likely add value to the businesses of the individuals involved, there appears limited appetite for individuals/organisation to fully fund the coordination of such groups. There are also extremely similar requirements in sheep so it is suggested that some cost efficiencies could be gained by having a broader livestock genetics extension network rather than a beef only network. Species specific sessions could still be held. Where possible a single person should be responsible for the coordination of the network and delivery of activities. It is envisaged this role would substantial and approximately 0.5 FTE.

The model adopted by sheep genetics extension has been one focused on different levels of engagement with people in the network. For example, there is more comprehensive involvement for genetics extension consultants (in-depth technical advisory role) but lesser involvement of people with lower component of their work comprising advice on genetics (e.g. advice to commercial producers on sire selection).

The network and its activities will encourage increased participation by producers in training and implementation of appropriate genetic improvement strategies with positive outcomes. Through this approach, people involved are likely those that will raise research issues as well as being direct beneficiaries of the research. Furthermore, by developing a participatory culture there will be increased producer ownership of outcomes and tools developed. This will lead to greater passion of transfer of messages to commercial clients and wider bull buyers.

Initial activities of network

a) Messages and material review

There was a consistent message during consultation that there were contrasting messages on BREEDPLAN and BBSE delivered to seedstock breeders and commercial producer audiences. The mixed messages are eroding producer confidence in R&D outcomes and creating uncertainty on the best course of action. An example from northern Australia of this is differing level of importance of BBSE and optimal age(s) at which to conduct BBSE. An example from southern Australia can be found in More Beef from Pasture manual (http://www.mla.com.au/mbfp/Cattle-genetics/Tool-42-Breed-trait-averages) which reports across breed BREEDPLAN EBVs from 2003.

It is recommended that current extension material for MLA major market programs be reviewed to ensure messages are current and consistent. During the review there is an opportunity to update current documents to focus more on compelling value proposition based on outputs from producer case studies (see Major recommendation 1). It is suggested that material is reviewed and updated annually. This does not need to represent a large on-going task once the foundation is provided. It would be prudent to make updates at a point where they can be effectively and efficiently communicated to industry service providers and livestock genetics consultants (e.g. prior to annual training and updates, see initiative detailed below).

b) Training and industry capacity – consultants and seedstock advisors

There are limited formal training opportunities for beef genetics extension officers and consultants, particularly for sole operators. From consultation it was evident there is a need for training with two levels identified. The first level is for advanced training in breeding program design and diagnostics. This need is partly met by the annual University of New England Summer School and previously through the Masters in Animal Breeding and Management offered jointly by UNE and Sydney University. The second need is for training of livestock genetic consultants to a level where they have:

i) A thorough understanding of the material underpinning bull select workshops
ii) The ability to interpret seedstock breeder herd metrics (see enhanced dashboard, minor recommendation) and make sound recommendations on options to cost effectively increase rate of genetic gain.

When considering this initiative it is important to recognise the limited size of the market making it difficult to justify the development and provision of a training package. As stated above, economies of scale could be gained through combined sheep and beef genetics training.

Given limited resources (Appendix 2, Tables 3-5) it is recommended that the current (initial) focus should be on training a small number (approximately 10) consultants that are able to both deliver bull select workshops and work with seedstock breeders in reviewing breeding program and providing recommendations. It is thought that this group will partly offset the recent loss of capacity that has occurred in State Departments. However, opportunities and methods for broader and effective engagement with industry service providers should also be explored. Primary activities for genetic focused consultants are detailed in Table 2.

c) Training and industry capacity - industry service providers

Beef industry service providers include but are not restricted to veterinarians, livestock agents, ultrasound scanners and semen agents. Mixed perspectives were evident during consultation on whether there should be investment in training of industry service providers. Some stakeholders perceived substantial opportunity in using these networks in basic genetic awareness whilst others queried the likely success. The suggested approach is through annual northern and southern service provider forums focusing on key messages and recent developments. The service provider sector should be provided with material generated in major recommendation 1 and shown how using these messages can add value to their businesses.

Table 2: Primary direct-to-producer activities for seedstock and commercial breeders

Deliverer	Activity and messages	Metrics and tools	Audience	Outcomes	Notes
Genetics consultant	Performance recording and breeding program review and options to increase rate of genetic gain	• $/gain/year • EBV genetic trends • %acc EBV and data quality • Generation interval • Sire selection differential • Inbreeding rate	Seedstock breeders	Breeder informed on options to increase rate of gain	Consultant will need detailed understanding of genetic evaluation
Industry service provider (e.g. extension officers)	Bull selection for commercial producers • Identifying appropriate breeding objective • Understading EBVs • Valuing genetics		Commercial producers	Purchase from seedstock herds with documented genetic imporvement in desirable direction	Beef extension officers, consultants

Market research

BREEDPLAN is an established technology that can demonstrably be used to inform animal selection and achieve genetic gain which is associated with greater profit for both beef producers and the wider beef value chain. Despite this, the rate of adoption and effective use of genetic evaluation for informed animal selection remains well below potential (see Appendix 2, Current level of adoption and rate of genetic gain). At the stakeholder workshop, there was considerable discussion and support for the engagement of a market research company to investigate barriers to adoption and to develop communication solutions to address such barriers.

