World-leading Genetic Evaluation and Improvement for the Australian Beef Industry

Robert Banks
AGBU
Key Points:

• Implementation of single step

• Industry investment in Australian evaluations

• Future evaluation opportunities
What is single step BREEDPLAN?

• “ordinary” BREEDPLAN:
  • Accounts for non-genetic effects (animal age, age of dam, contemporary group)
  • Uses pedigree data and performance records
  • Uses information from all traits – *multi-trait*
  • Uses information from overseas where available
  • Produces Estimated Breeding Values (EBVs) for 23 growth, carcase, fertility, eating quality and efficiency traits
  • Monthly analysis for most breeds, more frequent where dataflow requires

• Single step BREEDPLAN:
  • All the above plus
  • Uses pedigree, performance and DNA (genotype) data at the same time
  • Incorporates *genomic prediction*
  • *Only fully multi-trait beef cattle single step in the world*
Genomic Prediction: basic idea

1) measure lots of animals’ phenotypes and their DNA → Reference population

2) A breeder tests DNA on young animals

Look for patterns in the DNA associated with differences in performance
Accuracy of genomic BVs v traditional BVs:
Accuracy of genomic BVs v traditional BVs:

- Animals without record
- Animals with own record
- Animals with recorded progeny (sires)

Graph showing the comparison of accuracy between genomic BVs and traditional BVs for different categories of animals.
Breeds running single step BREEDPLAN:

Implemented

2018
Australia’s BREEDPLAN evaluations

• Why should the industry support and continue investing in Australian evaluations?

• EBVs must be relevant to Australian production systems, markets and cattle populations
  • Local genetic parameters are relevant to Australia and Australian populations
  • Overseas genetic information is included
  • Reliable meaningful EBVs allows everyone in the value chain to get the right animal for the job
  • Evaluations need to fit the flow of data and need for information

• R&D needed:
  • to develop and incorporate new traits,
  • new methods eg single step and beyond (including increased volume of genotypes)
Australia’s BREEDPLAN evaluations

• Why are we world leading?

  • Very comprehensive multi-trait analysis, using single step (no-one else does this combination, and most do not do multi-trait, and only a couple doing single step)
  • BREEDOBJECT $Indexes unique
  • Already using commercial data and some cross-bred data
    • System has capacity to grow that
  • Leading breeders are using BREEDPLAN to make genetic progress as fast (in terms of $Profit) as any breeders in the world
Australia’s BREEDPLAN evaluations

• How will our genetic evaluation remain at the forefront of international genetic evaluation?

  • Next generation single step already being tested
  • Expanded multi-country – linking with, and drawing on, relevant overseas data
  • Multi-breed
    • Needs more R&D data
  • Genetic information for all points in the value chain (ie for commercial producers using DNA tests)
  • Anticipate more traits being evaluated => EBVs (including Hard-to-Measure traits such as disease susceptibility)
Future Evaluation Opportunities ~ *multi-breed and crossbred*

- Needs head-on comparison data for robust EBVs – ideally for all trait groups and main environments
- R&D has shown proof-of-concept for growth and carcase traits in British and Euro breeds
- Software can handle it now
- Can include both other breeds and crosses
- Opportunities: assists composite development, stimulates within-breed selection
Future Evaluation Opportunities ~ future traits:

- Lifetime productivity: *first-calver and lifetime fertility and productivity (age at puberty, Lactational Anoestrus, longevity)*
- Disease: *worms, BRD, heat tolerance, ticks, ...*
- Meat nutritional content: *iron, zinc, omega-3, ...*
- Sector-specific traits: *eg feedlot efficiency, processing yield, ...*
- Data direct from retail outlets: *eg consumer eating experience data collected via apps*
- Cow feed intake & methane production

**Remember:**

- Any trait needs data – either from many sources and/or via formal reference projects
- Focus on whether the trait impacts profit, or is closely genetically linked to traits impacting profit
Future opportunities ~ *new applications*

- Continuous evaluations (i.e., rather than fortnightly or monthly)
  - Could be achieved for genotype-only animals now

- Race-side testing ~ only needs rapid genotyping

- Genomic testing commercial cattle
  - Screening feeder cattle for entry, or feeding regime
  - Screening commercial heifers for entry to cow herd
  - Ready to be trialled now

- Whole of life evaluation at birth
  - Based on DNA and updated with performance
  - Ready to be trialled now

- Coupling with reproductive technologies
  - JIVET plus mate selection based on genomic evaluation at birth
  - Scale is the biggest challenge (all the technology is in place now)
So what is possible?

- Genetic gain is worth c. $30-50m per year now – doubling that is feasible (and that is worth $2bn NPV over 15 years, or $2,600 per producer per year)

- For bull-breeders:
  - Faster progress (earlier selection)
  - Role in reference populations
  - Nucleus-multiplier enterprise option

- For producers:
  - Screening feeder cattle and heifers
  - Matching genetics to production-market pathway
  - Faster progress means beating the cost-price squeeze

- For other value chain partners:
  - Through-chain contracts
  - Better specification of genetics for suppliers, and of outcomes for customers
The disruptions

• Tapping into genetic progress that is faster than the cost-price squeeze is the game changer

  • Production efficiency:
    • Growth, fertility, yield, zero disease loss
  • Continually adding value for consumers
    • Eating & nutritional quality
    • Chemical-free
    • Environmentally friendly

• Managing (ie funding) the phenotypes is the #1 challenge