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The value of information from commercial livestock in multi-tier sheep breeding schemes

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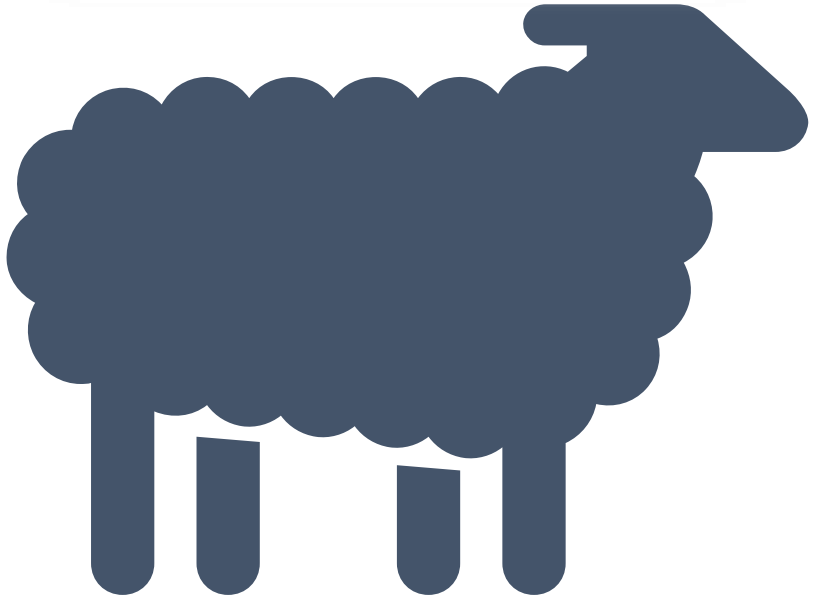
ssGBLUP

Background



Accuracy doesn’t make the world go round

$ genotyping

Accuracy doesn't make the world go round

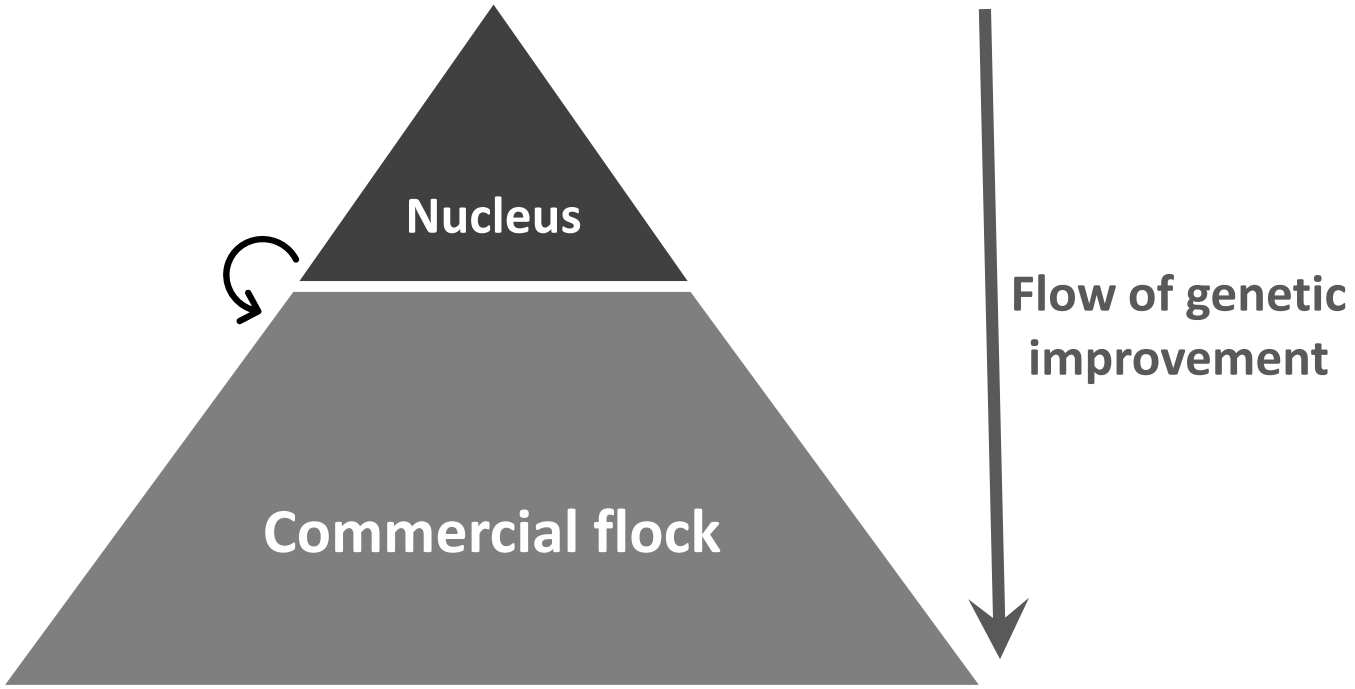
$ genotyping

genomic eBV's

more accuracy

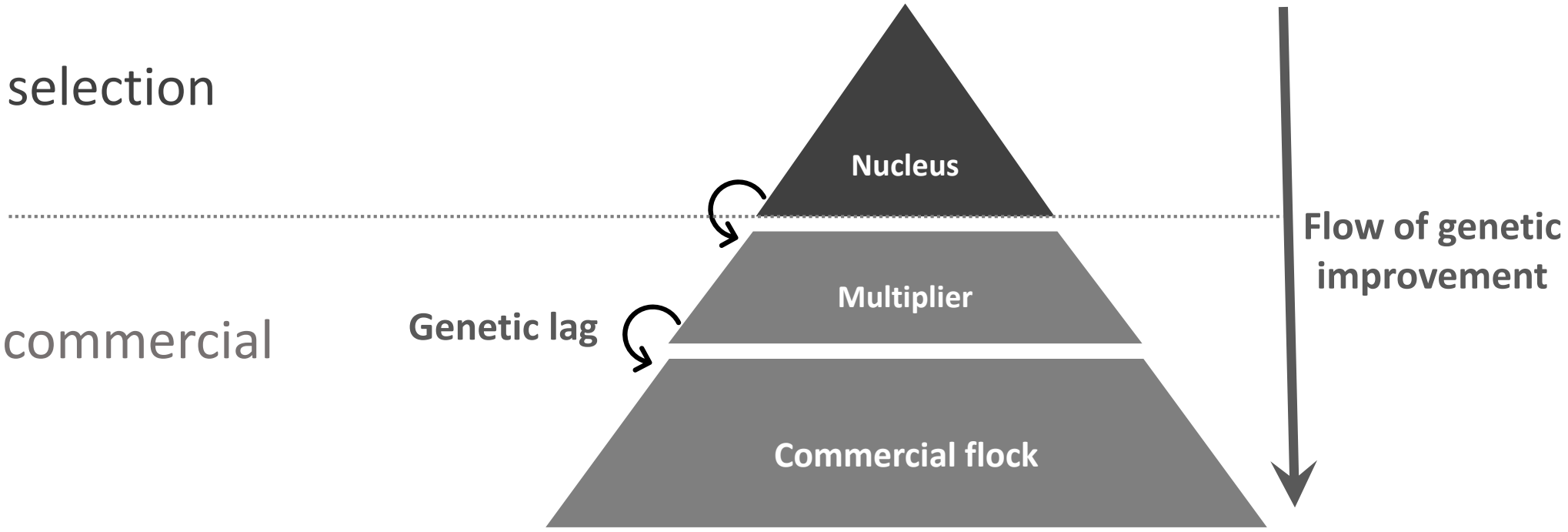
Accuracy doesn't make the world go round