Feedback from the workshop was that specialist market research and marketing companies had not previously been engaged in the branding and marketing of BREEDPLAN to either commercial producers or seedstock breeders. It is therefore recommended that a specialist market research company is engaged to investigate and report on:

i) industry characteristics and barriers to adoption of genetic improvement programs at both the seedstock and commercial level
ii) key influences on decision making processes and how to leverage them
iii) opportunities for improvement in communicating and marketing of BREEDPLAN and the economic benefits realised through genetic improvement

Minor recommendations

Seek external funding and co-funding opportunities

Given the limited industry funds available for beef genetics extension it is timely to consider alternative sources of funding. During consultation it was repeatedly noted that there are numerous funding initiatives on national, state and regional basis often linked with sustainability and environmental programs and outcomes, for example grazing management, reef management, greenhouse gas reduction. Genetic improvement to increase productivity aligns with several of these initiatives. A more organised effort to utilise these funds for combined purposes (e.g. genetics to improve productivity and lower greenhouse gas emissions intensity) would allow for increased direct-to-producer engagement.

Another theme that was evident during consultation was the scale of the beef industry and the value of beef producers to certain businesses including financial institutions, insurance and animal health companies. It was proposed there is scope to leverage this interest through corporate investment in beef extension initiatives including sponsoring of beef groups and producer demonstration sites. Whilst this idea has not been developed further, it is worth exploring particularly for co-sponsorship of demonstration sites that will receive much agricultural media focus.

Enhanced feedback and decision support tools for seedstock breeders

Efforts are underway in both beef and sheep to develop enhanced feedback and decision support tools for seedstock breeders for benchmarking (including genetic trends, selection differential) and tactical (e.g. mate allocation) and strategic decision making (breeding program design). In sheep, it is planned that these reports will be accessed through a web interface. Benchmarking reports currently provide the basis for on-farm consultation between TBTS/SBTS and breeders and for AGBU consultation as part of influential breeder workshops.

Easy-to-access and interpret benchmarking reports coupled with decision support tools offer significant potential for seedstock breeders and their advisors to review their breeding programs and identify changes to cost-effectively increase rates of genetic gain. This represents a business opportunity for consultants to work with seedstock breeder clients to cost effectively increase rate of genetic gain. Given similar initiatives in sheep, it is suggested that further development and testing be coordinated between AGBU, ABRI, Sheep Genetics, Sheep Cooperative Research Centre (Sheep CRC) with input/trial and testing from breeders and consultants.

Composite cattle and cross breeding

Hybrid vigour represents a significant on-farm productivity improvement both in northern and southern Australia. In addition, the development of tropical composite with *Bos indicus and taurus* genetics represents an additional productivity increase. During the consultation phase several stakeholders were very keen to ensure that commercial producers are presented with information on the productivity increases associated with composite cattle and not consider selection and management to be the only ways to increase on-farm productivity. This was also considered to be an avenue to engage with commercial producers on the topics of breeding objectives, cost of production and productivity.

Creating demand from the commercial sector

i) Focus on large scale commercial producers in northern Australia

In northern Australia lack of commercial demand for bulls with BREEDPLAN EBVs and BBSE was cited as the largest barrier to seedstock breeders engaging in performance recording to inform animal selection and facilitate genetic gain. It is essential that seedstock breeders in northern Australia are investing in performance recording and achieving genetic gain due to the substantial flow on effects.

A common message during consultation was that if large scale influential commercial breeders begin to use BREEDPLAN and BBSE in sire selection much of the rest of the industry will follow. This perspective is supported by a report written 20 years ago (Guerin and Guerin, 1994) that detailed that opinion leaders (influential and large scale producers) have an important influence on the adoption process by creating new norms in a community and influencing the behaviour of other end users. In northern Australia new norms are required, i.e. the purchase of bulls that have full performance recording, are genetically superior for industry selection indexes and that have passed a full BBSE. It is suggested that advisors to the large scale producers are approached to:

i) Develop a sire selection (or breeding plan) for the producer (and value proposition to the company)
ii) Assist with initial rounds of bull selection to ensure bulls are purchased on the above criteria
iii) These selection approaches and associated benefits are then documented and communicated to commercial producers through major market programs (e.g. FutureBeef and Bull Select events).

The initial focus in creating demand amongst large producers should be with the largest 10 producers who are collectively running 2.25M head in northern Australia.

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Appendix 1: Review of genetics messages

Genetic improvement of reproduction in tropical beef cattle - a synopsis of research findings from the Beef CRC (adapted from material provided by Geoff Niethe)

Practical messages for non-seedstock (commercial) producers wishing to improve reproductive efficiency.

- Purchase replacement bulls with above breed average (or herd average) EBVs for reproduction Days to Calving (more negative is favourable) and Scrotal Circumference (more positive is favourable)
- Ensure all bulls purchased are accompanied by a Bull Breeding Soundness Examination certificate.
- Develop a good heifer management policy and ensure the majority of heifers are cycling at the time of mating.
- Over-mate replacement heifers and select primarily on those that conceived earliest in the joining period.
- If breeder numbers are adequate, cull those maiden heifers that fail to re-conceive.

Practical Messages for seedstock producers wishing to improve reproductive efficiency.

- Record female reproductive performance (for all females)
  - Record the reproductive performance (i.e. mating group, mating outcome, lactation status etc.) of maiden heifers and first-calf cows.
  - Cull non-pregnant cows in these age groups.

- Selection based on EBVs and BBSE for sire selection
  - Select replacement animals on relevant $Index value
  - Consider important EBVs in selection, e.g. select stud sires with above average reproduction EBVs (i.e. more negative days to calving EBV, more positive Scrotal Size EBV)
  - Consideration should also be made for homozygous poll
  - all bulls purchased are accompanied by a Bull Breeding Soundness Examination certificate.

