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

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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*

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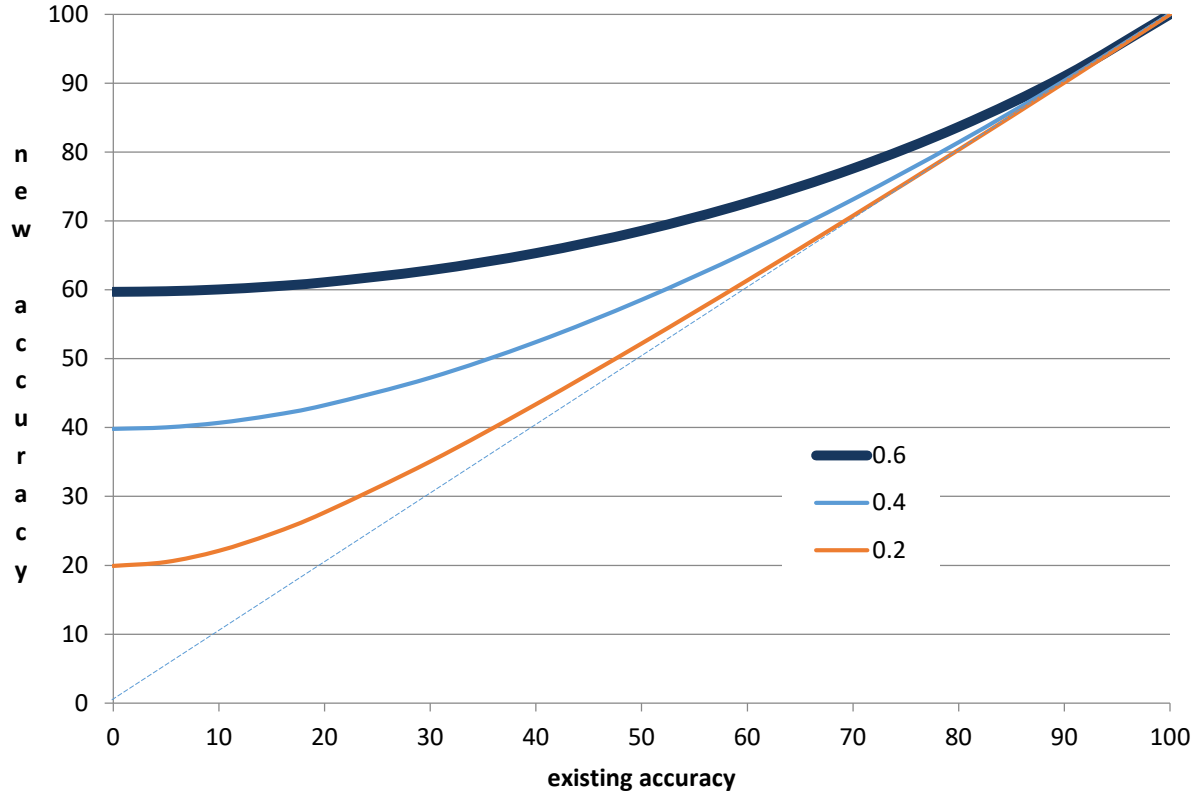
Genomic Prediction: basic idea

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:



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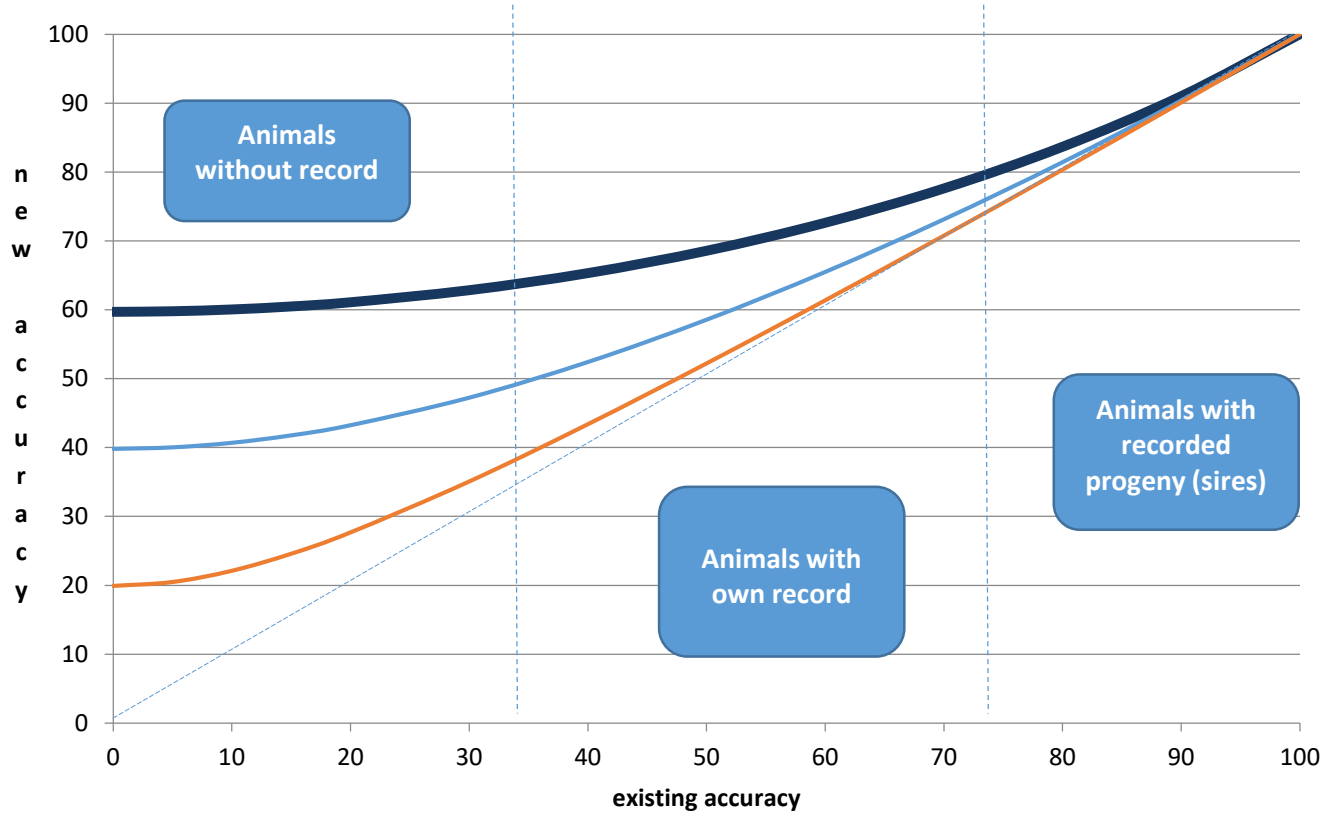

Breeds running single step BREEDPLAN:

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)

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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

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Future opportunities ~ *new applications*

- Continuous evaluations (ie 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)

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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