Background



Multi-tier breeding structure

Background



Multi-tier breeding structure

Multiplication power

1 nucleus ewe leads to 250 lambs born

1 nucleus pig leads to 2500 saleable pigs

1 pedigree selection leads to 50 million broilers

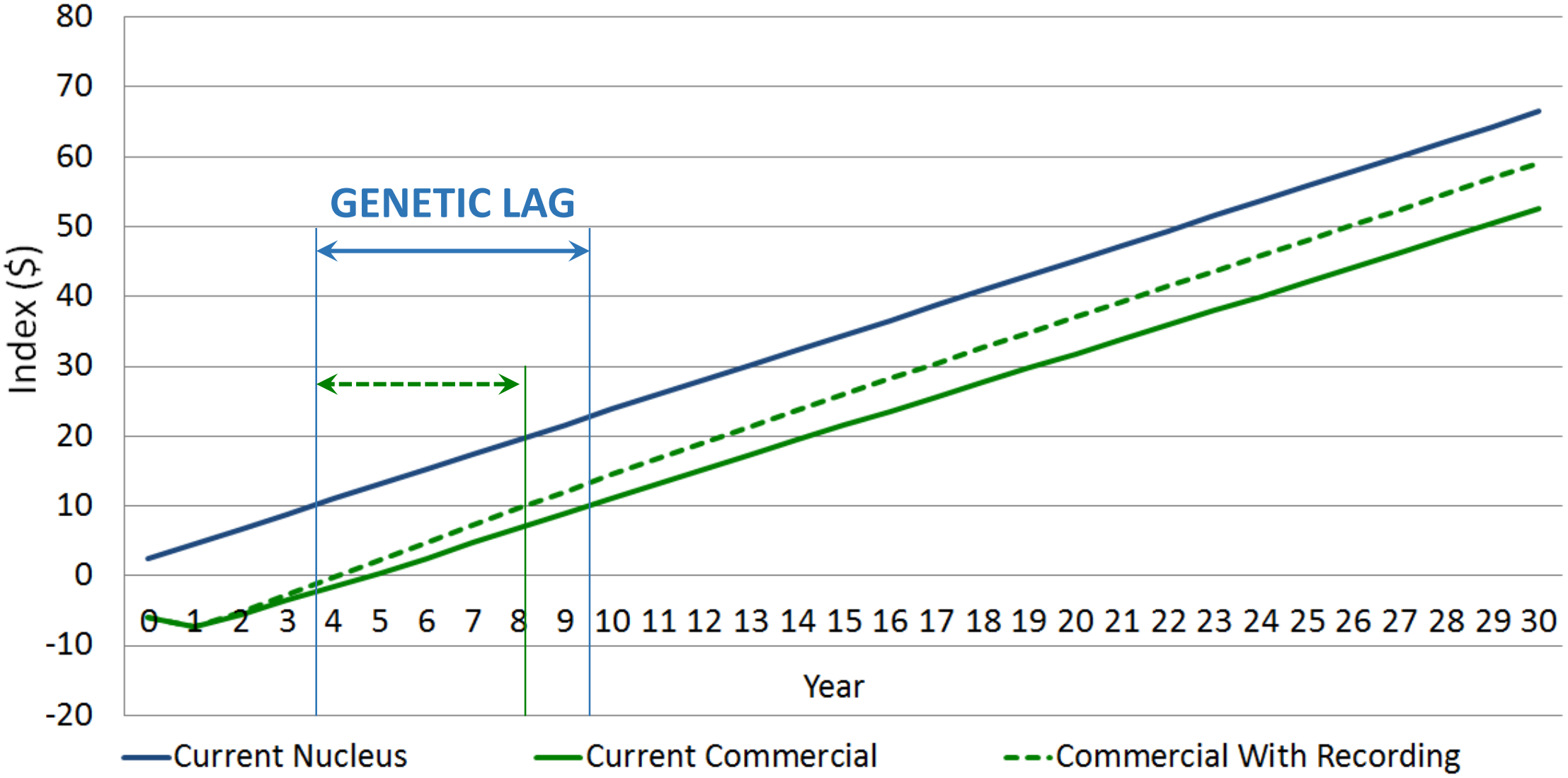
Hypothesis

Commercial performance records and genotypes can be used to

- reduce the lag between tiers (increase differential)
- increase prediction accuracy (N and M)
- account for effects of GxE

These could generate production and economic benefits

Dissemination – genetic lag



DISSEMINATION – SELECTION DIFFERENTIAL

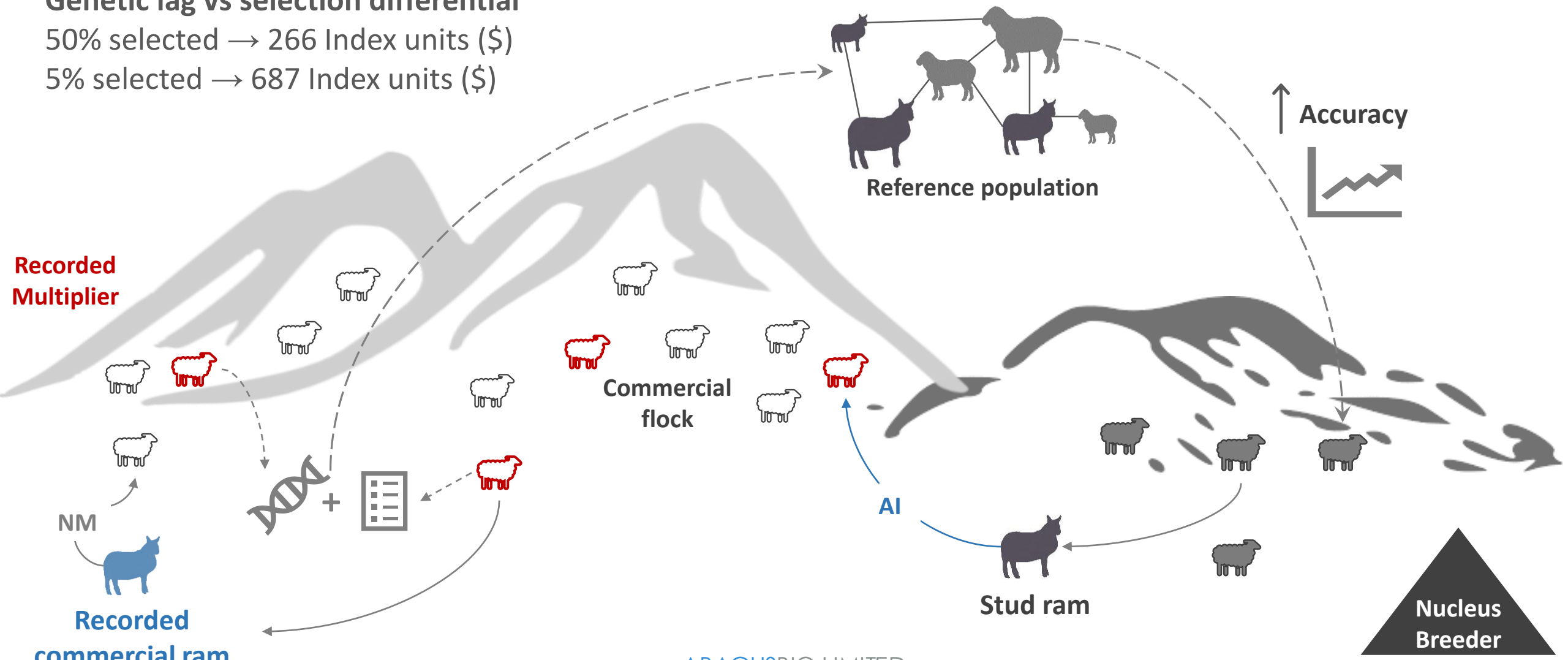
Genetic lag vs selection differential

50% selected + 266 Index units ($)