- Do not use bulls that have originated from dams that have failed to get in calf during their 1st lactation.
- Brahman breeders should record scrotal circumference in bulls at 12 months of age while Tropical Composite breeders should record SS at 6 months and collect Percent Normal Semen (PNS) data on 12 month old bulls.

A summary of the five components of bull fertility in the BBSE (source John Bertram)

- **Scrotum** - Scrotal circumference/size (SS) in centimetres (cm) where testes shape is within normal range. The current recommendations for tropically adapted bulls are a minimum scrotal size of 32 cm (and average is 34 – 36 cm) for a two year old bull.
- **Physical** – Within the constraints of a standard examination, there is no evidence of any general physical/structural condition or of a physical condition of the reproductive tract indicating sub-fertility or infertility. This evaluation will identify structurally unsound bulls in legs, feet, sheath and general structure.

- **Semen** – Crush-side assessment indicates that the semen is within normal range for motility, colour and percent progressively motile and is suitable for laboratory evaluation.
- **Morphology** – Semen examination of percent normal sperm using high power magnification to ensure minimum standards for normal function are achieved. Minimum 70%
- **Serving** – The bull is able to serve normally as demonstrated in a standard test and shows no evidence of fertility limiting defects.

Summary of research findings from Beef CRC Northern Lifetime Reproduction Project (source Geoff Niethe)

Cow body composition and reproduction
Genetic correlations between cow body composition measures and cow reproduction at breeding season 2 and lifetime weaning rate were low, with the exceptions of moderate correlations for Eye Muscle Area and Body Condition Score in Brahmans. These estimates suggest that cow body composition measures are not strong genetic indicators of female reproduction.

Cow early reproduction with cow lifetime reproduction
For both Brahman and Tropical Composite the genetic correlations were high to very high, indicating that selection for early measures of cow reproductive rate will be associated with genetic improvement in lifetime reproductive rates. Some differences exist in the initial breeding season in the magnitude of correlations between traits for calving versus weaning rates which reflect the influence of calf losses on the estimates.

Male with female traits
The main interest in the genetically correlated traits in males are focussed on finding measurements that can be used much earlier in bull selection to identify those sires which are most likely to pass their BBSE at 24 months of age. Stud producers can identify superior animals earlier if they record traits such as scrotal circumference at 12 months of age in Brahmans and 6 Months of age in Tropical composites and start collecting semen traits in tropical composites at 12 months age. These genetic associations suggest that scrotal circumference and sperm motility traits are potential early-in-life selection criteria for genetic improvement of bull fertility.

Selection messages
Selection for reduced age at puberty will result in increased reproductive performance at both the early and lifetime stages. In Brahmans, age at puberty and presence of a CL at joining were both highly correlated with Days to Calving in the first breeding season and were still moderately correlated with lifetime annual weaning rate. In the Tropical Composites, age at puberty and the presence of a CL at joining were strongly correlated with Post-Partum Anoestrous Interval (PPAI) at the second breeding season and with lifetime annual weaning rate.

a. Selection for early measures of breeder reproduction will be associated with improvements in lifetime reproductive rates – e.g. selection of females that reach puberty at an early age, cows that successfully wean calves at first and second joinings, and bulls from such cows, will increase lifetime reproductive rate.

b. Cow body composition measures are not strong genetic indicators of female reproduction.

c. The research has confirmed the benefit for those breeds currently using the DTC trait through BREEDPLAN for improving early and lifetime performance (as DTC correlates with the early lifetime traits). The Days to Calving trait is not widely measured in the stud industry and the accuracy is generally low. The CRC results have led to a range of genomic equations that can be used to improve the accuracy of this trait.

d. Management to control the start and duration of calving (to avoid late season bull calves), and to ensure rapid growth of pre-pubertal bulls, will improve reproductive traits in young bulls. There are no useful early-in-life phenotypic measures of young bulls that are predictive of their calf-getting ability in later life (as indicated by PNS at 2 years). Individual bulls should continue to be assessed for BBSE prior to mating.

e. The semen quality traits, mass activity, motility and PNS, show promise as predictors of components of female reproduction such as age at puberty and PPAI. Mass activity and motility were also strongly correlated genetically with lifetime reproductive rate of Brahman cows (but not for Tropical Composites).

Messages from Beef CRC Maternal Productivity Project

Overview

Maternal productivity is a function of a range of traits including fertility within a specified time, calving ease, calf survival, calf growth to weaning. The weaned calf should have desirable growth and carcass characteristics for the following part of the value chain. Cow feed intake is a major cost and so should be minimised relative to output, cow salvage value is an additional output and cows need to be able to remain productive while coping with variable levels of nutrition to cope with Australia's diverse environment and the large variability of seasonal conditions.

