Final report

Enhancing Technology Adoption Across the Angus Genetic Improvement Pipeline

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Prepared by: Jake Phillips
Angus Australia

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Meat & Livestock Australia Limited
PO Box 1961
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Abstract

The "Enhancing Technology Adoption Across the Angus Genetic Improvement Pipeline" project, a collaboration between Meat and Livestock Australia Donor Company (MDC) and Angus Australia, commenced in April 2018 with the aim of advancing genetic improvement in Angus-influenced cattle. This project successfully achieved its objectives, which included educating breeders, developing decision support tools, conducting proof-of-concept analyses, and supporting breeders in northern Australia. It also enhanced skill development and stakeholder engagement while conducting surveys to measure practice and attitude changes. Through comprehensive industry consultations, education, and innovative tools, the project significantly increased knowledge, skills, and genetic improvement practices among Angus breeders in Australia. Notably, it led to a 5% increase in the annual rate of genetic improvement in net profitability, demonstrating its positive impact on the cattle industry. The additional genetic gain realised as a result of this project will add an estimated $38.4 million after 10 years to 2032, or $200.1 million after 30 years to 2052, to the Angus- influenced beef value chain. The project underscores the importance of ongoing investment in extension methods and technology adoption, in particular targeted programs for seedstock producers, stock agents and service providers that provide a mix of online and face to face activities with the associated technical resources, for the continued success of the beef breeding industry, for the continued success of the beef breeding industry.

Executive summary

Background

The “Enhancing Technology Adoption Across the Angus Genetic Improvement Pipeline” project commenced in April 2018, and was a joint venture between Meat and Livestock Australia Donor Company (MDC) and Angus Australia. The project aimed to further enhance the world leading rates of genetic improvement achieved in Angus influenced cattle, contributing to the NLGC’s mission to double the rate of genetic gain in the beef value chain by 2022. This project has achieved the target by implementing an integrated suite of adoption and communication activities designed to harness disruptive technologies and to accelerate the application of continuous improvement programs among breeders of Angus and Angus-influenced cattle.

Objectives

(i) Develop and deliver an innovative education program to support breeders in understanding the opportunities and benefits of genetic improvement;
(ii) Develop, evaluate and deliver innovative decision support tools to assist breeders make better breeding decisions;
(iii) Conduct "proof-of-concept" analyses to demonstrate the benefits of genetic improvement (particularly for new traits);
(iv) Support breeders in Northern Australia in use of adapted and improved Angus-influenced genetics;
(v) Enhance skill development and capability among young breeders through engagement in collective learning exercises focused on commercial beef production;
(vi) Establish effective breeder and stakeholder consultative processes to ensure that RD&A initiatives appropriately address industry needs;
(vii) Conduct quantitative surveys amongst stakeholders across the beef value chain to enable measurement of practice and attitude change resulting from education and extension investments.

All seven objectives were met successfully.

Methodology

Angus Australia undertook a comprehensive and ongoing industry consultation process to establish a dynamic portfolio of innovative selection tools and a comprehensive education and extension program. These included reviewing existing education material and expanding the suite of resources available through face-to-face engagement and online activities. These education and extension components were targeted at subgroups of beef cattle breeders including seedstock and commercial breeders, new industry entrants, young producers and industry stakeholders such as service providers and stock agents.

Results/key findings

Overall, the project has achieved significant success in knowledge transfer, skill development, and enhancing the adoption of genetic improvement practices among Angus breeders in Australia. The development and implementation of various workshops, online events, decision support tools,

resources, and engagement activities have led to increased awareness, understanding, and practice change within the Angus breeding community. The project's comprehensive approach has not only met but often exceeded its goals, demonstrating its positive impact on the cattle industry (Table 1).

Project KPI	Target	Achieved (average p.a.)
Annual rate of genetic improvement in net profitability per annum in Angus and Angus influenced cattle increase by 5% (measured on the Angus Breeding Index)	5%	12.3%
The number of new animals with TransTasman Angus Cattle Evaluation EBVs per year greater than 70,000	70,000	76,373
Maintain the number of key performance measurements per year at greater than 450,000	450,000	522,139
Increase the number of genomic tests added to the TransTasman Angus Cattle Evaluation per year to be greater than 30,000	30,000	33,349
Increase the number of animal searches conducted on Angus Database Search per year to be greater than 800,000	800,000	1,202,189

Table 1. Project Key Performance Indicators and actual results

Benefits to industry

The additional genetic gain realised as a result of this project will add an estimated $38.4 million after 10 years to 2032, or $200.1 million after 30 years to 2052, to the Angus- influenced beef value chain.

Future research and recommendations

To ensure beef breeders are best placed to have the most appropriate tools and resources developed and have an increasing knowledge level of how to use the developing technology, is a clear recommendation of this project is future investment in the most desired extension delivery methods with proven adoption outcomes. These desired extension delivery methods include:

- Provide education and extension through the preferred information source – The Breed Societies and bull producers.
- Specialty Extension programs should be considered for seedstock, commercial producers and key industry people to cater for the specific learning outcomes
- Breed societies can act as a catalyst for information for the beef industry more broadly outside of the member base they ordinarily service day to day.

Table of contents

1. Background

This project was conducted to further enhance the world leading rates of genetic improvement achieved in Angus-influenced cattle, which has contributed to the NLGC's mission of doubling the rate of genetic gain in the beef value chain by 2022.

2. Objectives

(i) Develop and deliver an innovative education program to support breeders in understanding the opportunities and benefits of genetic improvement.
(ii) Develop, evaluate and deliver innovative decision support tools to assist breeders make better breeding decisions.
(iii) Conduct "proof-of-concept" analyses to demonstrate the benefits of genetic improvement (particularly for new traits).
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(v) Enhance skill development and capability among young breeders through engagement in collective learning exercises focused on commercial beef production.
(vi) Establish effective breeder and stakeholder consultative processes to ensure that RD&A initiatives appropriately address industry needs.
(vii) Conduct quantitative surveys amongst stakeholders across the beef value chain to enable measurement of practice and attitude change resulting from education and extension investments.

3. Methodology

3.1 Develop and deliver an innovative education program to support breeders in understanding the opportunities and benefits of genetic improvement

The development of the innovative education program was designed through consultation, review and analysis.

Consultation

A consultative committee was used to establish priority areas of education and extension. The committee consisted of seedstock and commercial cattle breeders and technical specialists in breeding, genetics and genetic evaluation. The consultative committee also had input and review of the yearly operational plans submitted to Meat and Livestock Australia.

Meat and Livestock Australia were provided half yearly operational updates for input and confirmation of activities and measurables. These activities were broadly assessed against the number of people engaged with, the average value the person placed on attending the program and what the likelihood of practice change was from attending the activity.

Review and analysis

Priorities for the education program were established by conducting reviews of the existing education resources and materials. A significant survey activity was conducted of Australian beef producers (by 3rd party company Chi Squared) to establish base line understandings of producers' knowledge and use of breeding and genetic decision-making tools. The survey conducted in 2019 was able to provide priorities for the project to focus the development of education resources.

3.2 Develop, evaluate and deliver innovative decision support tools to assist breeders make better breeding decisions.

To assist breeders make better breeding decision, this project developed and delivered the following decision support tools:

- **AngusSELECT**: a suite of web-based selection tools that enable Angus breeders to identify Angus genetics that are most aligned with their breeding goals and objectives.
- **Angus Database Search**: new features and enhancements to enable breeders to search Angus Australia's comprehensive animal database for a range of important animal and genetic information. This includes the display and presentation of Indexes and breeding values.
- **Decision support reports**: summarise the completeness and effectiveness of the pedigree, performance and genomic information that is recorded by each participant in the Angus genetic evaluation.

3.3 Conduct "proof-of-concept" analyses to demonstrate the benefits of genetic improvement (particularly for new traits).

To provide up to date, repeated, real-world demonstrations of the benefit of genetics improvement, "Lessons from the Angus Sire Benchmarking Program" were developed as new information was collected within the Angus Sire Benchmarking Program.

The education resources developed included video presentations, written resources, animations, and podcasts.

3.4 Support breeders in Northern Australia in use of adapted and improved Angus-influenced genetics.

Supporting the use of Angus-influenced genetics by Northern producers was provided through:

- Ongoing day to day support: via phone, email and where necessary, on property consultations to assist them in the use of cross breeding systems to improve eating quality, fertility and polledness, and in turn, profitability in Northern Australian beef enterprises.
- An annual workshop for key genetics and services providers (such as Future Beef, TBTS, beef consultants) in Northern Australia, outlining the latest developments within Angus Australia relevant to Northern Australia.
- Modern digital education resources and written resources on the Angus Australia website
- Several case studies of breeding operations in Northern Australia having success with the use of cross breeding programs to improve genetic merit for meat quality and fertility. These

have been distributed through the Angus Australia communication network (website, social media, e-news) and in rural press publications (Fairfax publications, Beef Central etc.).

3.5 Enhance skill development and capability among young breeders through engagement in collective learning exercises focused on commercial beef production.

The project delivered education programs as part of the annual Angus Youth National Roundup event, to support young breeders in understanding the benefits and opportunities associated with genetic improvement. This was also supported by the development and implementation of a future Leaders program to provide professional development opportunities for outstanding young beef breeders with leadership potential.

A new educational program was developed for young beef producers who were actively involved in beef breeding programs. This program focused on the foundation principles of breeding and genetics. These programs were promoted throughout the project by production and distribution of monthly electronic newsletters targeted at young breeders, including human interest stories relating to involvement of young people in beef breeding and production.

3.6 Establish effective breeder and stakeholder consultative processes to ensure that RD&A initiatives appropriately address industry needs.

An important element of the project has been to continuously engage across industry including collaborating with the other individuals and organisations within the genetics extension network to extend messages and deliver educational programs in accordance with MLA's genetics extension and adoption strategy. This has included facilitating meetings of the Genetic Evaluation, Northern Development and Angus Youth Consultative Committees to obtain feedback for consideration project activities.

Participation in the Beef and Sheep Extension Group (BSEG), including presentation of outcomes for this project for peer review and potential application by other breeds and groups has been conducted throughout the project.

3.7 Conduct quantitative surveys amongst stakeholders across the beef value chain to enable measurement of practice and attitude change resulting from education and extension investments.

An initial process of engaging an independent body to conduct a structured quantitative survey of stakeholders to establish performance and adoption benchmarks and baselines for the project was undertaken in 2019. This survey was called the 'Beef Breeding Stakeholder Survey'. Companies that had competitive pricing, experience in the agricultural sector, their own database of Australian producers and methodology that was aligned with the objectives of the project were viewed favourably, with Chi Squared ultimately being the preferred candidate.

A comprehensive analysis and a report highlighting the key findings and insights from the stakeholder survey conducted during 2019 was released and used to form operational priorities and areas of focused work and messaging.

In year 5 (2022) of the project a further structured quantitative survey of stakeholders to establish performance and adoption changes resulting from project initiatives was conducted.

Both iterations of the survey were conducted utilising both email and an Australian based call centre, leveraging Chi Squared's considerable producer database and Angus Australia membership database. Some responses were also fielded through Angus Australia's social media platforms. An incentive to complete the survey, being a $2,500 donation to the Royal Flying Doctors Service, was made on the behalf of the respondents.