5% selected + 687 Index units ($)

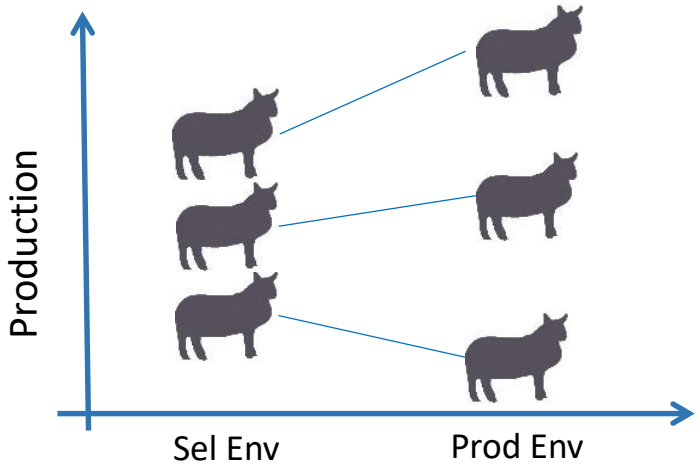
Increase prediction accuracy in nucleus

Genetic lag vs selection differential
50% selected → 266 Index units ($)
5% selected → 687 Index units ($)

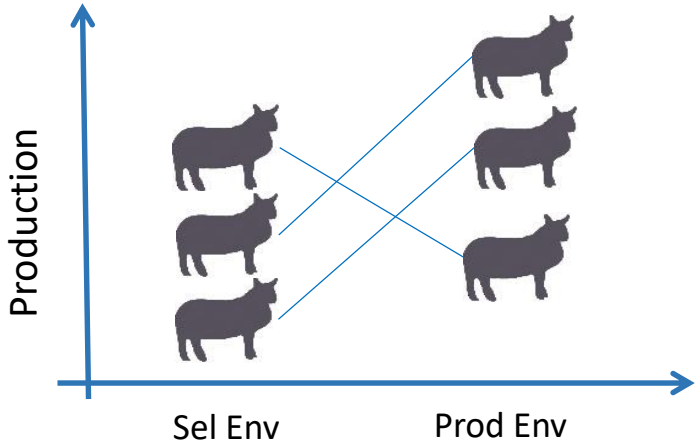


GxE

Scale



Ranking



Methodology

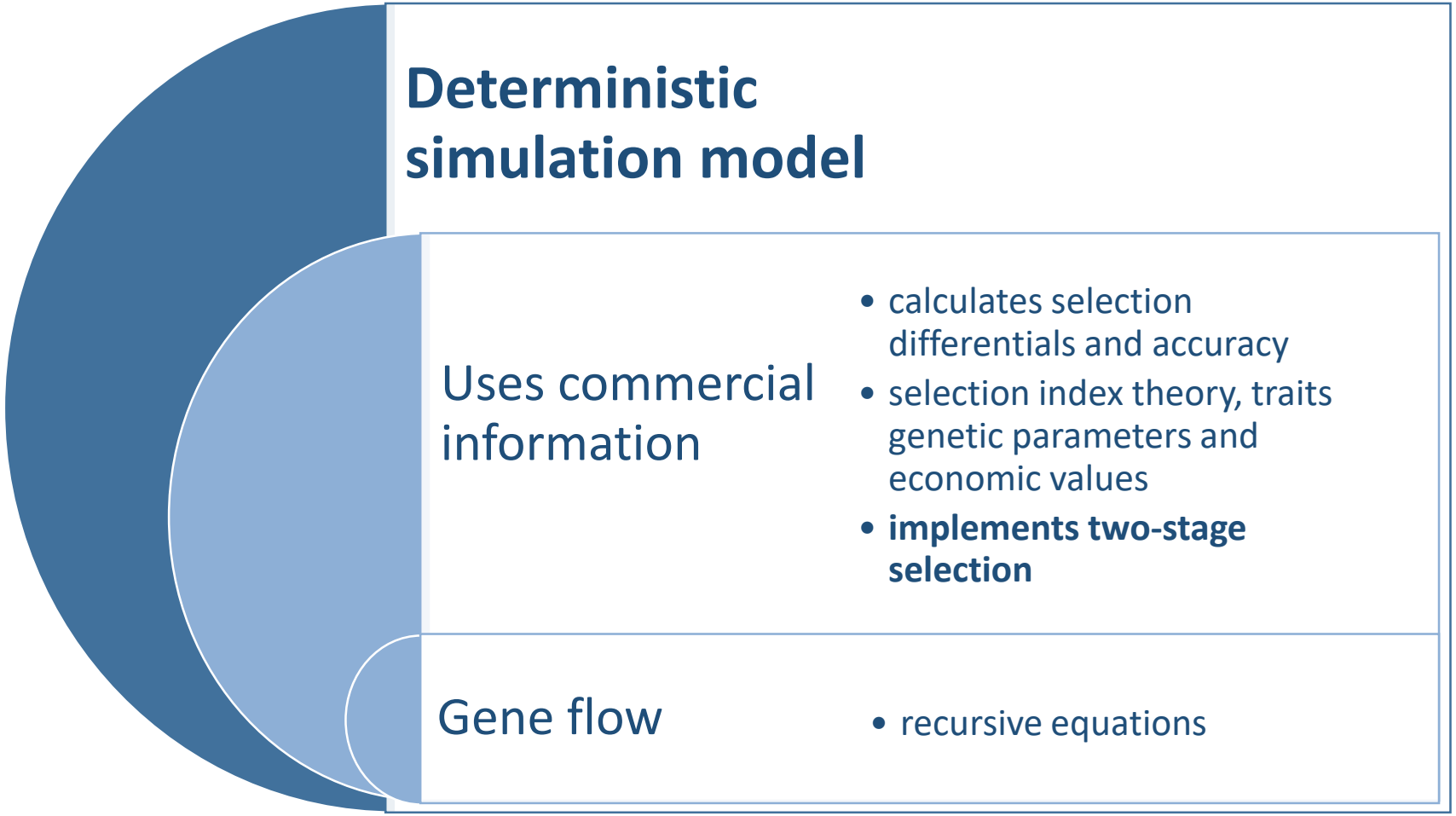
Breeding schemes with

- Nucleus with 1,000 ewes
- 3,000 to 5,000 multiplier ewes
- 150,000 commercial ewes