Key messages:

- There is a diversity of views among breeders in the importance of genetic fatness on maternal productivity
- Cow body composition can be genetically changed by selecting with current BREEDPLAN EBVs for rib and rump fat depth, intramuscular fat and eye muscle area
- Phenotypic growth and fat targets to maximise heifer pregnancy rates have been produced for current Angus cattle
- Genetically Low-Fat heifers had lower conception rates and slightly lower subsequent reproduction than genetically High-Fat heifers/cows
- Days to calving was the most important EBV affecting heifer conception rate, just as it is designed to do. However, accurate DC EBV are difficult to obtain on young bulls because it can only be measured in females and there is a large use of AI which masks some of the variation
- Commercial producers should focus on managing heifer growth and condition and cull dry heifers
- Genetically High-Fat cows were more efficient than Low-Fat cows when on Low-Nutrition but this was primarily due to differences in reproduction and so should be able to be managed;
- Genetically Low-Fat cows were more efficient than High-Fat when on High-Nutrition
- Genetically High-Fat cows ate more feed and gained more fat during spring which meant they required less supplementary feed during autumn when feed is expensive;
- Steers from Low-Fat cows met market specifications for weight and fat when finished a feedlot, but when finished on pasture more failed due to lack of fat cover compared to High-Fat steer progeny
- Selecting for efficiency by selecting for low net feed intake resulted in cows that were leaner, had slightly fewer calves (like low fat cows) but were still more efficient than High-NFI cows
- Seedstock and commercial breeders should continue selecting in a balanced manner

Appendix 2: Situation summary

Genetic improvement allows for commercial producers to increase the productivity of their enterprises and quality of their stock. Two key factors influence the success of genetic improvement

a) the level of adoption (i.e. what proportion of bulls bred are from programs achieving high rates of genetic improvement)
b) the rate of genetic improvement being achieved by seedstock enterprises.

There have been substantial R&D efforts in beef genetics in Australia, particularly through the three phases of Beef CRC. These (including some on-going) research efforts have led to significant increases in understanding of genetics underlying economically important traits and the development of DNA technology that has potential to significantly increase ability for seedstock breeders to identify and select superior animals at younger ages.

The benefit of these research outcomes is only realised when seedstock breeders utilise the technology to evaluate and select superior animals and achieve genetic gain in a direction that will increase value chain profit. However, to date only a small proportion of overall beef genetics investment in Australia has focused on facilitating greater rates of genetic gain in the seedstock sector through adoption and effective use of BREEDPLAN. This has led to lower adoption of the technology and rate of genetic gain than is considered technically feasible. This is particularly the case in northern Australia as evidenced by the low predicted returns on R&D investment in northern Australia. For example, in evaluating MLA investment in genetics R&D for 2002-2012, Fennessy *et al*. (2014) estimated a benefit to cost ratio for the period from 2014 to 2040 for northern beef of 1:1 and southern beef of 4.4:1 (sheep were 5.8:1) based on current rates of adoption of BREEDPLAN.

Poor profitability amongst commercial producers in northern Australia

The Northern Beef Situation Analysis (McKosker *et al.* 2010) reported that "Average beef producers tend to be spending more than they have earned in 6 of the last 7 years, indicating the northern beef industry is generally in a very unprofitable and unsustainable state." Poor business performance was linked with very poor reproductive performance such that a key recommendation was facilitating dramatic increases in use of objective measurement by the seedstock sector.

For the purposes of this strategy, the northern Australian beef industry is comprised of beef cattle producers in Queensland, the Northern Territory and northern Western Australia (north of 29^0 S). As at 2010, this region covered 59% of Australia's cattle (14.2M) with approximately 8000 specialist beef producers (>100 head) located in the region (ABS 2011). Ambitious targets were detailed in the Joint Government Action Agenda for this region by each of the respective state governments (e.g. 25% increase in cattle in NT from 2M to 2.5M within 10 years). It was recognised that a key factor in achieving these targets would be increasing productivity with a recommendation this be achieved through drawing on the skills and experience of high-performing producers.

Current level of adoption and rate of genetic gain

Rates of BREEDPLAN adoption and level of performance recording vary between breeds. For example, Fennessy *et al.* (2014) estimated that just 12% of *Bos indicus* bulls had BREEDPLAN EBVs compared 75% of *Bos taurus* bulls used in Australia. In addition, there is a lower level of performance recording observed in northern Australia amongst Group BREEDPLAN members. As at September 2014,

approximately 5% of full members were enrolled in Group BREEDPLAN for Brahman and Droughtmaster compared with approximately 35% for Herefords, For Hereford's, of the 306 members enrolled in Group BREEDPLAN 158 members had a herd Completeness of Performance rating of 3 stars or greater (out of 5) and 23 were 4.5 stars or greater. For Brahman, of the 75 members enrolled in Group BREEDPLAN, 6 herds had a rating of 3 stars or greater. Two of these were research herds and two other herds had less than 150 females recorded annually. Thus, it could be concluded there are currently only two large-scale Brahman seedstock herds in industry conducting performance recording over the past 5 years that could be considered remotely close to desirable.

Increasing levels of performance recording and genetic gain are being achieved for both the tropical breeds and southern breeds. For example, performance records for reproductive rate traits such as days to calving have increased substantially in Brahman and Santa Gertrudis, aided by the TBTS focus on influential herds. In addition, for Brahman, Brangus, Belmont Red and Santa Gertrudis, the average weighted selection index annual rate of gain has increased from $0.63/year in 2010 to $1.04 in 2012 ($2.13 in 2013, year to date figure) (pers. comm. P. Williams, TBTS Technical Officers report, 5th August 2014). For southern breeds, the average weighted selection index annual rate of gain has increased from $2.12 in 2010 to $4.68 in 2012 (pers. comm. C. Duff, SBTS Technical Officers report February 2014).