To ensure the survey captured responses that were representative of viable beef breeding enterprises across the wider beef industry there were disqualifying parameters put in place. These included:

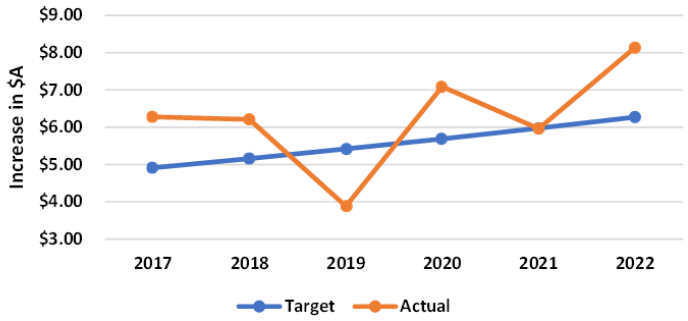
- Herd size less than 20 head of breeding females
- Participant younger than 18 years of age
- Less than 3 years of experience
- Participant wasn't actively involved in the management decision making process of the
- operation
- Main enterprise did not involve breeding or trading
- Participant didn't intend to be still be breeding cattle in 5 years' time

This ultimately yielded results of a significant representation of the Australian cattle producer demographic in each state with 1023 survey responses in 2019 and 977 survey responses in 2023.

4. Results

The overall results of the project are broadly assessed across the following key performance indicators. This project not only met but often exceeded its goals, demonstrating its positive impact on the cattle industry.

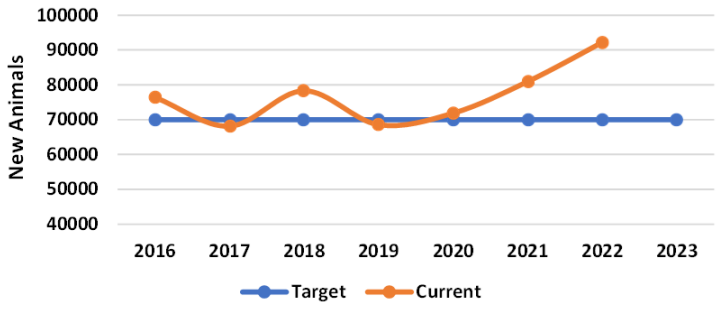
1. **Annual rate of genetic improvement, as measured by the Angus Breeding Index (ABI)**
   Target: Increase by 5%
   Outcome: average Increase by 12.3% p.a. (compared to the practice change baseline measured as a 3-year rolling average of the Angus Breeding Index between 2015-2017)



	ABI Increase		
Year	**Target**	**Actual**	**Rate of gain**
Baseline	$4.68		
2017	$4.91	$6.28	27.8%
2018	$5.16	$6.21	20.4%
2019	$5.42	$3.89	-28.3%
2020	$5.69	$7.09	24.6%
2021	$5.97	$5.96	-0.1%
2022	$6.27	$8.14	29.7%
Average			12.3%

Figure 1. Annual rate of genetic improvement by Angus Breeding Index (ABI) $A by year.

2. **Number of new animals with EBVs available**
   Target: 70,000 new animals
   Outcome: average 76,373 animals p.a.



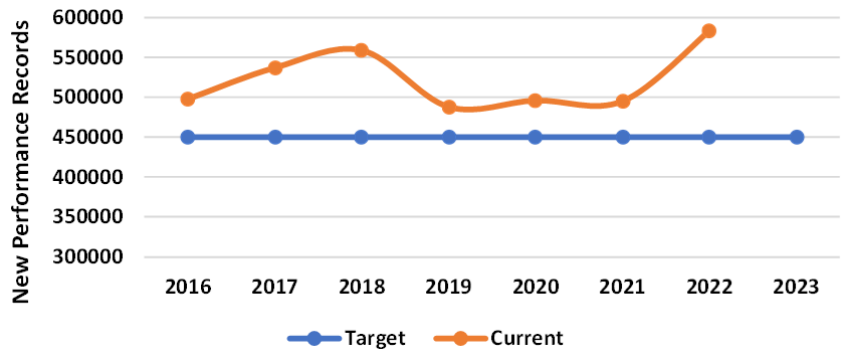
Year	**New Animals**	**Year on year change**
2016	76,468	6.4%
2017	68,161	-12.19%
2018	78,446	12.97%
2019	68,601	-14.17%
2020	71,878	4.56%
2021	80,941	11.20%
2022	92,192	12.20%
Average	76,373	

Figure 2. Number of new animals with EBVs by year.

3. **Number of performance records submitted**

Target: 450,000 performance records

Outcome: An average of 522,139 new performance records were submitted p.a.



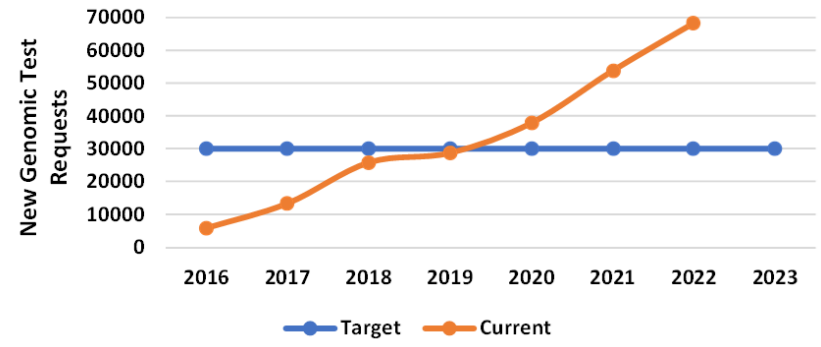
Year	New Records	Year on year change
2016	497,633	-8.1%
2017	536,867	+7.9%
2018	558,699	+4.1%
2019	487,709	-12.7%
2020	495,848	+1.7%
2021	494,888	-.10%
2022	583,329	+11.0%
Average	522,139	

Figure 3. Number of new performance record submissions by year.

4. **Number of genomic tests requested**

Target: 30,000 genomic tests

Outcome: An average of 33,349 genomic tests were submitted p.a.



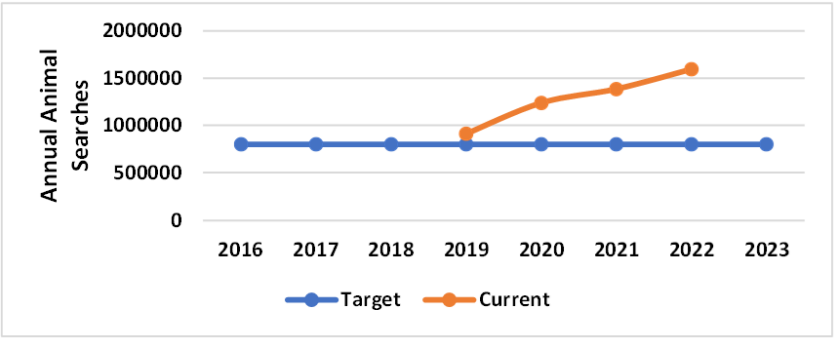
Year	Requests	Change
2016	5,773	n/a
2017	13,318	+231%
2018	25,771	+48.32%
2019	28,694	+10.19%
2020	37,829	+24.15%
2021	53,738	+29.60%
2022	68,322	+21.35%
Average	33,349	

Figure 4. Number of genomic test requests by year, and change observed compared to the previous year.

5. **Number of animal searches conducted**

Target: 800,000 searches conducted

Outcome: An average of 1,202,189 animals searched p.a.



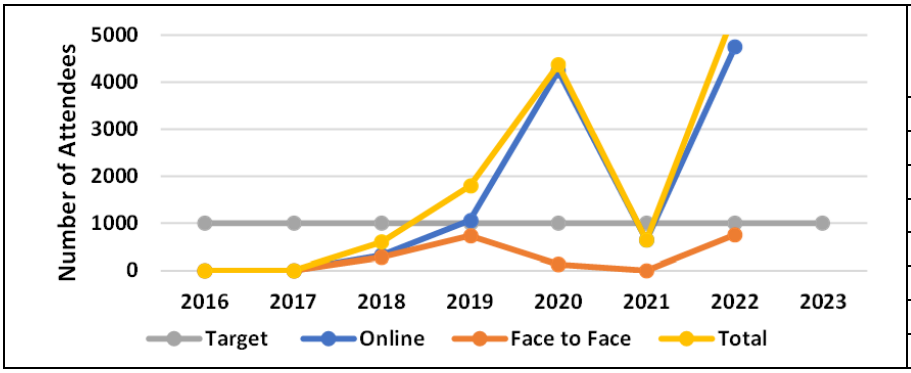
Year	Searches	Change
2019	911,173	n/a
2020	1,238,174	+27%
2021	1,384,642	+11%%
2022	1,594,408	+14%
Average	1,202,189	

Figure 5. Number of unique animal searches by year.

6. **Number of attendees at educational events**

Target: > 1000 attendees in educational activities annually

Outcome: Average of 1,894 attendees attended face to face activities and online activities p.a.



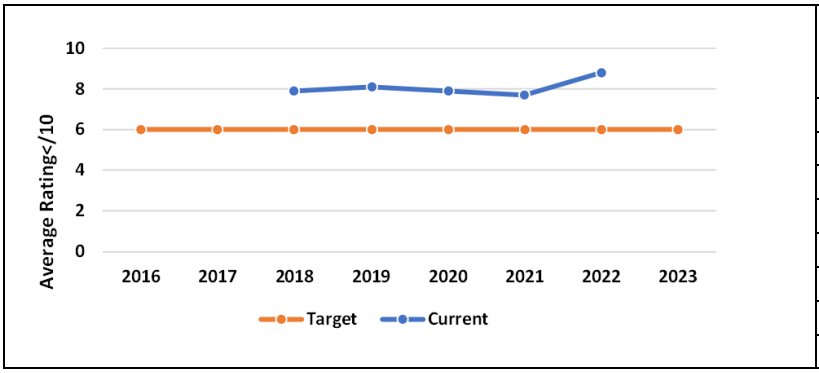
Year	Face to Face	Online
2016	n/a	n/a
2017	n/a	n/a
2018	282	320
2019	734	1,057
2020	130	4,241
2021	0	6,677
2022	753	4,751
Average		1,894

Figure 6. Number of attendees (face to face & online) by year.

7. **Average attendee satisfaction rating for educational events**

Target: >6/10 Average attendee satisfaction rating

Outcome: Across an average of 9.6 events p.a. the average satisfaction rating was 8.1/10



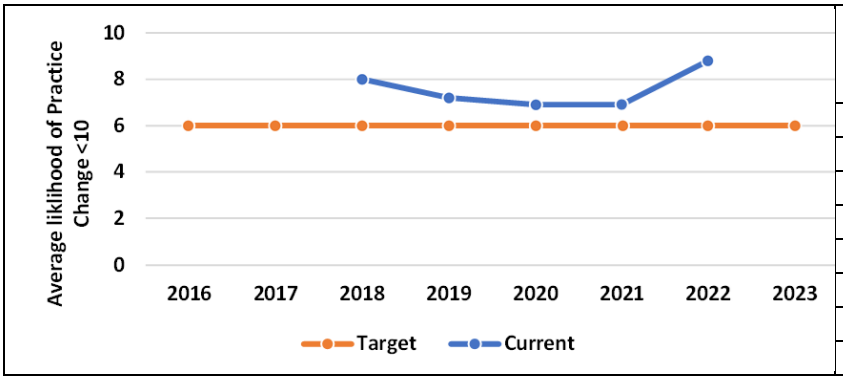
Year	Rating	Number of Events
2016	n/a	n/a
2017	n/a	n/a
2018	7.9	10
2019	8.1	9
2020	7.9	4
2021	7.7	8
2022	8.8	17
Average	8.1	9.6

Figure 7. Average attendee satisfaction rating by year.

