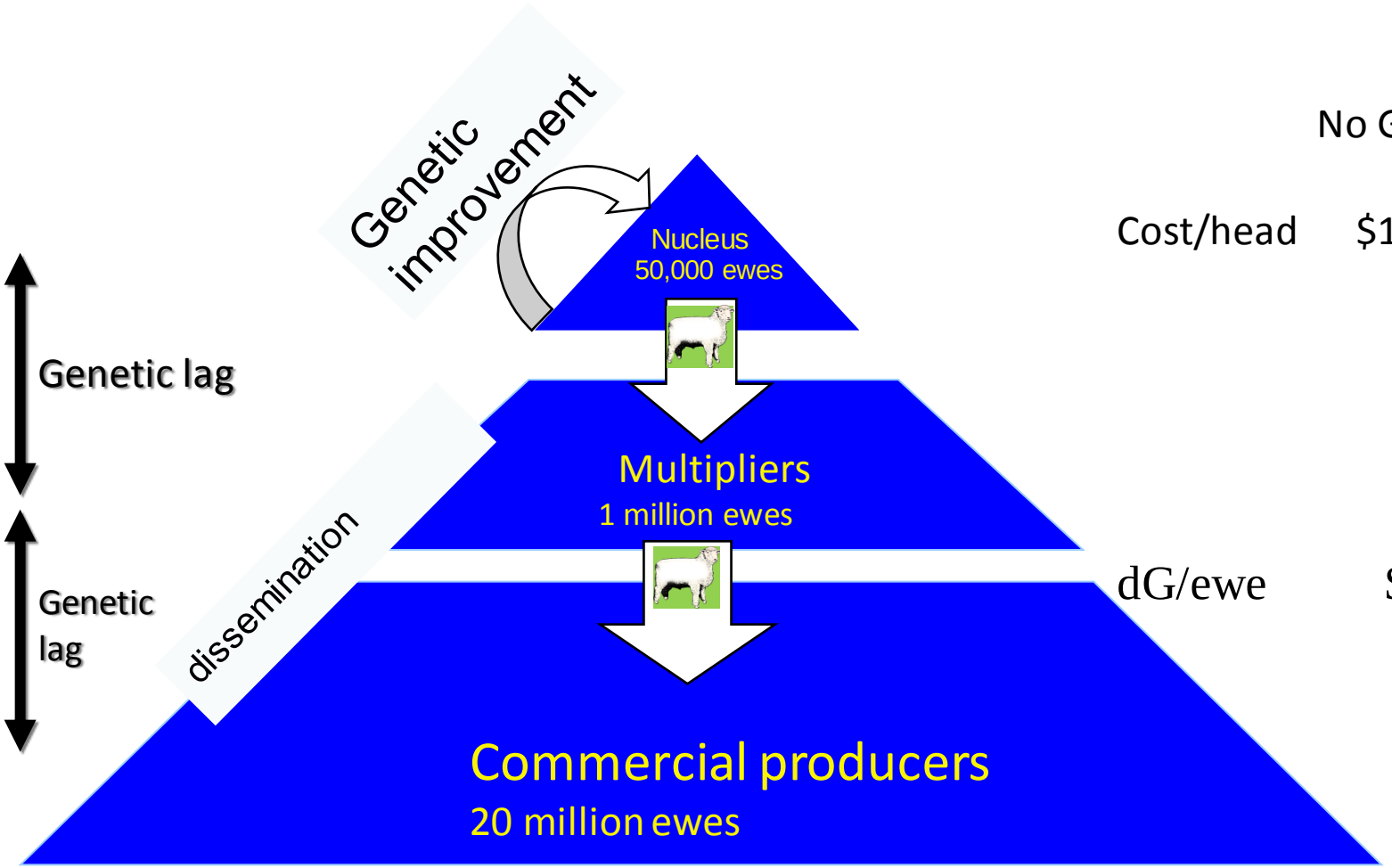
University of New England

Optimizing Breeding Programs

COST-BENEFIT of genomics

Cost - Benefit of breeding programs



	No GS	GS
Cost/head	$10	$60
dG/ewe	$2	$2.2

Cost-Benefit industry wide