Declining state extension resources and constrained industry resources

There has been a significant decline in state based extension resources (spending 50% of time in development and extension) with a reduction from 87.5 FTE 2009 (National Beef RD&E strategy) to 70.1 in 2013 (Blueprint paper, pers. comm. Lu Hogan). These figures do not include any further changes in capacity since 2013 or prior to 2009. With the completion of the Beef CRC in June 2012 there has also been a significant reduction in total funds invested into Beef RD&E with limited scope for substantial additional funding from Meat and Livestock Australia. Several people that were previously working in a state government supported extension role have moved into private sector. It will be essential to work with these people to achieve the aims of this plan. Estimates of available human resources are detailed for State Departments of Primary Industry (Table 3), organisations with a genetics extension or advisory capacity (Table 4), sole operators/small companies with genetics advisory capacity (Table 5).

Table 3: State department of primary industry estimated capacity for delivery in genetics extension and implementation

State/territory	Est. FTE	Primary people	Notes
NSW	1	Matias Suarez	Additional capacity through Local Land Services
NT	0.25	Trish Cowley, Tim Schatz	
Qld	1.5	Alan Laing, Tim Emery	
SA	0		Commercialised into fee for service
Tas	0		Commercialised into fee for service
Vic	1.5	Darren Hickey	
WA	0		Value chain focus

Table 4: Estimated FTE capacity of organisations for genetics extension and advisory services (based on nominated levels by individuals from each organisation at workshop)

Organisation	Est. FTE	Primary people	Notes
TBTS	1	Paul Williams	Substantial geographic area for one person
SBTS	2.5	Andrew Byrne, Gemma Nivison, Alex McDonald, Carel Teseling	Seeking to appoint further person
Zoetis	3	Emily Piper, sales team	Varied level of genetics understanding within team
AGBU	1	David Johnston, Matt Wolcott, Rob Banks	
Angus Australia	2	Peter Parnell, Christian Duff, Andrew Byrne, Carel Teseling	

Table 5: Estimated FTE capacity of various groups for genetics extension and advisory services

Group	Est. FTE	Primary people	Notes
Specialist genetic consultants	3	Greg Popplewell, Wayne Upton, Don Nicol	Detailed understanding of genetic evaluation and breeding programs required
Farm consultants/advisors	3	Alistair Rayner, Bill Hoffmann, Brian Cumming, Nathan Scott, Tiffany Bennett,	Genetics is a smaller component of business. Often sole operators. Genetics consultation and advisory unlikely to be primary focus
Ultrasound scanners	2	See: http://abri.une.edu.au/online/pages/accred_scanners_ausnz.htm	Varied amount of time spent on ultrasound scanning. Crush side conversation can be powerful. Limited amount of time to spend with breeders on extension and training as primary role is collection of performance records.
BBSE	1	John Bertram	Considerable time spent crush side with breeders. Similar to scanners, primary role on assessment not genetics advisory

Other groups for consideration include semen marketing companies, independent advisory services, beef veterinarians, livestock agents.

Adoptability of BREEDPLAN

Despite substantial value chain wide economic benefits from genetic gain, effective use of BREEDPLAN by seedstock breeders remains below potential. The lower than desirable rate of adoption of the technology is associated with several factors:

- Low adoptability of the innovation
- Lack of a compelling value proposition for commercial producers (and subsequent appreciation of the value proposition by seedstock breeders and their commercial clients)
- Technology push rather than technology pull

Low adoptability of innovation

Adoptability of agricultural innovations has been widely studied. Rogers (2003) detailed the characteristics that determined the level of adoptability as relative advantage, compatibility, complexity, trailability and observability.

The innovation fit for genetics has been summarised below by Burrow (2011, pers. comm.) in a discussion paper:
A number of additional factors identified by Rogers (1995) impact on the rate at which adoption of genetic improvement occurs, including:

- the difficulty of trialling and observing the initial results of genetic improvement before it can be fully implemented;
- the difficulty of comparing genetic improvement with other non-genetic options available to beef producers;
- the complexity of traditional genetic improvement, both in terms of the difficulty and expense of measuring and recording most economically important traits on all animals maintained in well-defined cohort groups and the requirement to understand the 'black-box' terminology of genetic improvement (this is a particular difficulty under extensive production systems such as those in northern Australia); and
- the perceived lack of compatibility with other on-farm management practices (e.g. drafting off individual animals for specific treatments such as supplementary feeding or dipping and drenching to control parasites) that need to be accounted for in genetic improvement programs.

In researching adoption of BREEDPLAN in Australia, Moreland and Hyland (2009) determined that BREEDPLAN had a "low innovation fit". To address this they proposed a model with greater end-user engagement (commercial producer) in the development process.

Lack of a compelling value proposition

Significant benefits accrue through genetic improvement in nucleus and dissemination of genetics to multiplier breeders and commercial producers. This makes adoption in the seedstock sector critical to success. However, there is little incentive for seedstock breeders to invest in performance recording and genetic evaluation in the absence of clear market signals from commercial producers, i.e. commercial producers paying higher prices for bulls with superior genetic merit.

Benefits from genetic improvement accrue through the value chain such that the majority of benefit from genetic improvement for carcass and meat quality traits is realised post-farm gate. Lack of clear price signals through the value chain and low producer awareness of the role genetics has on economic benefits to the beef value chain means there are often weak or non-existent price signals from commercial producers to seedstock breeders. There are examples where this is not the case, for example A Van Eenennaam (pers. comm.) reported an increase in bull auction sale

price of $83.58 AUD for every $1 increase in Long Fed/CAAB across four leading Australia Angus studs (r^2 = 20%). Where there are not clear price signals from the commercial producer to the seedstock breeder, there is a lack of preparedness for seedstock breeders to invest in performance recording due to no clear economic benefit to their business (Corrigan and Parnell 2005). In evaluating MLA genetic R&D investment, Fennessy *et al.* (2014) noted "There is a need to establish a clearer value proposition for commercial producers and define the value of recorded genetics in comparative commercial situations," and recommended this be achieved by greater investment in generation of robust data to show the benefits of genetic improvement in commercial settings.