8. **Average attendee likelihood of adopting new practices as a result of educational events**

Target: >6/10 Average attendee likelihood of practice change

Outcome: At an average of 9.6 events p.a. the average likelihood of practice change was 7.54



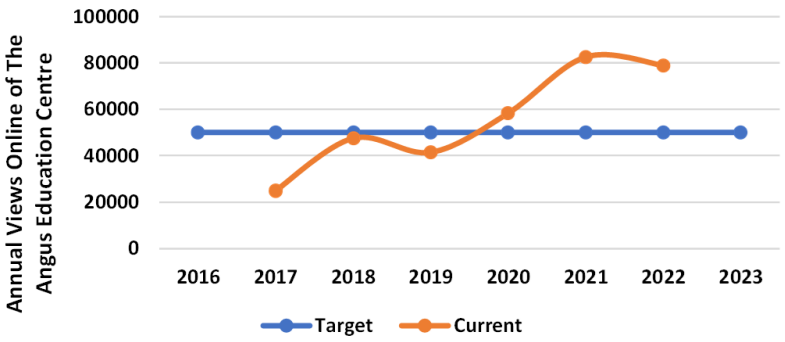
Year	Rating	Number of Events
2016	n/a	n/a
2017	n/a	n/a
2018	8.0	10
2019	7.2	9
2020	6.9	4
2021	6.9	8
2022	8.7	17
Average	7.54	9.64

Figure 8. Average likelihood of adopting new practices by year.

9. Number of views of Angus Education Centre

Target: >50,000 views annually

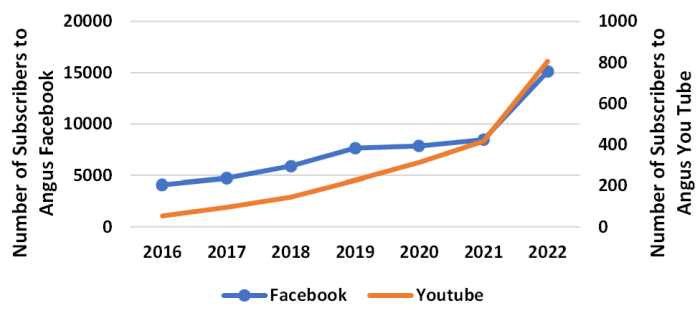
Outcome: An average of 55,631 views of the Angus Education Centre p.a.



Year	Views	Change
2016	n/a	n/a
2017	24,920	n/a
2018	47,537	+91%
2019	41,444	-13%
2020	58,352	+40%
2021	82,603	+30%
2022	78,927	-5%
Average	55,631	

Figure 9. Unique views of the Angus Education Centre by year.

10. Number of subscribers/followers of Angus Australia social media



Year	Facebook	YouTube
2016	4,089	54
2017	4,741	96
2018	5,897	145
2019	7,642	226
2020	7,859	313
2021	8,464	416
2022	15,112	805

Figure 10. Social media followers by year.

4.1 Objective 1. Develop and deliver an innovative education program

A review of existing education resources took place to identify new resources requiring development for release in either online or face to face activities. The review process and resulting educational program that was developed is summarised in Figure 11.

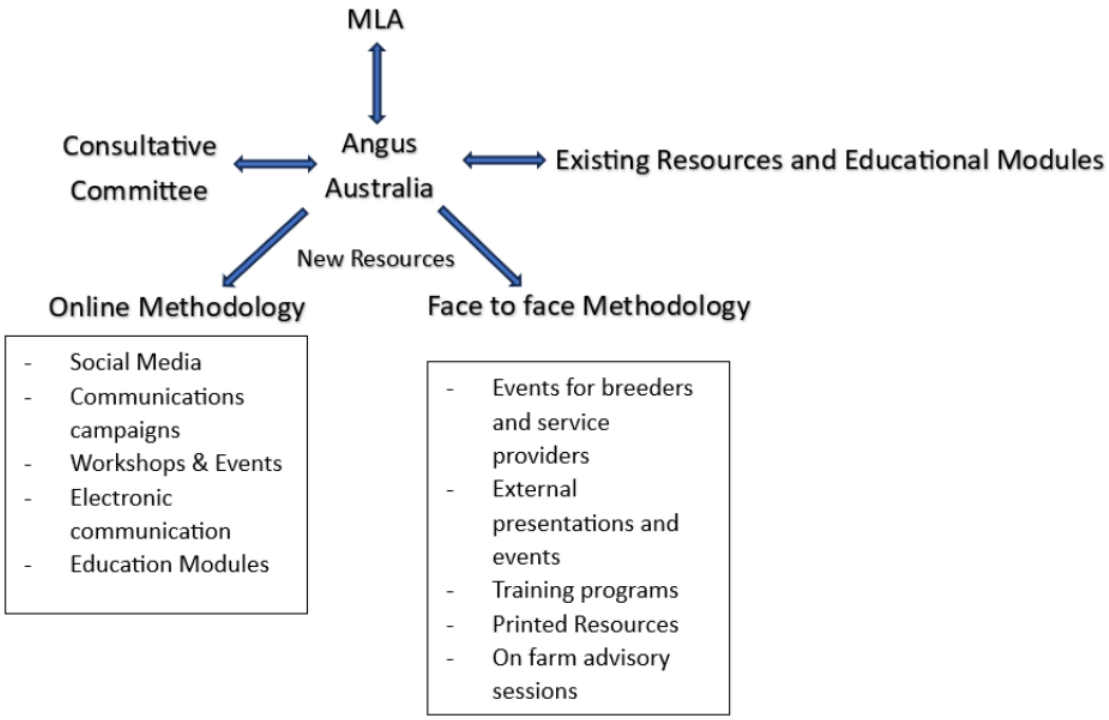


Figure 11. Methodology that was used to design educational programs.

The project has maintained and expanded existing learning modules within the Angus Education Centre, a central one-stop-shop on the Angus Australia website for all educational and extension resources relating to breeding and genetics, best practice performance recording and effective use of genetic evaluation results in breeding and selection decisions.

To accommodate individual learning processes, there are a range of modern digital education resources and activities:

- Video presentations, animations, written resources
- Social media platforms
- Online events
- Delivering physical workshops for service providers to industry through delivery
- Presentations and education to the broader industry outside of the Angus network by delivery of presentations at industry field days
- Delivery of one-on-one advisory sessions
- Printed and electronic educational resources

A summary of the specific activities conducted, and the impact metrics is provided in Table 2.

Activity Type	Number of activities (Target)	Number of activities (Achieved)	Number of Attendees	Average Value rating /10	Average Likelihood for practice change /10
Workshops	5	5	84	9.2	8.65
Advisory sessions	150	60	60	9.2	8.8
Online Events (General)	5	23	2,349 (10,533 views)	7.9	7.64
Online Events (Spring Bull Night)	5	5	12,200 Views	7.2	8.3
Online Events (Webinars)	18	20	1,106	8.9	7.56
Angus Sire Benchmarking Events	5	4	380	8.69	8.9
Angus Education Centre – New Modules	10	11	55,000 average views per year		
Communication and extension campaigns	200	280	>100% increase in followers across Facebook,Twitter, Instagram, YouTube & Linkedin		
External Presentations	5	10	>1000	N/A	N/A
Staff Training Sessions	5	16	Average 38 staff per session	N/A	N/A
New Printed Resources	4	16	N/A	N/A	N/A
Response to member enquiries	1000	1512	N/A	N/A	N/A

Table 2. Summary of education program components delivered through Objective 1.

4.1.1 Workshops

Five Southern Service Provider workshops have been delivered to key genetics and service providers in Southern Australia (such as semen companies, ultrasound scanners, beef consultants and leading cattle veterinarians) outlining the latest developments within Angus Australia and our programs (i.e. Breed Development, Strategic Projects) (Image 1).

Goal: 5 workshops
Achieved: 5 workshops
Attendees: 84
Average Value Rating: 9.2
Average likelihood for practice change: 8.65

Image 1. Producer Workshop Hamilton VIC 2019.

4.1.2 Advisory sessions

Sixty one-on-one advisory sessions were delivered, as part of a structured genetic advisory program, focused on increasing understanding of the opportunities for genetic improvement. These sessions were held predominantly on farm and in locations across Australia with influential seedstock breeders.

Significant disruption was incurred in the delivery of this activity due to the Covid -19 Pandemic and particularly border closures during 2019 – 2022.

Goal: 150 Sessions
Achieved: 60 Sessions
Average Value Rating: 9.2
Average likelihood for practice change: 8.8

4.1.3 Online Events (General)

Twenty three online events were developed and delivered to showcase the latest outcomes from research and development programs that Angus Australia is involved with, and increase awareness of upcoming enhancements to the TransTasman Angus Cattle Evaluation (Image 2).

As part of the disruption to in person field support and activities relating to this project, significant growth in online events eventuated in the activity goal being surpassed.

Goal: 5 workshops
Achieved: 23 workshops
Online Attendees: 2,349
Online Views: 10,533
Average Value Rating: 7.9
Average likelihood for practice change: 7.64

Image 2. Save the Date for 2022 TACE Enhancements Online Workshop.

4.1.4 Online Events (Selection Intensity – Semen Sires)

Five Spring Bull Night events were developed and delivered online events focused on increasing awareness of Angus bulls for which semen is available to drive an increase in selection intensity within participants breeding program and increase engagement with key members of the Angus genetic improvement extension network.

The spring bull night events have created significant attention which has led to breeders having higher selection intensity and familiarity with breeding decision tools available.

Goal: 5 events
Achieved: 5 events
Online Views: 12,200
Average Value Rating: 7.2
Average likelihood for practice change: 8.3

4.1.5 Online Events

Twenty online events were developed and delivered to showcase the latest outcomes from research and development programs that Angus Australia is involved with and increase awareness of upcoming enhancements to the TransTasman Angus Cattle Evaluation. Events included Angus Connect (R&D updates) (Image 3), TACE Enhancements (Annual enhancements to the genetic evaluation pipeline), Angus Essentials (a seven part series detailing genetics and breeding for beginners), Northern Service Providers workshop (providing updates to consultants and service providers in the Northern Beef industry) , Angus Spring Bull night (preview of Angus sires with semen available) and Angus Heifer Select webinars (Showcasing commercial genotyping tools for improved animal selection).

Goal: 18 workshops
Achieved: 20 workshops
Attendees: 1,106
Average Value Rating: 8.69
Average likelihood for practice change: 8.9

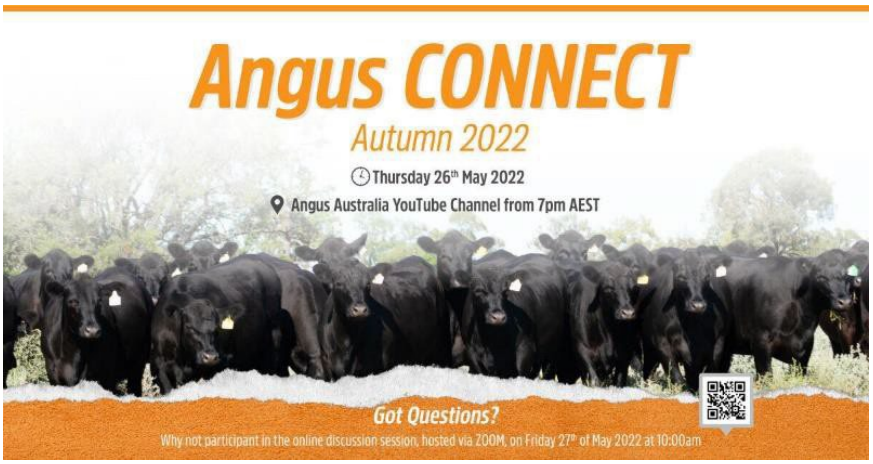


Image 3. Save the date for Angus Connect 2022.