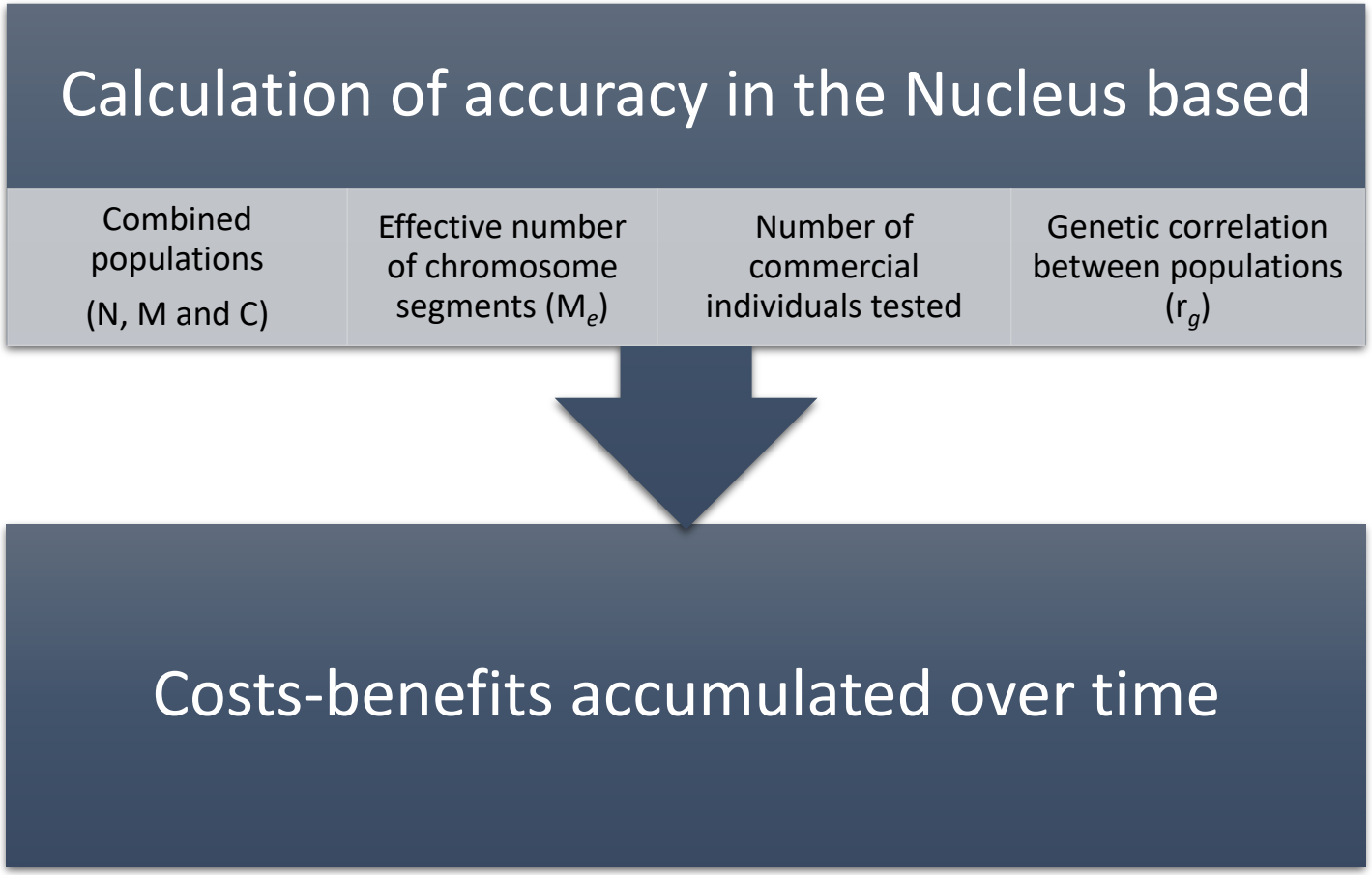
Scenarios combining different strategies

- Breeding objectives (NZ meat and AUS wool)
- Genotyping strategies
- Levels of GxE

Methodology



Methodology



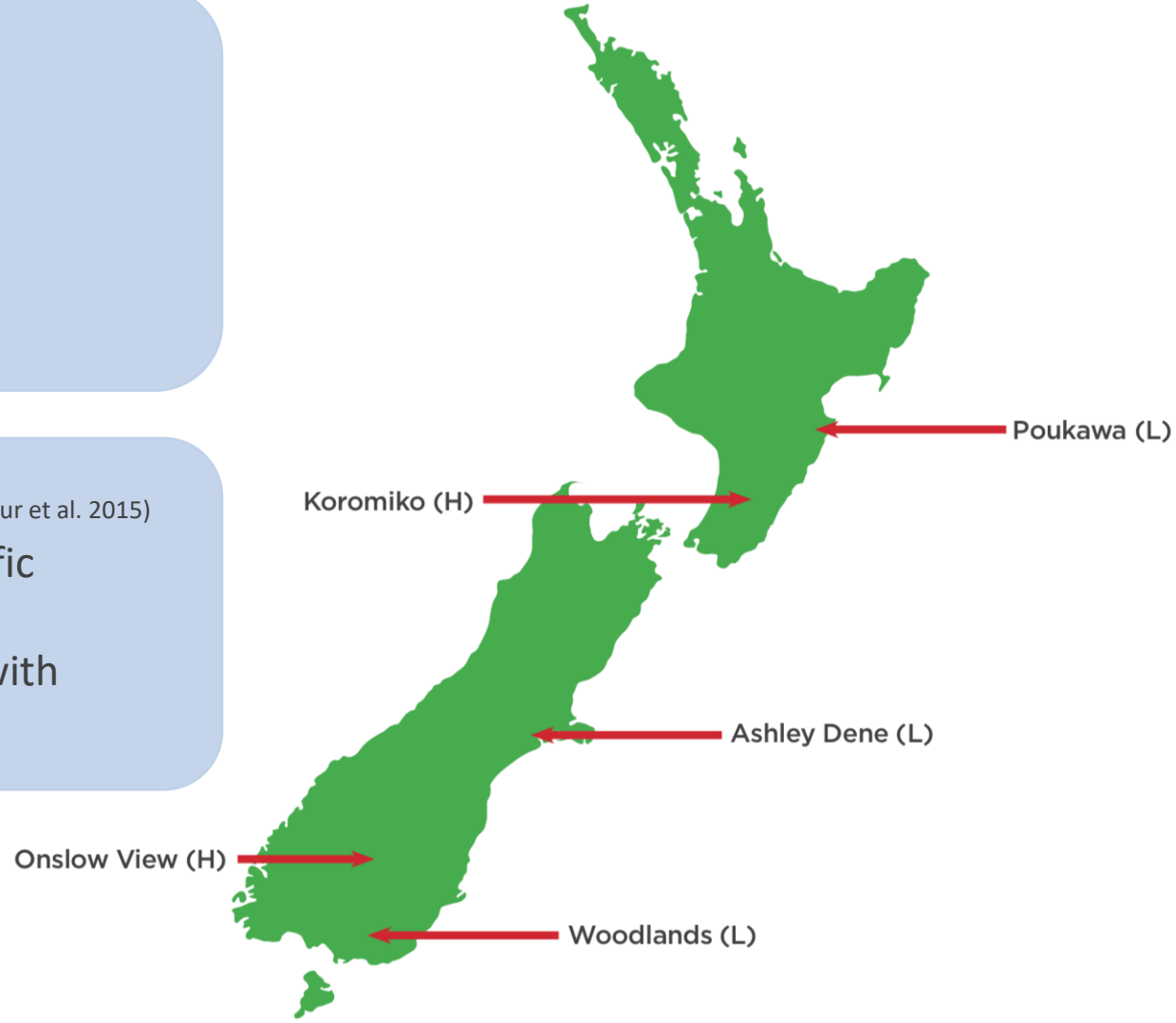
Methodology

Central Progeny Test (CPT)