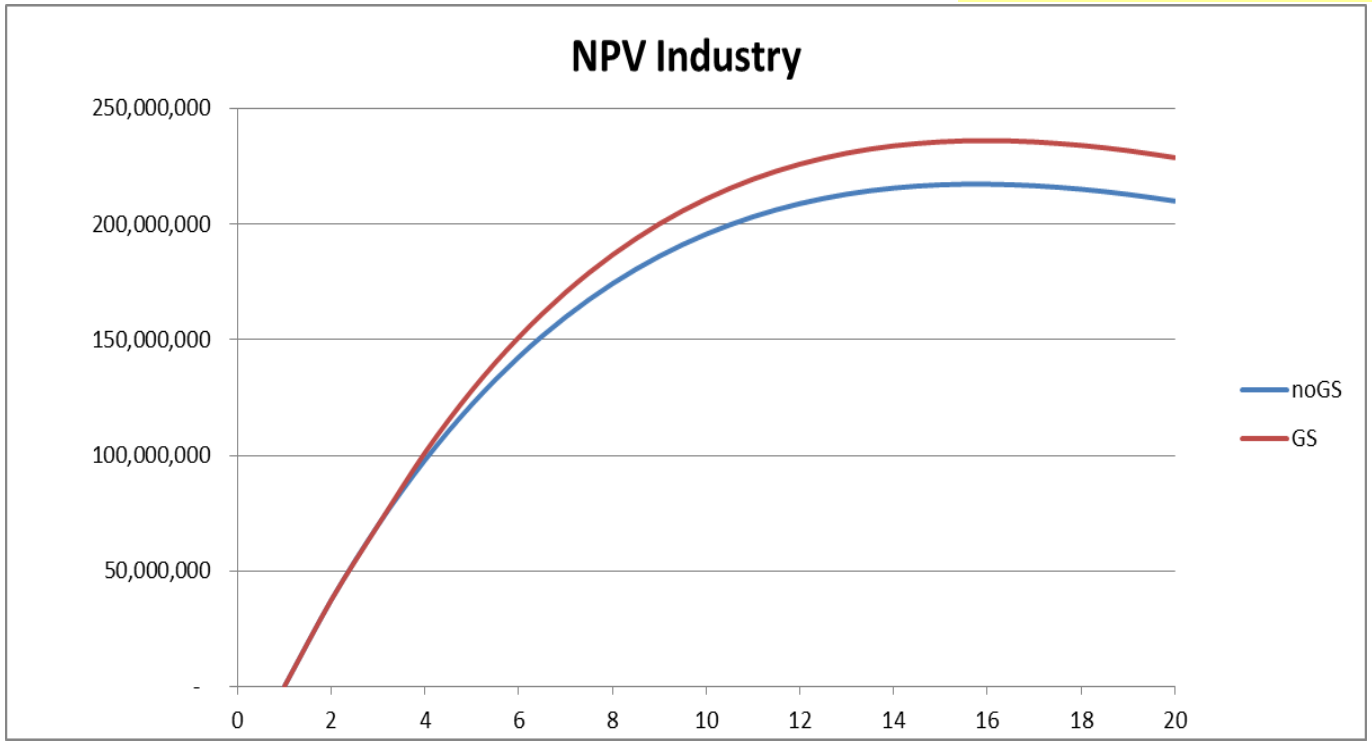
3 tier benefit

Per annum added

This does not accumulate

This accumulates

	No GS	GS
Cost	$0.5 M	$ 1.65 M
dG Return	$40 M	$ 44 M
Cum NPV	$2.45 b	$2.65 b



Note the much higher cost and lower RTI ratio!