4.1.6 Angus Sire Benchmarking Events

Four annual events were delivered focused on the latest outcomes from the Angus Sire Benchmarking Program. These have been held at the University of New England Tulimba Feedlot and often in conjunction with other service providers or collaborators (Image 4). One event was cancelled due to the Covid-19 Pandemic.

Goal: 5 workshops
Achieved: 4 workshops
Attendees: 380
Average Value Rating: 8.69
Average likelihood for practice change: 8.9

Image 4. 2022 ASBP Open day at Tulimba Feedlot, NSW.

4.1.7 Angus Education Centre – New Modules

A comprehensive portfolio of learning modules was developed within the Angus Education Centre. The education centre is a central one-stop-shop on the Angus Australia website for all educational and extension resources relating to breeding and genetics, best practice performance recording and effective use of genetic evaluation results in breeding and selection decisions. Each learning module consists of a range of modern digital educational resources and activities that accommodate individual learning processes (e.g. video presentations, animations, written resources).

Education modules released during the project include:

- The Stock Agents Toolkit
- Understanding Research Breeding Values
- Angus Selection Indexes
- Guideline for collecting Coat Scores
- Relocating Management (Bulls for Northern Australia)
- Genetic Conditions in Angus Cattle
- Angus Heifer Select
- Angus Online (Database search and report centre)
- Collection guideless for TACE
- Collection guidelines for Angus research

Goal: 10 new modules
Achieved: 11 new modules
Average Views per year: 55,000 unique views

4.1.8 Communication and Extension Campaigns

More than 280 communication campaigns have maintained and expanded the engagement of Angus breeders across social media platforms, supplying key information on the value of genetic improvement and upcoming enhancements to the TransTasman Angus Cattle Evaluation. This has lead to more than 100% growth in social media followers over the course of the project.

An example of a tagline campaign was used to promote core messages regarding tools for breeding and selection. For increasing the level of understanding and use of EBVs a tagline was conducted with key messages (Images 5 & 6).

Goal: 200 campaigns to social media platforms
Achieved: 280 campaigns to social media platforms
Average uptake: More than 100% increase in followers across Facebook, Twitter, Instagram, YouTube and LinkedIn

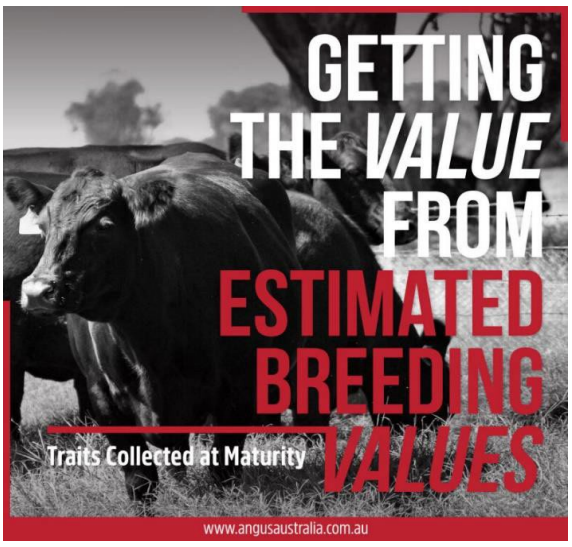


Image 5. Social Media Tile used for a Tagline Campaign.

Image 6. Social Media Tile used on Facebook to link to the Angus Education Centre.

4.1.9 External Presentations

Ten presentations have been delivered at industry field days regarding new developments in breeding and genetic technologies, and the best practice use of genetic evaluation results in their breeding and selection decisions. These presentations include training sessions for stock agents and personalised sessions for Intercollegiate meat judging, Paraway pastoral, Tocal Beef Cattle Assessment School, Knowla Livestock, Western Districts Beef Group, Zoetis and others (Images 7 & 8).

Goal: 5 presentations
Achieved: 10 presentatons

Image 7. ICMJ Wagga Wagga NSW 2022.

Image 8. Tocal Beef Cattle Assessment School, Tocal NSW 2019.

4.1.10 Staff Training sessions

Sixteen training programs for Angus Australia staff who assist Angus breeders with regards to genetic improvement were delivered across the project. The number of training sessions exceeded the original expectations due to the amount of significant developments achieved through the project that have resulted in new or enhanced tools being made available to breeders.

Goal: 5 training sessions
Achieved: 16 training sessions

4.1.11 New Printed Resources

Sixteen new printed educational resources, relating to genetic improvement, to enhance the delivery of key educational messages around the value of genetic improvement were developed and delivered under the project. Resources compiled include those relating to performance record collection, structural scoring, relocating bulls to pastoral zones, Lessons from the ASBP and understanding the annual TACE enhancements amongst others (Images 9, 10 and 11).

Goal: 4 printed resources
Achieved: 16 printed resources

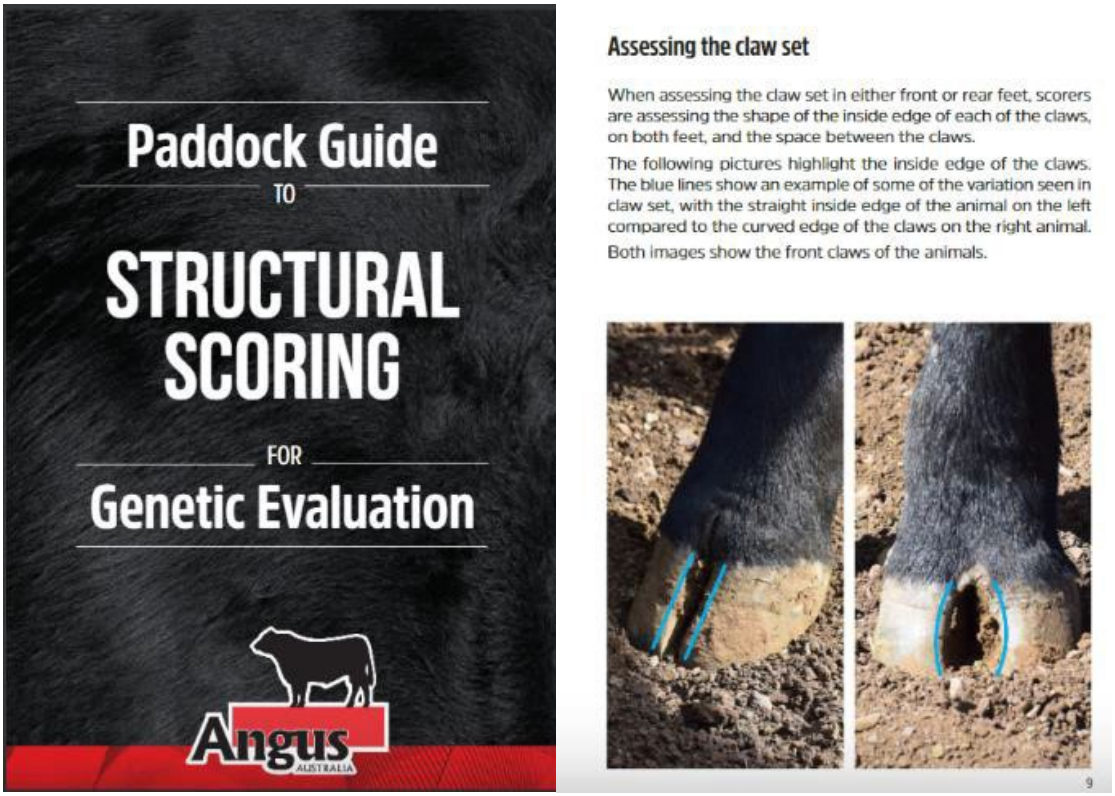


Image 9. Paddock Guide for Structural Scoring

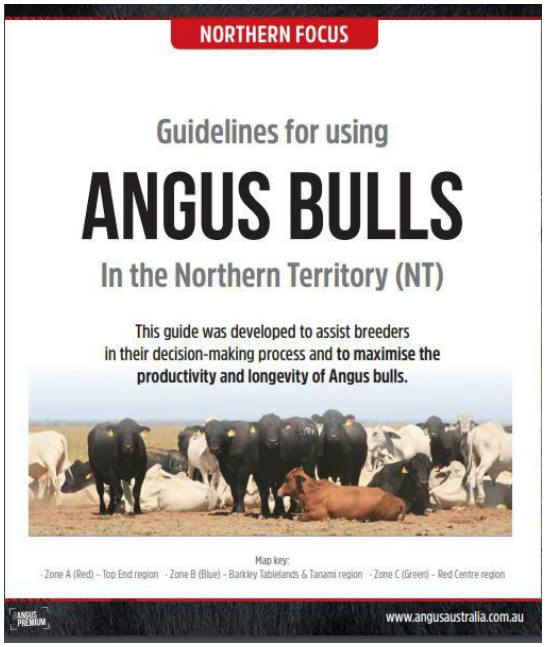


Image 10. Guidelines for using Angus bulls in the Northern Territory

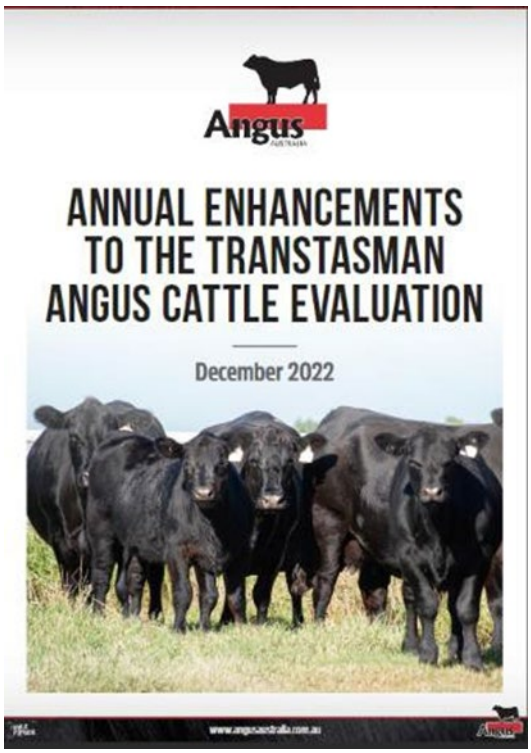


Image 11. Annual Enhancements to the TACE evaluation brochure

4.1.12 Respond to member enquiries

Throughout the project day to day assistance has been provided to Angus breeders via phone, email and video conference in matters relating to genetic improvement.

Goal: Resolve 1000 member enquiries
Achieved: Resolved 1512 member enquiries

4.2 Objective 2. Develop, evaluate and deliver innovative decision support tools

A range of new features and enhancements was developed and implemented to maximise the utilisation and effectiveness of web-based tools. One development is AngusSELECT, which is a suite of selection tools that enable Angus breeders to improve the profitability of Angus genetics within the beef supply chain by assisting with the identification of Angus genetics that are most aligned with their breeding goals and objectives. AngusSELECT includes SaleSELECT, SemenSELECT, ASBPSELECT and MemberSELECT, which includes the ability to place breeding objective criteria on search results particularly for animals for sale.