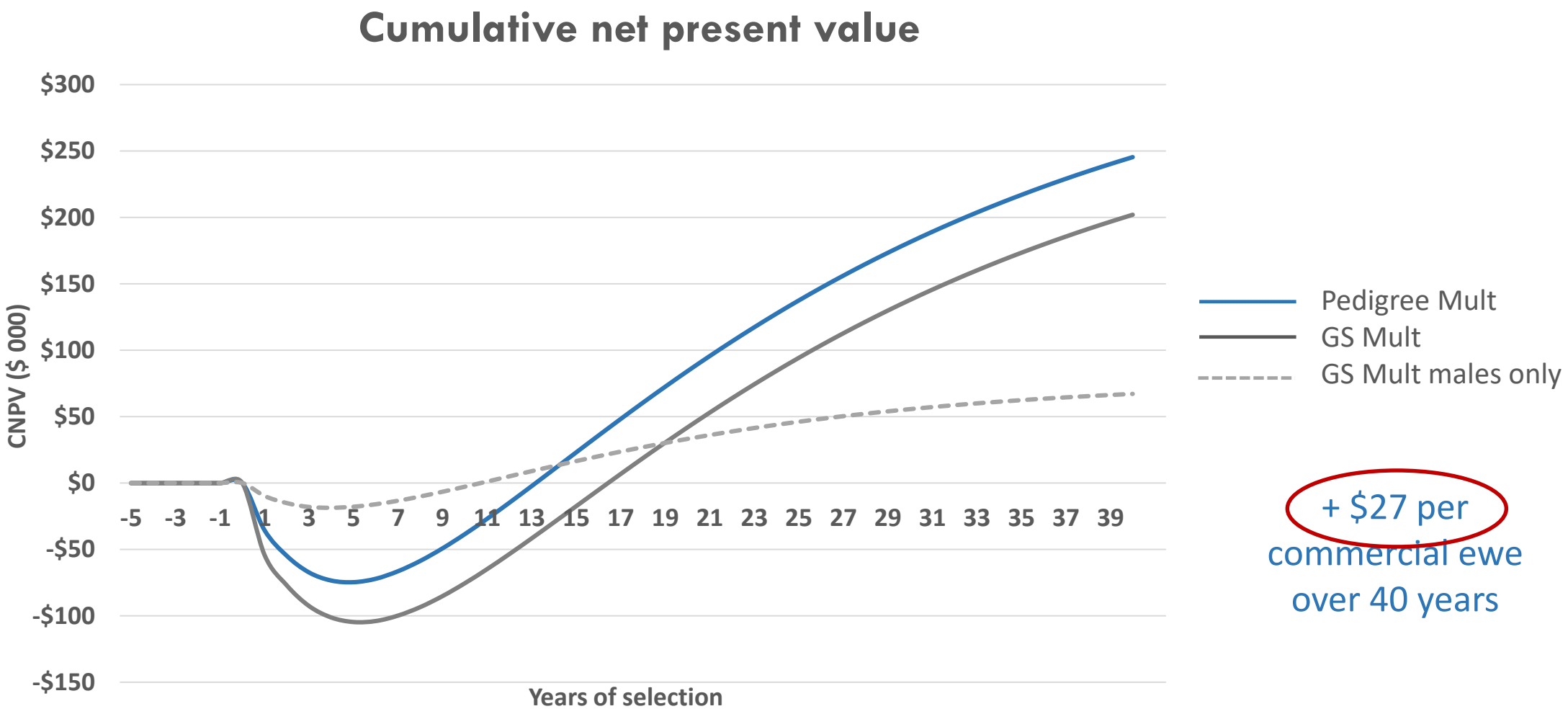
- Across multiple sites
- 300 + rams tested
- Low land *vs* hill sites

Extended factor analytic (XFA)

- Univariate models, ASReml (Gilmour et al. 2015)
- Each flock was defined as specific environment
- 143 rams and 24,352 progeny with records



