

*Julius van der Werf*  
*University of New England & Sheep CRC*  
**Genetics and Genomics**  
Industry benefit from using the tools:  
what is coming and how we can use them



## Overview

Decisions in breeding programs

New technologies / genomic selection

Costs and benefits of breeding programs

*Tools to support decisions*

# Decisions in breeding programs



## Decisions in breeding programs



Where to go?

breeding objective (which traits)



Which animals to measure?  
which traits?

Performance recording, DNA test

*\$ investment*

genetic evaluation



Who to select and mate?

reproductive technologies

*\$ investment:*

rate of gain <-> inbreeding

# Development

Where to go? Breeding Objectives are becoming more sophisticated:  
Product quality, hard to measure traits

Measurement? Some traits hard to measure on-farm  
*Cost-benefit* Central test, *Information Nucleus*, *DNA test*

Who to select and mate? Combining EBVs and *Genomic BVs*



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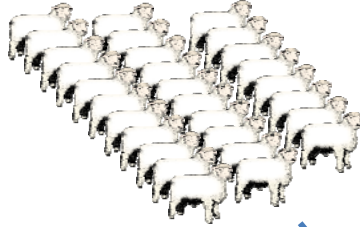
# Genomic Selection



# Genomic Selection: basic idea

Measure lots of sheep,  
and their DNA

Reference population



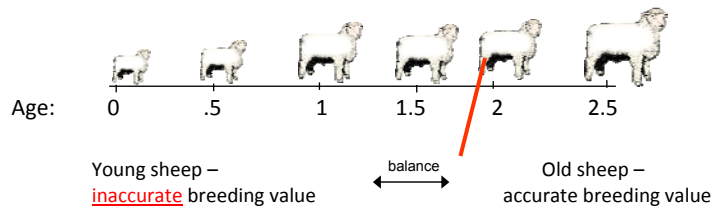
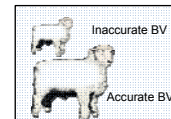
Measure DNA of selection candidates, e.g. young rams

Predict breeding value based on how their DNA compares  
with reference population

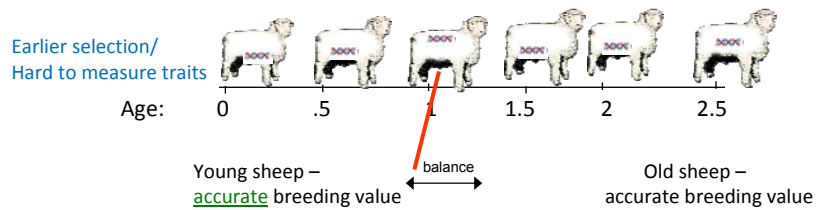
Can predict breeding value of young animals, for 'any trait'  
as long as it is measured in reference



# Traditional Selection



# Genomic Selection



## Shifting the balance with genomic selection

	Current Selection		Genomic Selection		Difference
	Accuracy	Response	Accuracy	Response	
Weight kg	0.71	0.79	0.75	0.76	-4%
Dressing %	0.26	0.23	0.59	0.42	83%
Saleable meat yield %	0.33	0.29	0.6	0.46	59%
Overall Merit \$Index	0.58	2.03	0.69	2.43	20%

*Note: not only more gain,  
but shift to traits that are hard to measure*



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## Genomic Selection - how will it work?

1. Breeders DNA test their young rams (or the better part of them)
2. Sheep Genetics provides ASBVs based on performance measurement + DNA test
3. Young rams will have more accurate breeding values,  
Especially for traits like carcass, birth weight  
adult fleece weight,  
WEC, reproduction
4. DNA information needs to draw on a measured reference population

*Note: this is not so much about ‘finding the genes’*



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## Genomic Selection – key issues

Can select young animals more accurately, esp. *hard-to-measure* traits

Cost - benefit?

- national perspective ✓✓✓
- breeder's perspective ?

Are breeders getting paid for these *hard-to-measure* traits?

Who is paying for ongoing measurement of these *h-t-m* traits?

reference population: – need 1000s of animals, multiple breeds



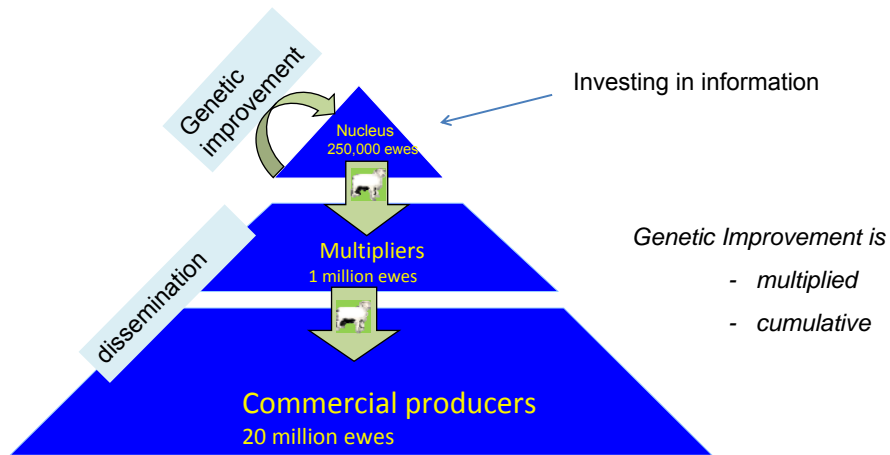
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## Cost benefit



## Whole industry benefits



## What are we achieving now?

Genetic progress in Sheep	Annual improvement (\$ value <u>per ewe</u> )		Annual improvement \$ value total
	Realised Since 2000	Realistic Potential	
Border	1.7	2.0	\$6.5M
Merino	0.7	2.3	\$4M
Terminals	2.0	1.8	\$19.5M

Swan et al. 2009

# Cost and benefits of breeding programs

## Whole industry/ National economic benefit

- Increased production efficiency
- Better products, increased market share
- Survival of the industry



## Individual benefit to breeder

- Immediate benefits to clients short-intermediate term
- Consider payment system,



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# Summary