A range of new features and enhancements to maximise the utilisation and effectiveness of the Angus Database Search facility were implemented, which enables breeders to search Angus Australia's comprehensive animal database for a range of important animal and genetic information. This includes the display and presentation of Indexes and breeding values.

Several decision support reports and tools that summarise the completeness and effectiveness of the pedigree, performance and genomic information that is recorded by each participant in the Angus genetic evaluation have also been developed.

The features developed and implemented under this project are:

New Reports

- **Trait comparison**: provides a graphically display of EBVs for two individual traits for a group of selection candidates, enabling the identification of animals with superior (or inferior) genetics for both traits.
- **Trait distribution**: provides a graphical display of the EBV distribution for an individual trait for a group of selection candidates, enabling the identification with superior (or inferior) genetic for the trait.
- **Search Result Listing** (PDF): provides the ability to create, download and print a pdf report of the results from a search.
- **Search Result Listing** (CSV): provides the ability to create and download a csv file of the results from a search.
- **Detailed Animal Reports** (PDF): provides the ability to create, download and print detailed customised reports for each animal returned from a search.
- **Angus Datacheck Report**: provides information enabling breeders to carefully review the completeness of the pedigree, performance and genomic information that is included in the TransTasman Angus Cattle Evaluation for animals within the seedstock enterprise. These results have been generated and made available to Angus breeders who are a member of TACE 26 times per year (Image 12).
- **Genetic Benchmarking Report** (PDF): provides information enabling breeders to carefully evaluate and benchmark the genetic improvement of their seedstock breeding enterprise against other Angus seedstock enterprises who are members of Angus Australia. These results have been generated and made available to Angus breeders who are a member of TACE 26 times per year (Image 13).

- **Angus Effectiveness of Performance Report**: provides an overview of the performance recording undertaken and the subsequent assignment of contemporary groups within the TransTasman Angus Cattle Evaluation (TACE). These reports have been piloted during on property consultations during this project and have been delivered on 60 occasions.
- **Angus Heifer Select Report Centre**: provides a suite of decision support reports and analysis tools related to the genetic predictions for Angus commercial heifers. This includes search results listings (PDF and CSV), detailed animal reports, results summary, sire summary, trait comparison and trait distribution analysis tools.

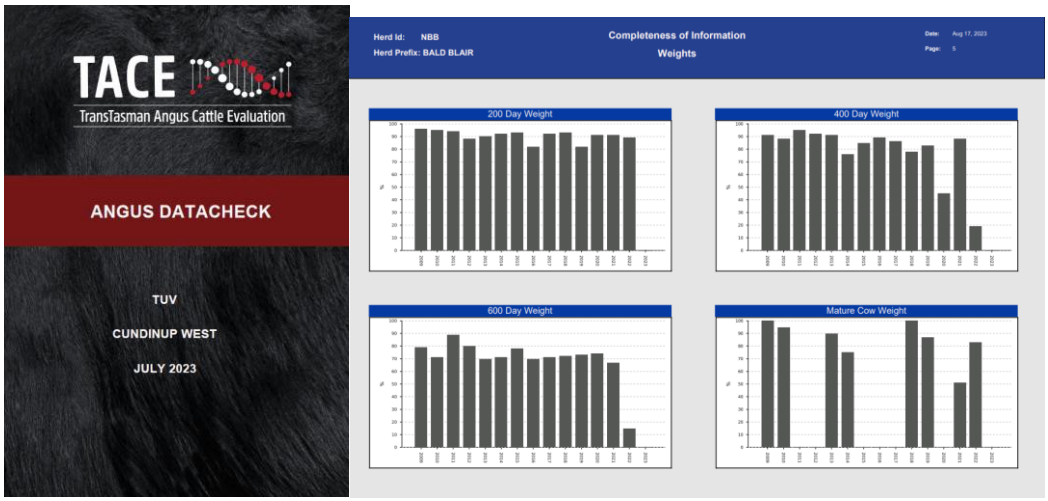


Image 12. Angus Datacheck Report showing percent of eligible animals with trait submitted by year and by sex.

Image 13. Genetic Benchmarking Report shows change in EBV by Year.

New Tools

- **Angus Mating Predictor**: provides expected average progeny values to assist breeders estimate the outcome of particular mating combinations and improve the selection accuracy and intensity of their mating decision while considering inbreeding. The Angus mating predictor returns more than 5,000 mating scenarios with predicted genetic merit and inbreeding coefficient every month. (Image 14).
- **Angus Mobile App**: provides simple database search results in an application-based program available on all android and IOS operating systems allowing producers to search for animals and genetics in a convenient app format suitable to yards, paddocks and sales

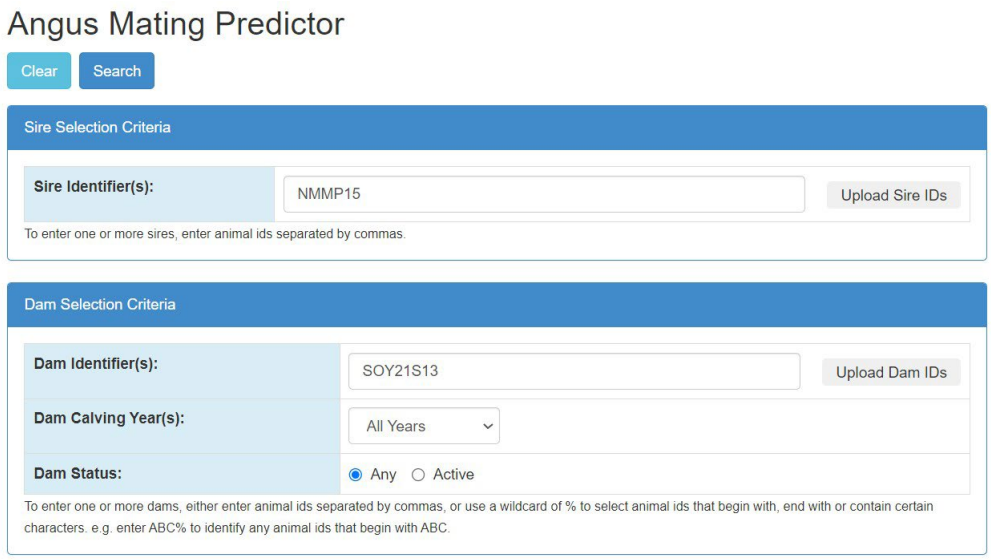


Image 14. Angus Mating Predictor Selection Criteria.

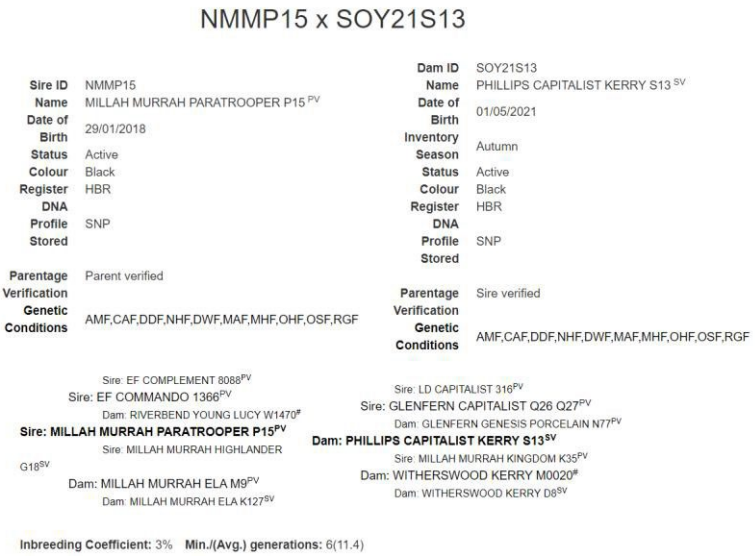


Image 15. Angus Mating Predictor Inbreeding Coefficient.

Expected Average Progeny Values												
	Calving Ease				Growth					Fertility		Temp.
	Calving Ease Dir	Calving Ease Dtrs	Gestation Length	Birth Weight	200 Day Growth	400 Day Weight	600 Day Weight	Mat Cow Weight	Milk	Days to Calving	Scrotal Size	Docility
EBV	+7.8	+6.7	-7.3	+3.7	+61	+108	+138	+116	+22	-5.3	+1.8	+16
Acc	73%	59%	84%	83%	84%	83%	83%	79%	73%	46%	81%	71%
Perc	10	13	14	40	9	8	12	23	14	34	63	69

	Carcase						Feed Efficiency	Structural			Selection Index	
	Carcase Weight	Eye Muscle Area	Rib Fat	Rump Fat	Retail Beef Yield	IMF	NFI-F	Claw Set	Foot Angle	Leg Angle	Angus Breeding Index	Angus Breeding Low Feed Cost Index
EBV	+85	+8.1	+0.1	-0.4	+0.3	+2.4	+0.19	+0.68	+0.77	+0.96	$251	$431
Acc	73%	72%	73%	73%	67%	74%	58%	80%	80%	78%	-	-
Perc	7	28	47	50	65	42	52	20	10	31	5	2

Image 16. Angus Mating Predictor Expected Average Progeny Values

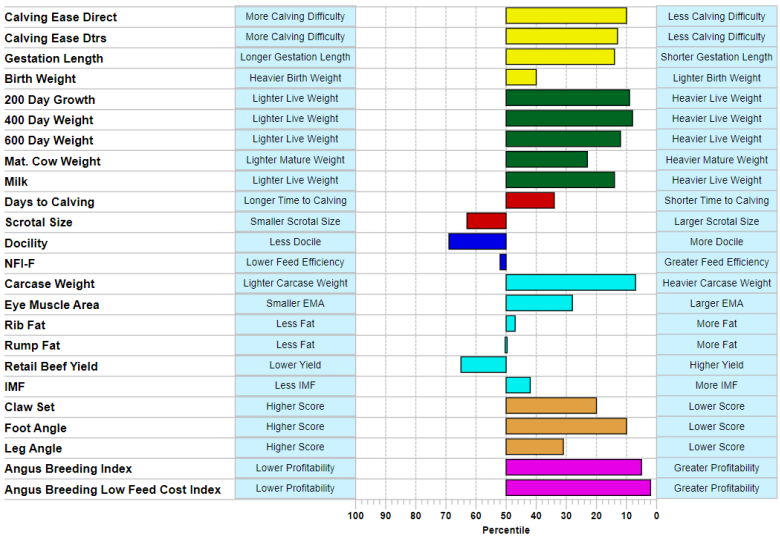


Image 17. Angus Mating Predictor Expected Average Progeny Value Percentile Graphs

Enhancements of Existing Reports

- **Result summary**: provides a summary of the genetic merit of the animals returned from a search of selection candidates
- **Sire Summary**: provides a summary of the sires represented in the results returned for a search of selection candidates
- Software development has been completed to improve the manner in which breeding values are presented on Angus animals. Specifically, the percentile band in which EBV is placed is now displayed in association with the EBV, preventing the need for breeders to review EBV reference tables and considerably improving interpretation of the breeding value. In addition, the number of progeny for which performance information has been analysed is now displayed in association with each EBV.

Detailed Animal Reports have been made available to Angus breeders that would like a PDF report of the search result and particularly individual animal records from the result (Figure 11). This has seen significant adoption across the audience since 2018 peaking at 6000 custom reports in 2022.