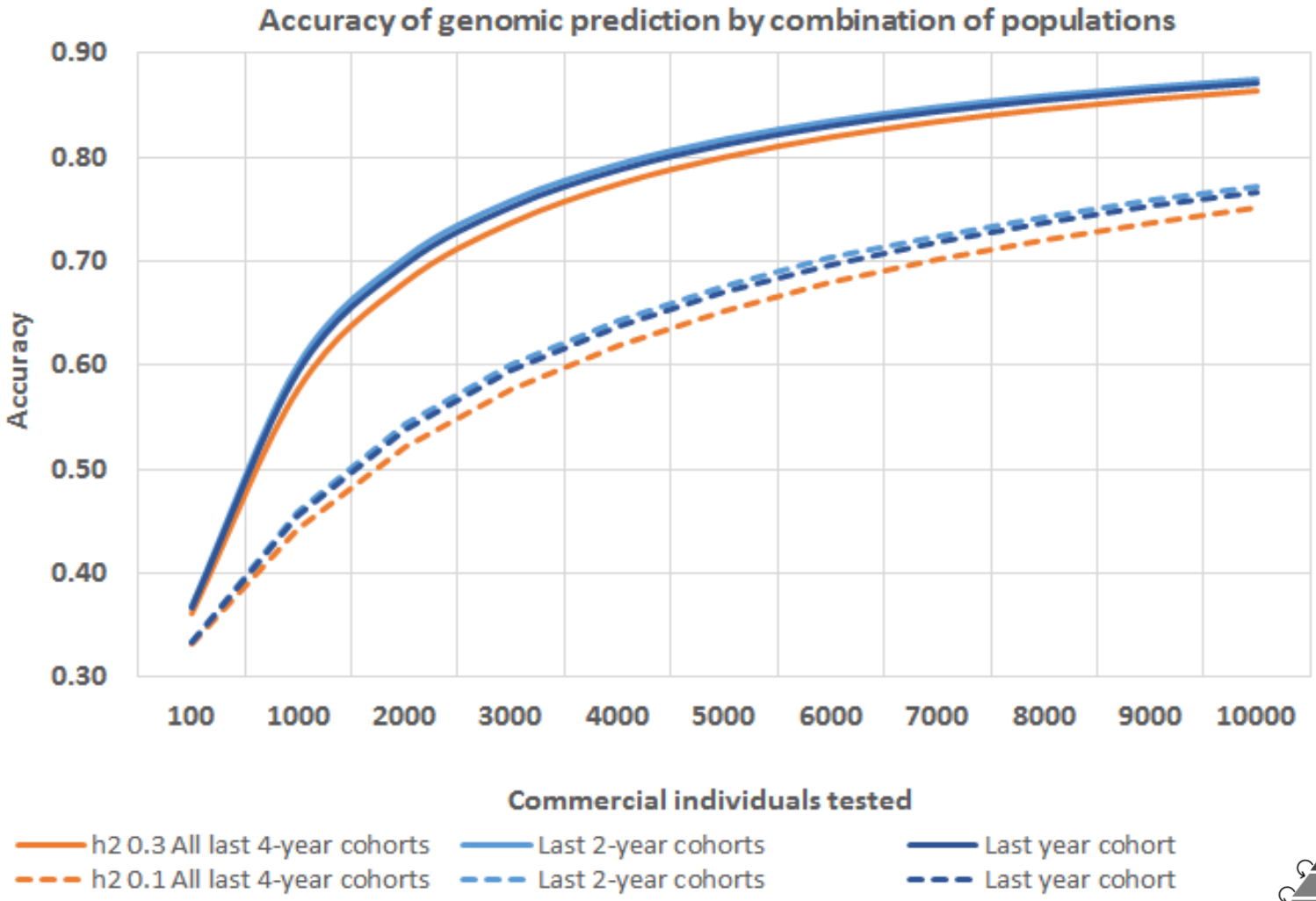
Results –return from shortening the lag

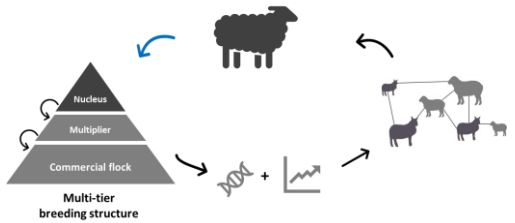


+ $27 per commercial ewe over 40 years

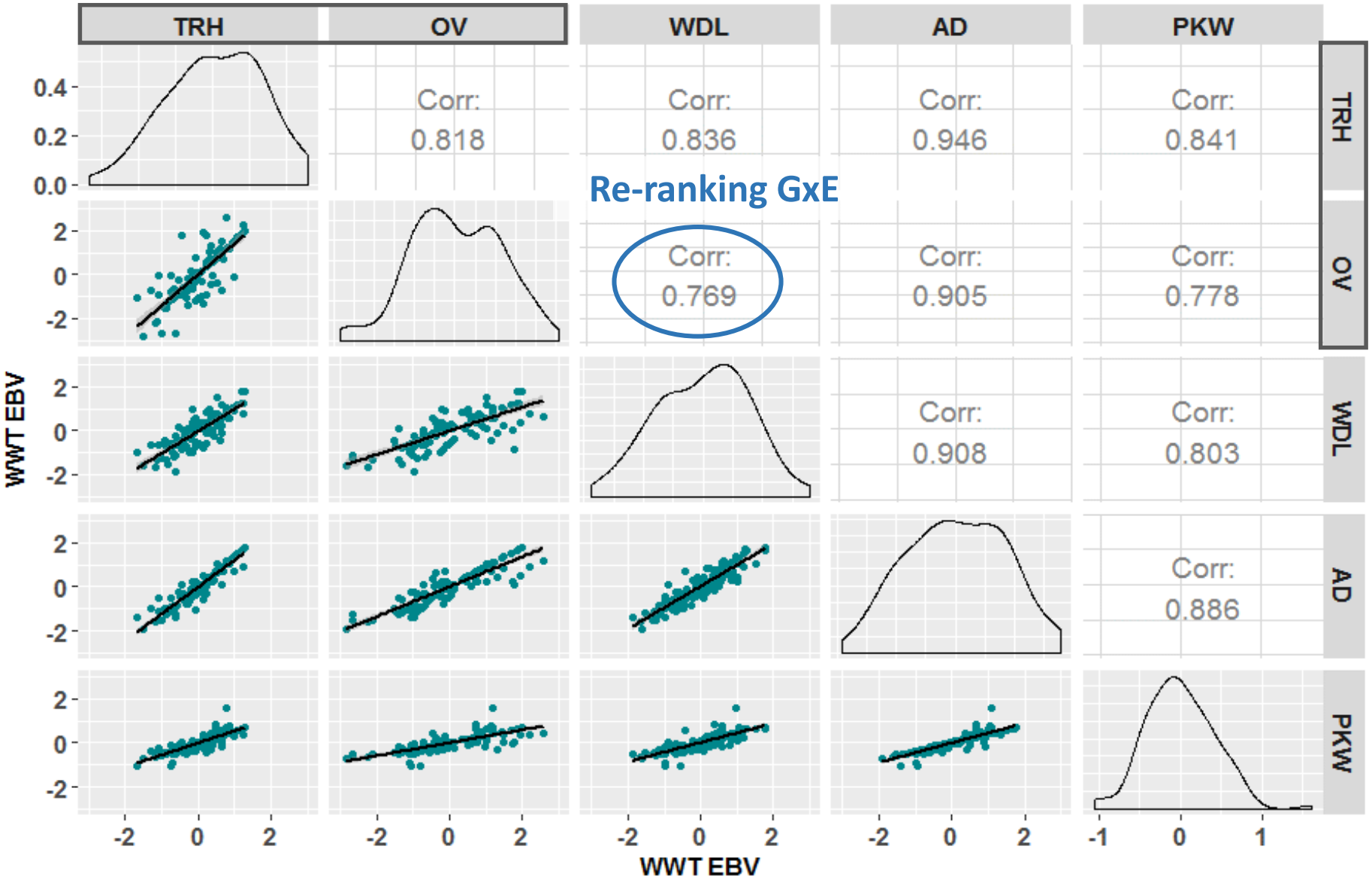
Results – Accuracy of prediction in Nucleus