Even with lack of clear price signals through the value chain, it is estimated that 33-50% of the benefit from genetic improvement is realised by the commercial producer for Australian beef production (Fennessey *et al*. 2014) such that it should be possible to develop compelling economic cases for commercial producers to invest (demand) bulls with superior $Index for a breeding objective based on the whole value chain. Importantly, in situations with through-chain partnerships and value based marketing, there would be clear direct incentives for producers to procure genetics from seedstock breeders investing in genetic gain for benefit of the whole industry.

It is also useful for producers to realise that non-adoption of technology results in financial disadvantage to the commercial producer. Carroll (2010) and Fennessey *et al*. (2014) both outlined that late adopters of technology (such as BREEDPLAN and genetic gain) will be penalised twice. The first time is associated with not achieving a cost saving/ productivity gain on farm. The second is associated with lower general livestock prices associated with increased production by those who have adopted technology. However, it is worth noting that a significant component of the benefit from technology adoption (such as BREEDPLAN and genetic gain) occurs through increased value of productive land, thus whether a producer adopts the technology or not they will still receive this benefit (Carroll 2010).

Technology push vs. technology pull

In researching adoption of BREEDPLAN in Australia, Moreland and Hyland (2013) concluded that the primary focus had been on technology push rather than technology pull, i.e. telling seedstock breeders they should be collecting performance data in BREEDPLAN rather than a focus on creating demand for BREEDPLAN and genetic improvement amongst commercial producers. The conclusion of Moreland and Hyland (2013) is supported by observations from other studies of a) low desire of commercial producers for training in genetics and b) low importance placed on BREEDPLAN by seedstock breeders in bull selection. For example Rickards (2008) investigated the training needs of commercial red meat producers in southern Australia. Producers ranked genetics 9th out of 10 for training needs (6%). Marketing (19%) and financial management (17%) were the highest priorities for training.

In northern Australia, John Bertram has been investigating the awareness and attitudes towards genetics and selection amongst bull breeders. Preliminary results suggest very low use of BREEDPLAN by seedstock breeders. For example, the average importance of BREEDPLAN EBVs in sire selection for seedstock herd breeding program was 5.4/10 with >20% assigning value of 0 or 1/10, and 45% of respondents 5/10 or less. In the Bertram survey the main reasons for seedstock breeders not using BREEDPLAN are listed below with several contributing reasons of which the main one was no market signal:

- No market signal (from commercial producer's) 46.2%
- Costs are too high 33.7%
- Insufficient time to collect and submit data 29.8%

- Don’t think it works 27.9%
- BREEDPLAN doesn’t translate into actual production gains 27.9%

Appendix 3: List of people consulted in development of strategy

Rob Banks
John Bertram
Andrew Byrne
Hamish Chandler
Trish Cowley
Libby Creek
John Croaker
Neil Donaldson
Steve Exton
Tim Emery
Steve Farmer
Charlotte Fox
Sam Gill
Bruce Hancock
Darren Hickey
Bill Hoffmann
Lu Hogan
Tim Hollier
David Johnston
Burnett Joyce
Alan Laing
Ian Locke
Mark Lucas
Alex McDonald
Hayley Moreland
Don Nicol
Geoff Niethe
Emily Piper
Greg Popplewell
Paul Quigley
Robert Rea
Matthew Ryan
Tim Schatz
Steve Skinner
Matias Suarez
Mick Sullivan
Carel Teseling
Wayne Upton
Jane Weatherley
Gemma Wilkinson
Paul Williams

Appendix 4: Review of current activities and identification of gaps

Through consultation and review of documents a matrix of current activities by target audience has been generated as detailed in Table 3.

Table 3: Current events delivered by target audiences and delivery agency. Green shading indicates high impact; yellow shading indicates moderate current impact &/or area for focus. Numbers refer to notes from consultation detailed on following page

Target Audience	Specialist consultant	Beef genetics extension officers and consultants	Influential seedstock breeder	Seedstock breeder (multiplier)	Influential /major commercial producer (northern)	Commercial producer	Breed society boards and technical committees	Other industry service provider (vet, agent, scanner, sales reps).	Supply chain partners
UNE summer school	1								
Advanced consultant			2		3				
AGBU			4		5	6	7		
ABRI									
SBTS		8	9	10		11	12		
TBTS			9	10					
MBfP									
Future Beef									
Breeding Edge						13			
Better beef (Vic)						14			
Client days/workshops						15			
Breed society events				16		16			
UA ISP day		17						17	
PDS		18		18		18			
Vic beef value chain									
Genetics R&D current			19	19	19	19			19
Sheep CRC genetics		20	21			22			
Sheep CRC lamb Supply chain group									23
Sheep Genetics		24							

Notes associated with above matrix (based on feedback through consultation process)