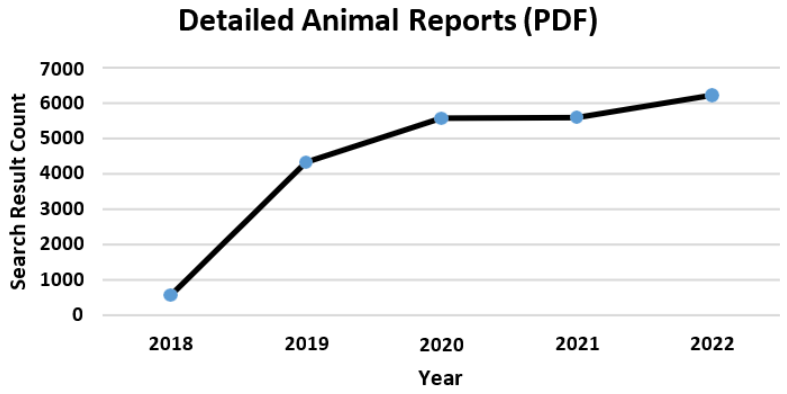


Figure 11. Detailed Animal PDF Reports by Year

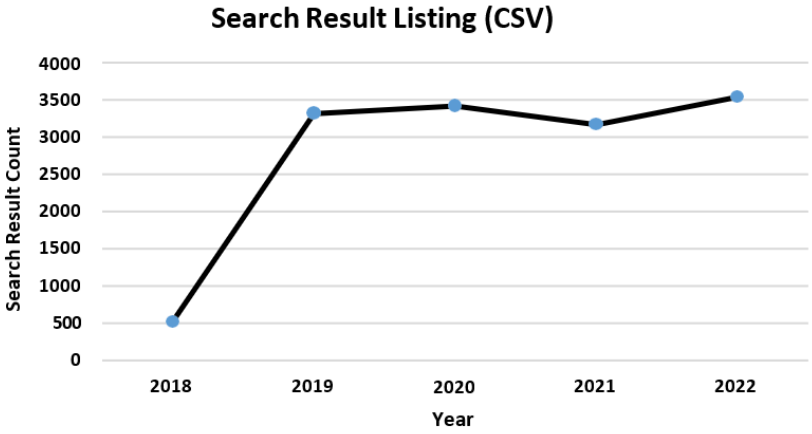


Figure 12. CSV Search Results by Year

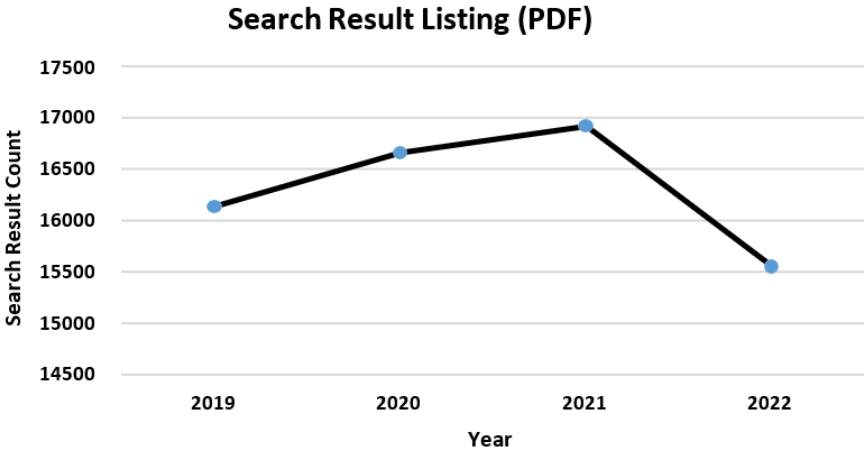


Figure 13. PDF Search Results by Year

Angus breeders looking to customise their search result in CSV has increased in number since 2018, peaking in 2022 at more than 3,500 CSV extracts of genetic merit information on groups of animals.

Angus breeders looking to customise their search result in PDF has increased in number since 2019, peaking in 2021 at nearly 17,000 PDF extracts of genetic merit information on groups of animals. A decline in 2022 is likely caused by the ability of people to attend sales again following covid-19 restrictions and use physical sale catalogues as a traditional method of comparison.

Goal: Implement 10 new features on AngusSELECT
Achieved: 15 new features on AngusSELECT

4.3 Objective 3. Conduct "proof-of-concept" analyses to demonstrate the benefits of genetic improvement

A suite of new resources were developed through "proof of concept" analyses around the Angus Sire Benchmarking Program outcomes.

Two new resources tailored to DNA technology use have been developed under this project. A two-page case study titled "Developing a genomics testing strategy for your herd" has been released and promoted through the education and communications components of this project.

In support of this initial resource a case study resource was developed titled "Bull discovery – powered by genomics" which demonstrated the role of genomic testing on a population of cattle and highlighted the average and spread of the breeding values, any individual movement and reranking and improvements in breeding value accuracy.

Goal: 2 new resourced developed
Achieved: 2 new resources developed

By using outcomes learnt from the Angus Sire Benchmarking Program, a suite of resources has been developed showcasing the repeated, real world demonstration of the benefit of genetics, and the benefits that can be obtained by utilising genetic evaluation results in breeding and selection decisions.

Resources developed from the "lessons from the ASBP" include:

- Capitalising on genetic variation
- EBVs reliably predict progeny performance
- Starting vs Finishing EBVs
- Individual sire EBV changes.

This project has illustrated the considerable genetic variation that can be found between Angus animals and the opportunity that consequently exists to improve the productivity and profitability of Angus beef breeding enterprises by utilising superior genetics.

This project further supported that EBVs provided a reliable prediction of how the progeny from sires in the ASBP subsequently performed and should be used with confidence when selecting animals for use within a beef breeding program.

Two projects compared the average starting EBVs of the 10 sires with the highest and lowest EBVs for each trait, from cohorts 1 to 3 and 5 to 7 of the ASBP, with their average finishing EBVs, to see whether there was significant change in their EBVs once all of their progeny performance data has been included in the calculation of their EBVs.

What was observed was that, despite the initial EBVs being of relatively low accuracy, there was very little change in the average EBVs of the sires. This clearly demonstrates that EBVs can be used with confidence when selecting young animals for use within a breeding program.

Two projects assessed the EBVs of individual sires entered into cohorts 1 to 3 and 5 to 7 of the ASBP to analyse whether the EBVs for individual sires, when initially joined in the ASBP program, differed

considerably from the sire's EBVs at the end of the program, by which time their progeny has been comprehensively performance recorded.

Results demonstrated that while for some individual sires, the EBVs did change, there was, on average, minimal change, and very little re-ranking of sires. Also, even though some initial sire EBVs were of low accuracy, they still described the genetic merit of sires well. Further, the number of sires for which the EBVs did change considerably, and the magnitude of the change in their EBVs, was within expected ranges.

Goal: 12 new resourced developed
Achieved: 8 new resources developed

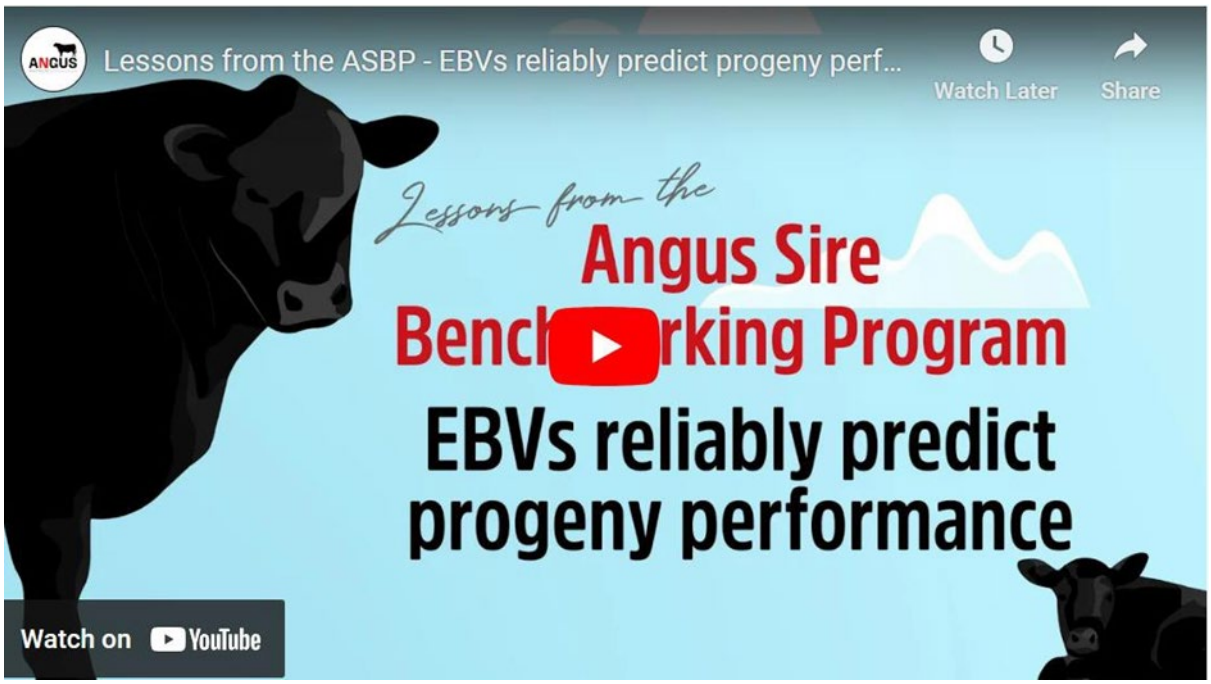


Image 18. YouTube videos have been produced showcasing the four main work streams conducted under the proof-of-concept lessons from the ASBP.

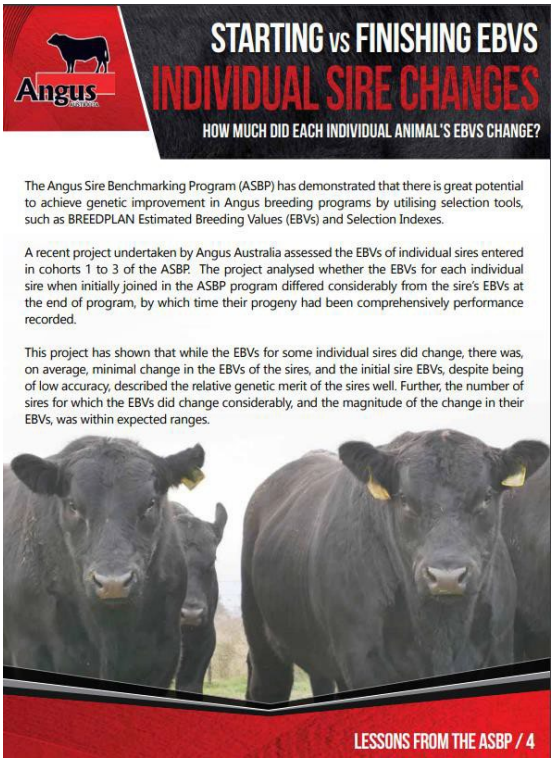


Image 19. Brochures have been developed and used at industry field days and producer consultation.