Accuracy increases with higher number of commercial individuals tested



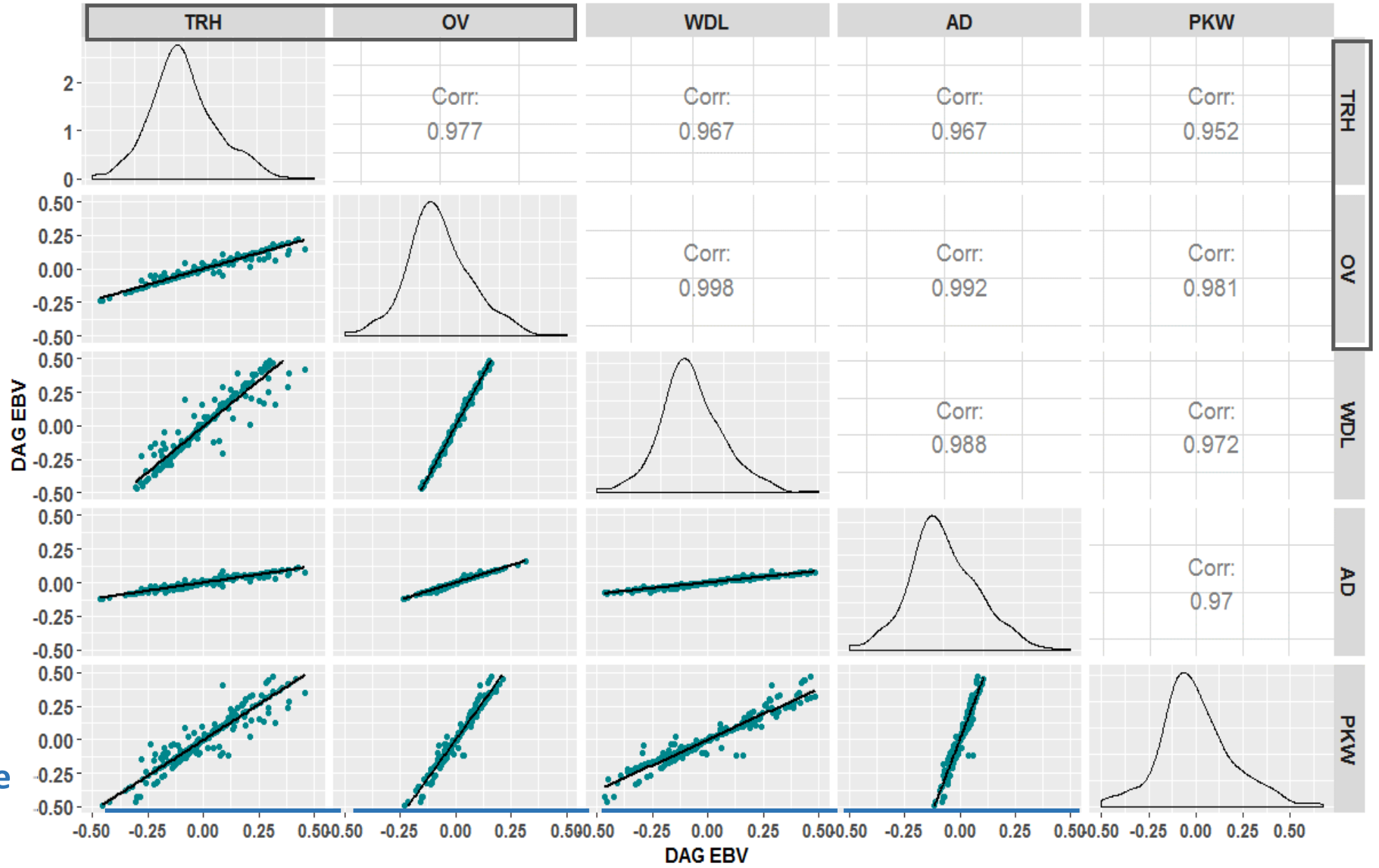


Evidence of GxE (CPT sites)



Hill sites

Scale GxE (CPT sites)



Hill sites

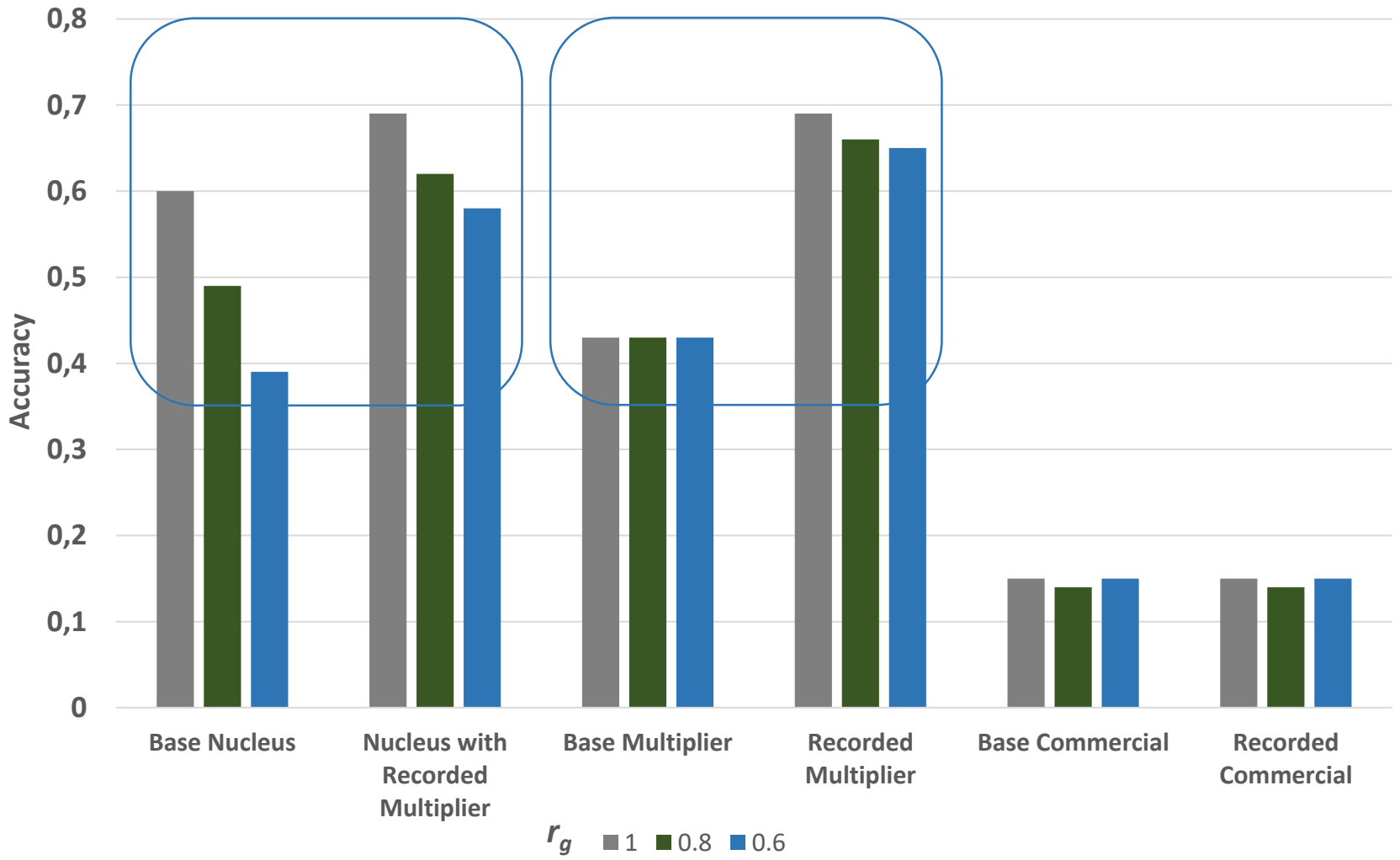
Scale GxE

Partial Results - GxE (Heritabilities)

Heritability estimates for different traits across five CPT sites.