1. Prof Julius van der Werf, University of New England coordinates annual week long summer school aimed at people already holding postgraduate qualifications in genetics
2. Specialist consultant: likely to have post graduate qualifications. Able to develop breeding objective and breeding programs. Use of software to optimise matings.
3. Potential point of major influence if right consultant teamed with right company
4. AGBU holds influential breeder workshops. These take significant time to prepare and deliver in conjunction with SBTS/TBTS but is not significant part of FTE commitment. They have major impact with breeders that attend.
5. AGBU (and Beef CRC) have worked with Northern Pastoral Group in R&D on genetics oriented projects.
6. Delivery of R&D and genetics messages via events organised by others
7. Preparation of material to inform breed society and board technical committees (understand this is in collaboration with TBTS/SBTS)
8. Potential to train small number of people to deliver Bull Select workshops
9. Significant focus on TBTS/SBTS. Some feedback from consultation was that questions could often only be comprehensively addressed by AGBU/specialist consultant
10. Substantial effort through webinars, newsletter, presentation at events and on-farm consultation but somewhat limited by resource constraints
11. Substantial effort at training commercial producers in BREEDPLAN and other considerations (e.g. horn/poll, recessive disorders etc.)
12. Substantial effort in preparation of material for breed society board and technical committee for updates and consideration of enhancements to genetic evaluation. Through consultation it was suggested these groups are influential allocating more time to this activity may be beneficial.
13. High impact intensive 3 day workshop but limited number run due to high initial attendance cost (>$1500)
14. Better beef network receives funding from state government and other sources including MLA and producer input. Substantial involvement of commercial beef producers in Victoria. Typically whole farm focus.
15. Many seedstock enterprises run own client days often with SBTS, TBTS, AGBU, other research scientists and consultants delivering presentations on genetics. These are often self-funded by the stud and very well attended.
16. Can include workshops on updates to genetic evaluation and $ Indexes, reporting BIN and other R&D outcomes and implications.
17. Annual workshop focused on reporting R&D outcomes and implications to SA consultants and industry service providers
18. Some genetic oriented producer demonstration sites have been initiated. Difficult to implement because of lags in selection but powerful demonstration that genetics works.
19. Several research projects with a beef genetics component have recently been initiated (Accelerated genetic improvement of reproduction in tropical beef breeds, Next Gen Beef Breeding Strategies, Addressing key issues affecting compliance rates of pasture-fed cattle in southern Australia). These have significant potential to generate material that can be used to develop compelling value proposition, assist with training of bull breeders in performance recording and engagement with value chain stakeholders (e.g. processors) on role genetics has in carcass value. Some material available now but R&D needs to be undertaken.
20. Sheep CRC engaged in training process for sheep genetics consultants focus on breeding program optimisation incorporating genomic tests
21. Sheep CRC collaborating with influential breeders to trial, test and implement DNA technology in breeding program and breeding program optimisation
22. Sheep CRC facilitating delivery of ram select workshop to train commercial sheep producers on Australian Sheep Breeding Values and value of genetics
23. Lamb supply chain group examining considering carcass quality and yield. Developing understanding of role genetics has in both yield and quality. Could lead to value based marketing.
24. Sheep Genetics hosts annual 2 day training workshop for consultants and advisors who work with ram breeders and their commercial clients.

Appendix 5: Messages from consultation

Awareness and motivation of the role genetics has in productivity and profit are low in northern Australia

- There is a complete lack of awareness by many commercial bull buyers on what the role of genetics in productivity, product quality and profit
- "BREEDPLAN" is typically seen as a cost and hassle with absolutely no return
- BREEDPLAN is a real barrier, rename it, repackage it, people instantly glaze over on its mention
- There is absolutely no price premium for well described bulls in northern Australia
- It is difficult to migrate to user-pays system for training and extension due to lack of awareness and value of genetic improvement. There is scope to change this, but compelling value proposition and clear commercial demand are required. Scope for this exists in both northern and southern sector – northern through reproduction and eating quality, southern through growth and eating quality via MSA Index

Must focus on creating demand

- Actually invest in working with large scale commercial producers to implement staff awareness and purchasing plans and business plan underpinning and others will watch. It is broad industry good and not simply private good.
- Messages get most traction when people can see them and they come from someone respected, often this could be a bull supplier
- Training needs are back to basics needed in many cases
- Some wins in the north through market pull as large pastoral companies are requiring EBVs on bulls

Beef supply chain and market pull

- MSA Index will start to become more important in south and drive closer consideration of carcass traits
- Genetics along the value chain has substantial scope

Hybrid vigour and composite cattle

- Don't discount hybrid vigour – it is a way of getting people to think about valuing genetics
- Crossbreeding and composite cattle represent an opportunity that is often overlooked in extension material and thus industry

Compelling proof of profit and communications embedded within the R&D and Producer Demonstration Sites

- Beef Information Nucleus projects are very useful for R&D and also for extension and demonstration
- Have the extension staff involved in the R&D, builds ownership and understanding (i.e. build an industry wide culture of participatory work at all levels)
- Sire benchmarking has multiple benefits
    - Increased EBV accuracy
    - Identifies best young sires
    - Really valuable communication / education forum/example

- On-farm demonstration / PDS model is effective - opportunity to do this along the supply chain
- Harness support from other rural sectors or groups including banks, insurance, animal health, fast food, retailers etc.