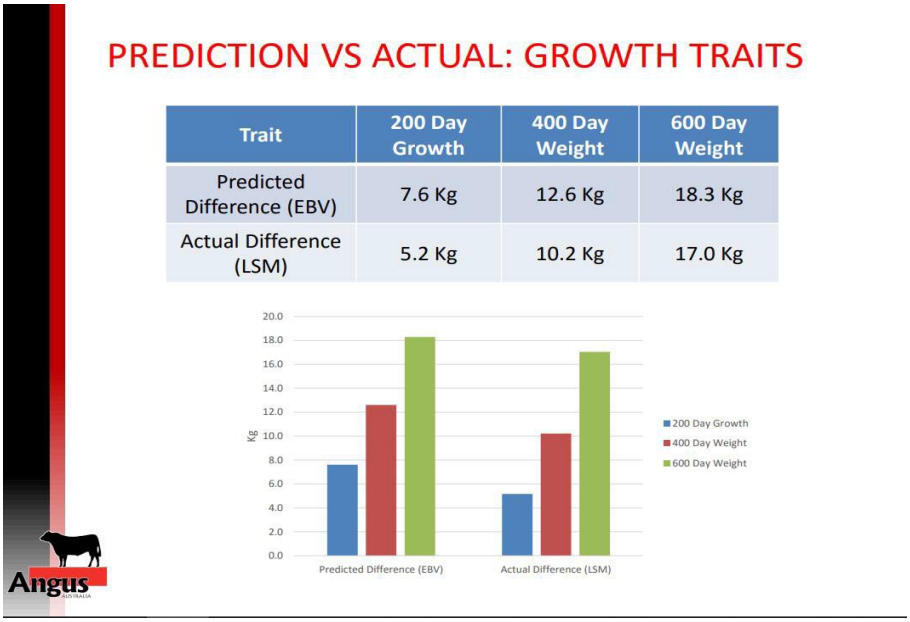


Image 20. Power point presentations have been produced showcasing the outcomes of the project for education at industry events and field days.

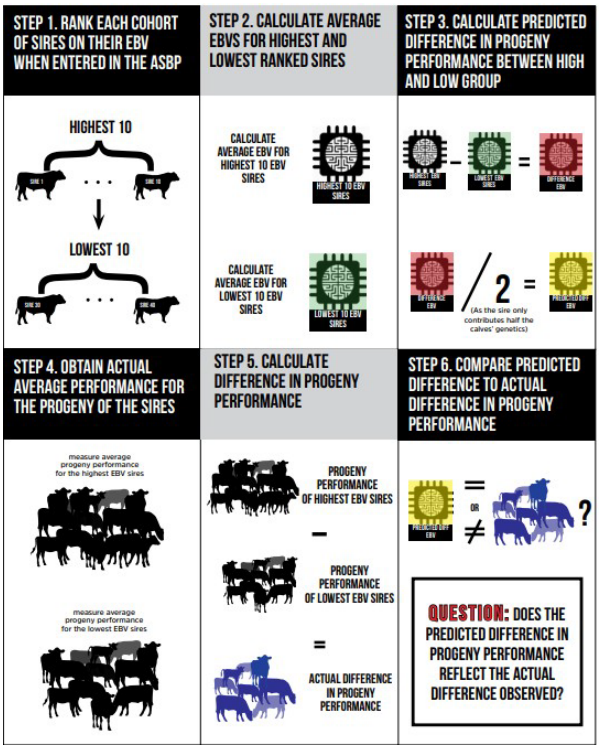


Image 21. An example of the trial design for calculating if predicted progeny performance reflects the actual difference in performance observed.

4.4 Objective 4. Support breeders in Northern Australia in use of adapted and improved Angus-influenced genetics

A suite of support tools and resources has been carried out in Northern Australia to improve the understanding an adoption of utilising Angus influenced genetics the area.

Annual service provider workshops were conducted for advisors, consultants, stock agents and influencers of practice change in Northern Australia. These workshops have had high value rating from participants (8.4/10) and a strong likelihood of practice change as a result (7.3/10) of attending the workshop.

In addition to structured workshops for service providers, individual member support has been provided to more than 400 cattle breeders from Northern Australia in relation to the breeding and selection decisions and considerations unique to the Northern environment.

As part of the overall strategy for supporting breeders in Northern Australia, a large number of high-quality case studies where researched and written showcasing breeders in Northern Australia and particularly their own experiences and strategies in use of adapted and improved Angus – influenced genetics.

As a support mechanism for the work and resources being conducted a centralised website for the Northern production system has been developed and released on the Angus Australia website.

Written resources and guides have been released to support the work conducted including guidelines for using Angus bulls in Queensland, The Northern Territory and Western Australia.

- **Workshops**
  - **Goal**: 5 service provider workshops
  - **Achieved**: 5 service provider workshops, Attendees:20, Avg Value: 8.4/10, Avg likelihood of Practice change: 7.3/10
- **Member Enquiries**
  - **Goal**: 250 member enquiries
  - **Achieved**: 406 member enquiries
- **Case Studies**
  - **Goal**: 15 Case Studies
  - **Achieved**: 21 Case Studies
- **Resourced Developed**
  - **Goal**: 5 New resources developed
  - **Achieved**: 6 new resources developed

4.5 Objective 5. Enhance skill development and capability among young breeders

A highlight of this project has been the delivery and associated value and practice change results from the GenAngus Future Leaders program. The program has been delivered to 61 attendees over three years with content tailored to each group to assist the attendees to have an in-depth

understanding of aspects of commercial beef production. Topics such as breeding and genetics, beef business benchmarking, red meat marketing and strategies for better decision. The GenAngus program has been tailored for 18 – 40-year-old attendees looking for ways to improve their beef business productivity and profitability.

Complimenting the GenAngus program has been dedicated sessions at the Angus Youth National Roundup for 8 – 25 year old attendees, tailored at the importance of breeding and genetics decision making, showcasing the tools available to beef breeders to make informed breeding decisions.

These sessions have covered topics such as setting a breeding objective. tools available to seedstock and commercial breeders and proof of concept on using Estimated Breeding Values from the Angus Sire Benchmarking Program. It should be noted one (1) event was cancelled due to the covid-19 pandemic.

As well as the two flagship face to face programs, a comprehensive and regular email newsletter has been circulated to more than 3500 members weekly containing regular articles targeted at understanding breeding and genetics and enhancing the skills and capability amongst young breeders.

A concept paper for new initiatives was developed in 2021 which included a strategy to host a production tour showcasing the breeding and genetics considerations in certain areas of Australia.

GenAngus
Target: 3 GenAngus Future Leaders programs
Achieved: 3 GenAngus Future Leaders Programs, Attendees: 61
Average value rating: 8.8/10
Average likelihood for practice change: 9.4/10

Image 22. The Gengus Future Leaders Program Delegates, 2022.

Image 23. The Gengus Future Leaders Program Delegates, 2022.

Angus Roundup
Target: 4 Angus Youth Roundup Events
Achieved: 3 Angus Youth Roundup Events, Attendees :389

Enews editions
Target: 30 enews editions
Achieved: 130 enews editions (circulated to 8,000 subscribers weekly)

4.6 Objective 6. Establish effective breeder and stakeholder consultative processes to ensure that RD&A initiatives appropriately address industry needs

A key focus for this project was to ensure activities and future research appropriately met the industry needs. Part of this included collaborating with other genetics service providers in the industry and collectively working through feedback and strategies across research and adoption. Some of these groups included the Agricultural Business Research Unit, The Animals Genetics Breeding Unit, Beef and Sheep Extension Group and Sheep Genetics.

An important part of the consultative process was to conduct strategic consultative committee meetings for key areas of the project including Northern Development, Genetic Improvement and Angus Youth amongst others. These consultative groups provided feedback from industry and were used as a sounding board of ideas and operational deliverables to ensure that the initiatives appropriately addressed the industry needs. Four less meetings were held than targeted due to Covid-19 related delays and changes to deliverables during this period.

Beef extension groups
Target: Contribute to 2 service provider groups
Achieved: Attendance at 2 service provider meetings

Consultive committee meetings
Target: 30 meetings held
Achieved: 26 meetings held

4.7 Objective 7. Conduct quantitative surveys amongst stakeholders across the beef value chain to enable measurement of practice and attitude change resulting from education and extension investments

4.7.1 Knowledge about genetics and animal selection

The Beef Breeding Stakeholder Survey indicates an evolving landscape of cattle breeding practices, focusing on the utilization of genetic information and its impact on breeding decisions. The study provides insights into self-rated genetic knowledge, changes in knowledge levels, the role of Estimated Breeding Values (EBVs), and the perspectives of cattle producers, particularly within Angus Australia. The survey also investigates the influence of EBVs on cattle production outcomes and the preferred sources of information that shape breeders' decisions.

Self-Rated Genetic Knowledge:

1. **Steadfast Knowledge Levels**: The self-assessment of genetic knowledge has demonstrated stability over the past four years. Producers' self-ratings have largely remained consistent, with a slight increase observed in the proportion of participants rating their knowledge as 9 or 10 out of 10, rising from 25% in 2019 to 28% in 2023.

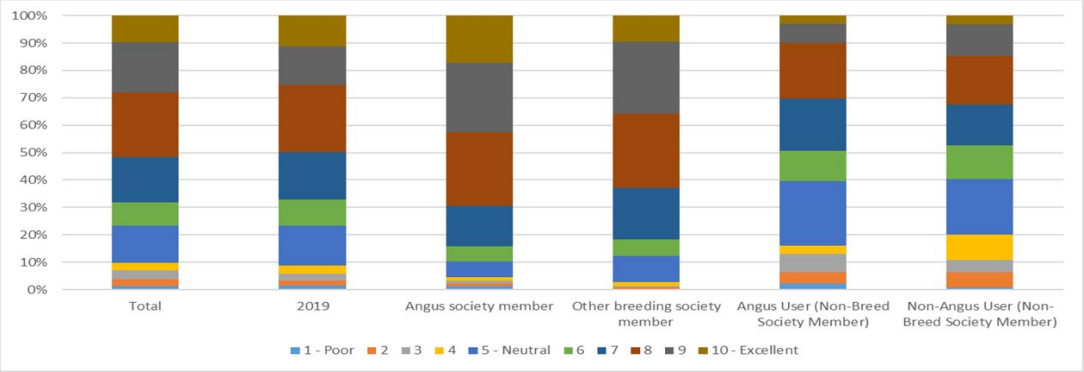


Image 24. Self-assessed knowledge of genetics is rated higher amongst breed society members completing the survey

2. **Knowledge Enhancement Trends:** A significant proportion (68%) of respondents reported an improvement in their understanding of genetics over the past five years. This positive sentiment extended to Angus Australia members, where an even higher percentage (75%) acknowledged a growth in their genetic knowledge. Notably, this trend was uniform across various age groups and experience levels within cattle production demographics. Of those producers that believed that their knowledge of genetics had improved over the last five years, 35% had attended an Angus Australia event or accessed Angus Australia resources. Half went on to make changes to their management of bull selection or breeding decisions, based on the information they accessed through Angus Australia.

Importance of Selection Criteria and EBVs:

3. **Key Selection Criteria:** The study identified key selection criteria based on producer ratings. Temperament retained its position as the most highly rated trait, with a rating of 9.3/10. This was followed by visual appraisal, polledness, BULLCHECK, genetic conditions, coat colour, and EBVs.
4. **EBVs in Bull Selection:** The study highlighted the growing role of Estimated Breeding Values (EBVs) in bull selection. An encouraging 60% of producers indicated that they consistently consider EBVs as part of their bull selection criteria. A subset (25%) reported considering EBVs on occasion. This emphasis was even more pronounced among Angus Australia members, with an impressive 79% stating that they always incorporate EBVs in their bull selection process.
5. **Increased Utilization of EBVs:** A significant shift in the utilization of EBVs was observed. Compared to five years ago, 46% of survey respondents reported increased use of EBVs in their bull selection, while 52% noted a consistent level of usage. This reflects a growing recognition of the value of EBVs in enhancing breeding decisions.