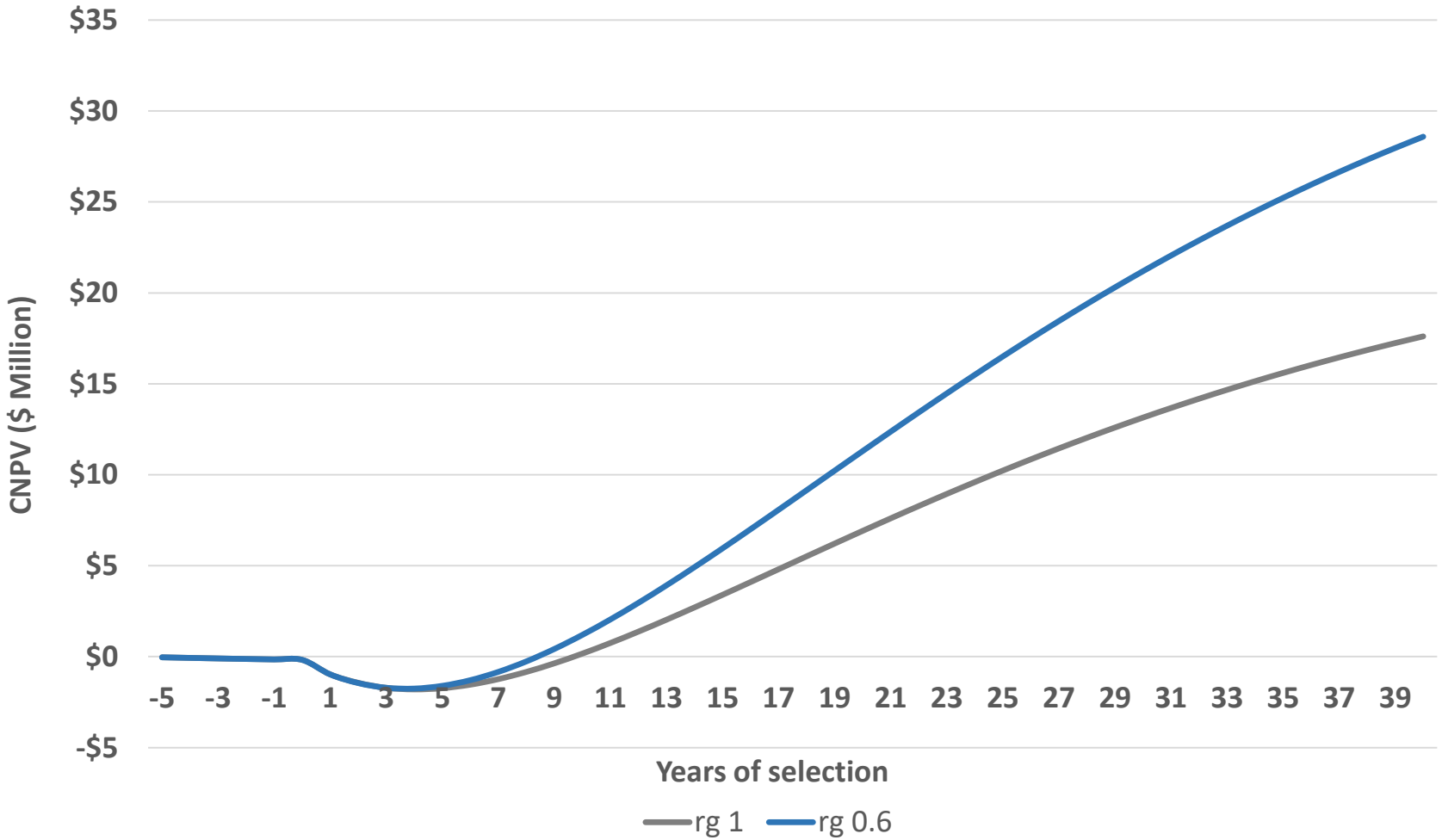
Flock	Maternal						Growth			Carcass
	NLB (lambs)	BCS (score)	DAG (score)	FE (GGT21)	FW12 (kg)	WormFEC (%)	WWT (kg)	LWT8 (kg)	EWT (kg)	VS Leg (kg)
3385	0.1178	0.205	0.295		0.5470		0.1666	0.1816	0.1632	0.4646
3400	0.0763	0.2151	0.0247		0.5259		0.3386	0.3199	0.2532	0.4423
4640	0.1044	0.2259	0.2122		0.3904		0.1652	0.2926	0.2048	0.4186
4757	0.0846	0.3343	0.2093		0.5504		0.1947	0.2113	0.4052	0.3277
9153	0.0843	0.1107	0.0432		0.5583		0.1021	0.1637	0.1288	0.3841

Results - Accuracy of prediction across tiers



Results - Cumulative Net Present Value (return)

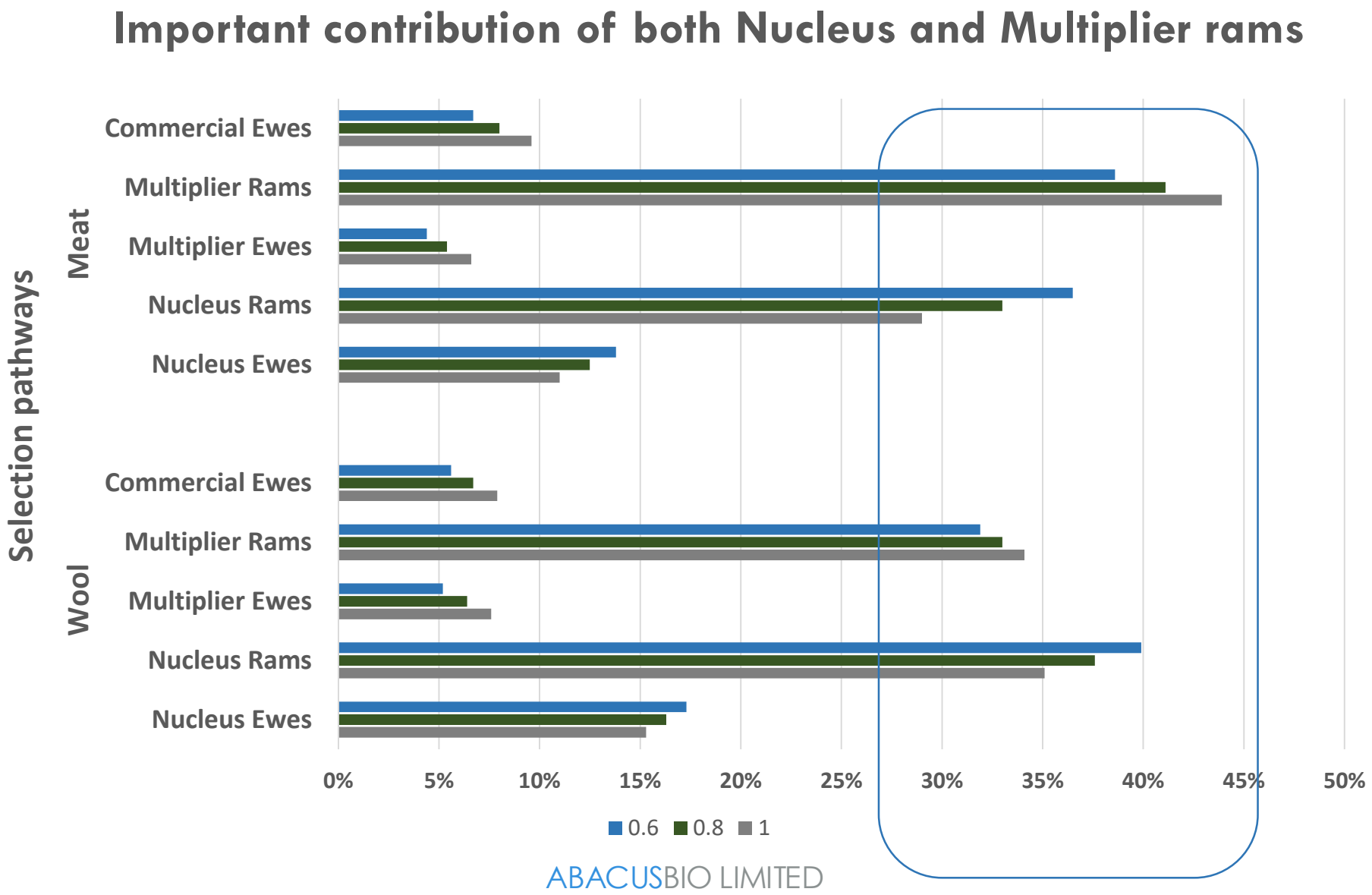
higher returns (CNPV), more value in commercial information in higher GxE situation



+ $117 to $249 per comm ewe
Breakeven between 8-10 years

$80/ comm ewe
Under current gains 40 years

Results - Contribution to total genetic gain



Conclusion

- **Commercial information, biggest impact to increase N accuracy**
- **Records/genotypes can be used to reduce impacts of GxE**
- **Value in linking wider range of candidates, genetic gain and $ returns**

Implications

build integration

- throughout livestock industries
- performance records
- genomic relationships

better selection

- elite sires/strains/lines across environments

Solutions for GxE impact

- SNP effects, environment definition
- scale effect
- INDEX SOLUTIONS

Acknowledgements

John Yates

Dr Jo Conington