50k Nuc ewes
20M Comm

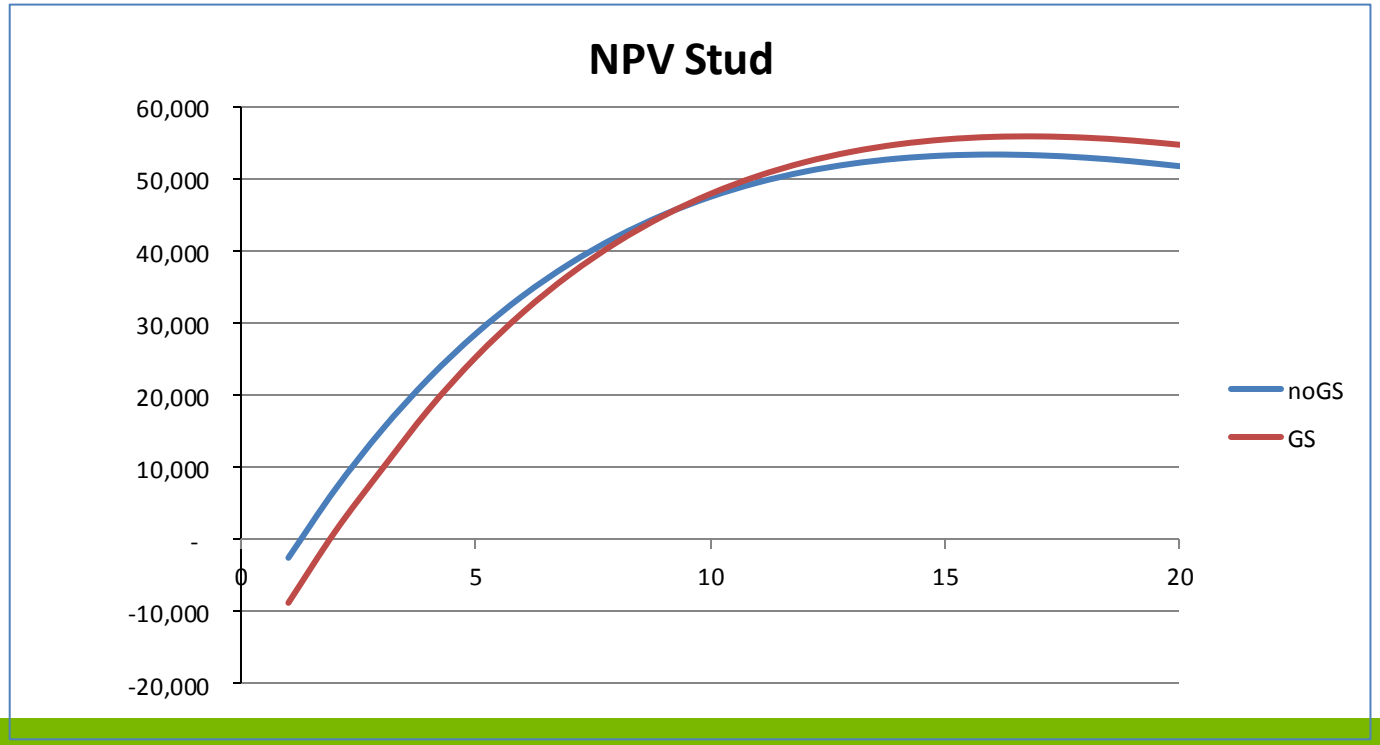
Cost-Benefit Stud + Direct clients

2 tier benefit

Per annum added

50-50 split of benefit between stud and comm

	No GS	GS
Cost	$ 5 k	$17.5 k
Returns dG	$20 k	$ 22 k
Cum NPV	$807 k	$859 k



500 Nuc ewes
10k Comm

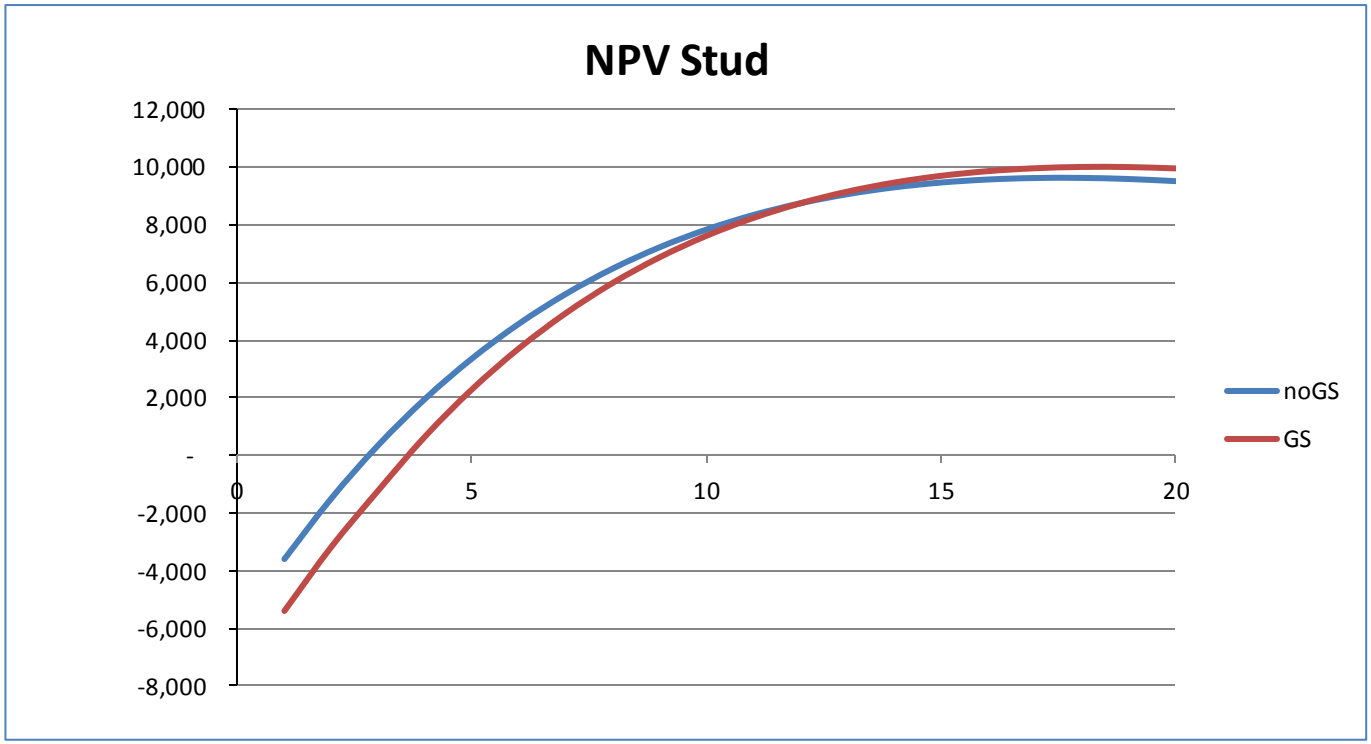
Cost-Benefit Stud + Direct clients

2 tier benefit

Per annum added

90 -10 split of benefit between stud and comm

	No GS	GS
Cost	$ 5 k	$17.5 k
Returns dG	$20 k	$ 22 k
Cum NPV	$125 k	$117 k



500 Nuc ewes
10k Comm

Value of selecting Stud Rams and Flock Rams