Impact of EBVs and Breeding Outcomes:

6. **Positive Impact on Businesses:** The utilization of EBVs was reported to have a positive impact on cattle businesses. A substantial 64% of respondents noted that EBVs had brought about some to considerable benefit to their operations. Angus Australia members attributed a slightly higher impact (69%) compared to other breed society members (62%)
7. **Range of Benefits:** Cattle producers reported diverse benefits from incorporating EBVs, including increased calving ease (46%), higher average weaning weights (26%), improved market compliance (16%), enhanced growth rates (12%), lower birth weights (11%), and better temperament (10%).
8. **Key EBVs for Selection:** Among the range of EBVs, respondents highlighted the top five most nominated ones in terms of importance for selection criteria. These included temperament, Intramuscular Fat (IMF), 400-day weight, Eye Muscle Area (EMA), and Milk.

Sources of Knowledge and Learning Preferences:

9. **Primary Sources of EBV & Technology Knowledge:** Producers predominantly gained knowledge about EBVs from various industry sources (such as MLA, Angus Australia and service provider companies and consultants)(32%), independent research (27%), and work or experience (17%) emerging as the primary avenues. Angus Australia information, catalogues, workshops/seminars, and online content also played significant roles.
10. **Role of Angus Australia:** Angus Australia emerged as a valuable source of EBV information for both Angus Australia members (27%) and other breed society members (14%). Notably, conversations with key industry figures (32%) were the most influential source among Angus Australia members.

Selection Indexes and Technological Adoption:

11. **Selection Indexes and Utilization:** Selection indexes, though considered sometimes by 39% of respondents and always by 31%, experienced higher utilization among Angus Australia

members, reaching 40% and 41%, respectively. Furthermore, 43% of respondents reported using selection indexes more frequently than five years ago.

12. **AngusONLINE Adoption:** Approximately 34% of producers reported utilizing the AngusONLINE suite of tools, with increased usage reported by 58% of AngusONLINE users. This adoption was particularly notable in southern states, reflecting its positive reception and impact.

4.7.2 Catalyst for change

Appetite for Change:

1. **Growing Willingness for Change:** Findings indicate a strong level of practice change among cattle producers. A remarkable 97% of respondents expressed their readiness to make minor to significant alterations to their farming practices after gaining new knowledge or skills. This demonstrates a substantial uptick from the 87% reported in 2019, signifying an increasing openness to innovation and adaptation within the industry.

Information Sources and Value:

2. **Key Information Sources:** Producers predominantly sought information from peers and experts within the industry. The most popular sources included other farmers/neighbours (56%), bull breeders (52%), and breed societies (52%). Notably, Angus Australia breed society was identified as a primary source by an impressive 83% of its members.
3. **Perceived Value of Sources:** Respondents perceived bull breeders and breed societies as the most valuable sources of information, both receiving a commendable rating of 4.2 out of 5. This recognition highlights the pivotal role these entities play in disseminating crucial knowledge to cattle producers.

Engagement with Angus Australia:

4. **Participation in Angus Australia Events and Resources:** Approximately 30% of respondents reported having attended Angus Australia events or utilized Angus Australia resources over the past five years. This engagement was particularly notable in New South Wales (36%) and Victoria (39%).
5. **Impact of Angus Australia Interaction:** A significant proportion (47%) of those who engaged with Angus Australia events and resources reported implementing changes to their bull selection and breeding decisions. A leading outcome of these changes was an increased utilization and understanding of estimated breeding values (EBVs), which was highlighted by 34% of all attendees. This impact was consistent among Angus Australia members (35%) and other breed society members (43%).
6. **Resulting Impact on Productivity and Profitability:** The changes resulting from Angus Australia interactions led to positive outcomes for many respondents. Around 24% reported improved breeding outcomes, 19% perceived better quality animals, and 19% simply witnessed enhanced productivity and profitability.
7. **Catalytic Role of Angus Australia:** When assessing whether these changes would have occurred without Angus Australia events or resources, 47% of respondents believed that

they probably would not have implemented these alterations. Meanwhile, 38% were confident that the changes would still have taken place, and 15% remained uncertain.

Preferred Learning Methods:

8. **Effective Learning Preferences:** The survey revealed that producers favour personalized learning experiences. One-on-one discussions were ranked as the most preferred way to acquire new information, earning a commendable rating of 4.1 out of 5. Reading materials were also valued highly, with a rating of 3.9. Practical experiences such as farm walks (3.6) and informal group discussions (3.3) were also preferred over formal group learning scenarios such as workshops (3.2).

The survey response showcases a growing enthusiasm for change among cattle producers, with a notable emphasis on improving genetic knowledge and bull selection practices. Angus Australia's role as a key source of information and catalyst for positive changes in the industry is evident.

5. Conclusion

5.1 Key findings

Creation of an Innovative Education Program

A key finding of the project has been the delivery of an education program that has been engaged with due to the range of activities involved.

The delivery of face-to-face activities has shown to deliver the most value for breeders and also achieved the highest level of intended practice change from the engagement. In addition to the face-to-face activities a range or online activities allowed participants to engage with content and access information to suit their own learning styles. This range of activities also included targeted activities for key industry people such as service providers, seedstock breeders, new industry entrants and stock agents. Provide details on the main key findings of this project. Dot points acceptable.

Overall project success

By achieving significant increases in knowledge transfer, skill development, and enhancing the adoption of genetic improvement practices among Angus breeders in Australia the project has met the overall KPI of increasing the rate of genetic gain by 5%.

The project has demonstrated the benefit of beef extension for genetic evaluation and particularly in breeding and genetic selection including developing tools, technology and education programs that are easily adopted by the target audience. The targets for annual rate of improvement, number of animals in the analysis, number of key performance measures, increased genomic testing and number of animal searches were met or exceeded due to a variety of elements contributed to in the project.

This increase in knowledge has led to better overall outcomes for producers who interacted with the activities as they have been able to make better breeding and selection decisions from increasing their knowledge and having an enhanced range of tools to assist their decisions.

5.2 Benefits to industry

The outcomes generated from this project have contributed substantially to the increase in the rate of genetic gain across the Angus genetic improvement pipeline, compared to the gain achieved at the commencement of the project i.e. as measured by the increase in Angus Breeding Index, ABI. This being $5.86 per cow mated (2015-2017) compared to $6.43 per cow mated (2020-2022). This comes partially as the result of the coordinated adoption initiates delivered by this program. The economic value of this outcome can be estimated by modelling the transmission of this increased genetic improvement through the value chain and comparing this with the predicted genetic gains achieved without this project.

“Without project” case: In the absence of this project, it is anticipated that only 50% of the achieved increase in the rate of genetic gain in ABI between 2015-2017 to 2020-2022 would have been realised and would continue to be achieved in Angus seedstock herds into the future. This would result in an overall net present value of $4.55 billion across the Angus-influenced value chain for the 10 years following the project to 2032, or $12.26 billion over 30 years to 2052 (though it could be

argued that rates of genetic improvement may decline without continued inputs in the adoption area).

"With project" case: Assuming that 50% of the increase in the rate of genetic improvement observed in the ABI from the commencement of the project to 2020-2022 can be attributed to the outputs of the project (i.e. the rate of gain increased to $6.43 per cow per year in Angus seedstock herds), resulting in a net present value of $4.59 billion across the Angus-influenced value chain for the 10 years following the project to 2032, or $12.46 billion over 30 years to 2052.

The net present value of this additional gain beyond the "Without project" case is $38.4 million after 10 years to 2032, or $200.1 million after 30 years to 2052, with a 10-year Internal Rate of Return of 47%.

Additional assumptions used in this analysis are listed in Appendix 1.

6. Future research and recommendations

The breeding and genetics industry is an evolving industry with an increasing demand for animals to be selected on new and existing traits of importance. To ensure beef breeders are best placed to have the most appropriate tools and resources developed and have an increasing knowledge level of how to use the developing technology, investment in the most desired education delivery method with proven adoption outcomes is a clear recommendation of this project.

Recommendations of this project for future work:

- Provide a range of tools and resources and varied educational programs to support the adoption of the tools.
- Provide education and extension through the preferred information source – The Breed Societies and bull producers.
- Specialty Extension programs should be considered for seedstock, commercial producers and key industry people to cater for the specific learning outcomes.
- Breed societies can act as a catalyst for information for the beef industry more broadly outside of the member base they ordinary service day to day.

One of the main factors contributing to the success of this project is that producers surveyed in the stakeholder survey identified key sources of information as seedstock bull breeders (52%) and Breed societies (52%). This is further supported by the MLA Genetics Insights Survey (2023) which also recognised producers peer-to-peer learning and breed societies as the preferred places to learn from. The survey also highlighted that for producers with formal training guidance, breed societies were rated as the single largest source of information (35%).

Considering the demonstrated benefits of the program to the beef industry more broadly, ongoing funding support of breed societies to develop selection tools and resources with demonstrated benefits through education and extension is a clear recommendation.

The projects outcomes and recommendations also support the MLA Genetics Insights Survey future recommendations based on:

- A proven strategy to increase adoption of genetic tools

- Improving breeders knowledge of genetic evaluation and its outcomes
- Encouraging producers to engage with formal training
- Increasing the number of breeders using genetic evaluation websites (for education)
- Developing programs for breeders to develop relationships with key industry people (Seedstock breeders, Breed Societies, Stock agents) and develop training activities for these key industry people

7. References

1. MLA Genetics Insights Report 2023, Bob Sloane and Laura Walker,Kynetec Australia Pty Ltd
2. Angus Australia, Beef Breeding Insights Report 2018 https://www.angusaustralia.com.au/content/uploads/2021/06/FINAL-Australian-Beef-Breeding-Insights-Report-1.pdf

8. Appendix 1.

Industry Economic Value Assumptions

The economic gains achieved in the temperate Australian beef industry resulting from genetic improvement by Angus seedstock breeders was calculated from the trend in the average Angus Breeding Index value achieved in the registered Angus seedstock population. For simplicity, the calculations ignore any benefits accrued in the sub-tropical northern beef industry where Angus genetics have also had significant penetration in recent years.

Since no accurate statistics are available on the breed composition in the Australian beef herd, it was assumed that the proportion of Angus animals represented in the temperate commercial beef population (targeted population) was equivalent to the proportion of Angus cattle in the seedstock sector relative to the total number of registered breeding females across all temperate breeds, as published annually by the Australian Registered Cattle Breeders Association (ARCBA). These statistics show that the proportion of Angus cattle in the seedstock sector servicing the targeted population increased from about 10% in the early 1980s to 48% in 2021 (Beef Breeding Insights Report, 2018). In the analysis it was assumed that this proportion would continue to increase at the same average rate of that experienced over the last 10 years.

In the “Without Project” case it was assumed that 75% of the industry in the targeted population sourced their bull replacements from recorded seedstock herds (“Tier 1” commercial herds), with a 5-year lag in genetic improvement (approximately 1 generation); and, the remaining 25% of commercial herds (“Tier 2” commercial herds) had a 10-year lag (approximately 2 generations) in genetic improvement relative to the seedstock sector. In the analysis it was assumed that the proportion of the targeted population that source their bull replacements from recorded herds progressively increases to 80% over 5 years, commencing from Year 2 of the project.

Statistics on the numbers of breeding females mated each year in the temperate Australian beef herd were estimated from industry data provided by MLA, with 50% of these cows assumed to be run in temperate regions where Angus bulls are commonly used.

Further details of the model calculations are available on request.