Consistent messages and sound knowledge

- Huge importance on having consistent messages. Wrong advice can do a lot of damage quickly and takes a long time to address
- Beef genetics extension – must have a sound genetics base – if you are shallow you will get found out and discounted.
- Consistent messaging and then the level of detail can change according to need

BREEDPLAN and genetic evaluation considerations

- Replace Days to Calving with weaning rate EBV
- Investigate development of indexes that value more than just $ traits (horns, docility, BBSE)
- Delivery too slow for research outcomes into implementation
- Info is way too tightly held in Armidale
- ABRI not really able to support cutting edge seedstock breeders

Assisting seedstock breeders

- For seedstock producers, focus must first be on ensuring high rates of gain amongst influential herds/nucleus herd
- Further consideration in northern Australia is people will want well described bulls, polled and passed BBSE and there are not that many that would meet these specifications. Need to make sure as industry we don't do an excellent job of engaging commercial sector only to not be able to provide the product they are after
- Need to help bull breeders new to performance recording as often not very well set up/experienced in the process

Consideration of messages for within herd breeding

- Many herds provide own bulls, BREEDPLAN and performance recording may be an initial step too far so aid in ensuring they are at least likely to be going in the right direction via
    - Informed new stud sire selection
    - Constrained mating period and keeping bulls from cows that calve each year and pass a BBSE
- Bull testing for BBSE and pregnancy testing are profitable management tools let alone useful for genetic gain at a commercial level

Coordination and communication amongst stakeholders

- Absence of CRC has had a big impact on communication, awareness and networks
- Lack of communication and knowledge of what various parties are doing is perceived as a major constraint
- Perception that communication between R&D and extension/implementation has been ad hoc
- MLA must lead the collaboration (mapping of projects, outcomes, implementation and communication of messages) and take ownership in the coordination space

Decision support tools needed

- Decision support tools need to be accessible and interface easy to use
- Considerable scope for dashboard with drill down hotlinks (just need time to develop)

Industry service provider (ISP) training

- Engage with peripheral ISPs such as stock agents
- Train-the-trainer and development of non-genetics ISP is important (at least building their awareness of how EBVs work and what their value is)
- So few FTE in state DPI that other sources of extension opportunities need to be considered. Stud stock agents are one such source.
- Useful to have training opportunities for industry service providers
- Training privately funded ISPs is a good model. It is in their interest to provide value and extract income from any source.

Professional development for livestock genetics consultants and beef extension officers

- There is merit in pulling people together in a structured way. CRC used to perform this role but no longer exists so there is a gap that is resulting in lower levels of effective communication amongst people 'upstream' of bull breeders
- Maintaining communication and collaboration network is essential
- Annual updates and link with tool development

Appendix 6: Mapping to higher level documents

The development of the beef genetics extension plan aligns with

- MLA strategic plan 3.1.1 (on-farm productivity – enhance rates of genetic improvement), 5.1 (innovation adoption) and 5.2.4 (Support the development of essential science, research, technical and extension capabilities).
- Australian Government Rural R&D Priority of “Productivity & adding value”
- Beef RD&E strategic imperative of “increasing cost efficiency and productivity (including adapatability and risk management)”
- RD&E strategic imperatives for Northern Australia (from Ministerial forum) “Enterprise viability: Increasing cost efficiency and productivity and profitability” and “Human capacity: Enhancing human capital- producers, researchers, extension”
- North Australian Beef Research Council RD&E priorities prospectus for the Northern Australian Beef Industry RD&E priorities of *Reproduction* with the NABRC stated goal of “Accelerate the dissemination of genetics that will improve the economic performance of beef cattle enterprises in northern Australia” with a focus area being on improved used of objective information to increased selection intensity. The second priority is “Human capacity and enabling change.”

Appendix 7: Project objectives and description

Through consultation with Beef CRC participants and other key organisations and individuals in national genetic fields, this project will identify gaps and opportunities for delivery of messages to producers. This will be executed by scoping their sentiment on delivery mechanism and content
Based on the scoping work a draft extension strategy will be developed that outlines delivery strategies and tactics (including events and industry programs), delivery agencies and partners, target producer segments and key messages for each target market.
Messages are to be targeted at:
a. Seedstock producers, focusing on why and how to use genetics and genomics tools in their breeding systems
b. Bull/seedstock purchasers to create pull-through demand. These messages will be heavily dedicated to emphasising “what’s in it for them?”, or the benefit of purchasing animals that are produced utilising genetics and genomics technologies.
Conduct a workshop with the key influencers, stakeholders and organisations to test the extension strategy and obtain stakeholder commitment to implementation. The researcher will also outline a preferred approach to strategy and delivery coordination for Beef CRC 3 messages

Objectives
The Research Organisation will achieve the following objective(s) to MLA's reasonable satisfaction: This project will deliver an integrated beef genetics extension plan for ongoing coordinated delivery of Beef CRC genetics outputs that maximise adoption by doing the following:

1. Consult with Beef CRC participants and other key influencers/stakeholders/organisations in the northern, southern and national genetic fields to identify delivery gaps and opportunities. This consultation will also seek to clarify their views on extension delivery mechanisms and content

2. Based on the consulting work, develop a draft extension strategy that outlines delivery strategies and mechanisms (including events and industry programs), delivery agencies and partners, target producer segments and key messages for each target market. Messages are to be targeted at:

a. Seedstock producers, focusing on why and how to use genetics and genomics tools in their breeding systems

b. Bull/seedstock purchasers to create pull-through demand. These messages will be heavily dedicated to emphasising “what’s in it for them?”, or the benefit of purchasing animals that are produced utilising genetics and genomics technologies.

3. Outline a preferred approach to strategy and delivery coordination.

4. Conduct a workshop with the key influencers, stakeholders and organisations to test the extension strategy and obtain stakeholder commitment to implementation

5. Devise a final report detailing consultation findings, a report of the results from the workshop and a strategic plan for delivery coordination and key messages to be conveyed