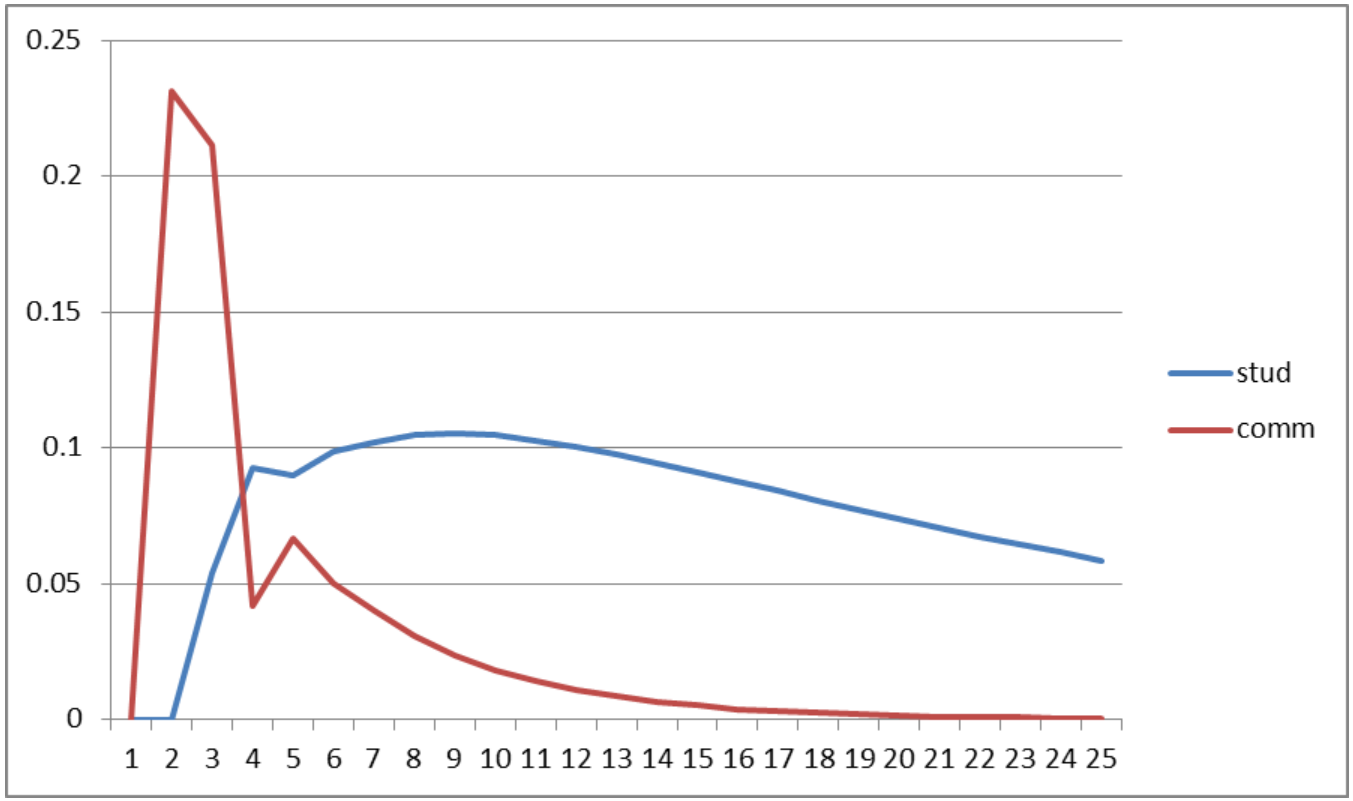
Value of a superior ram

CDE

= Selection Difference * Nr.Progeny * expression per progeny

Flock Ram	+ 1.4	100	0.55	= $ 77
Stud Ram	+ 3.0	400	1.35	= $ 1,620

(allele) frequency of one unit of superiority as expressed in commercial flock



Discount rate	CDE flock rams	CDE stud rams
0	0.99	3.93
0.05	0.78	1.96
0.08	0.68	1.37

Herd structure

Nr Cows Commercial Herd	12,000	
Comm Dams/sire	50	
Comm Sire replacem. rate	0.33333	
Comm Weaning rate	1	
Nr new rams needed for comm herd/yr	80	
Nr lifetime Progeny per commercial sire		150

100 prog/comm bull

Prop. Stud.Males sold as breeding bull	20%	
Stud weaning rate	1	
Stud dams/sire	40	
Nr stud breeding cows	800	
Nr. Of stud sires	20	
Nr of comm bulls sold per year	80	
Proportion of males DNA tested	100%	
Nr. Stud born Male DNA tested/yr	400	
Nr of commercial bulls sold per Stud male	4	
Nr of DNA tested young male per stud bull	20	
Nr of commercial progeny receiving genes from a stud male		600

400 prog/stud sire

Value of selecting Stud Rams

Value of a superior sire

= Selection Difference * Nr.Progeny * expression per progeny

Stud sire

	+ 8.8	400	1.36	= $ 7,194
With Genomics	+ 9.8	400	1.36	= $ 8,011

+817

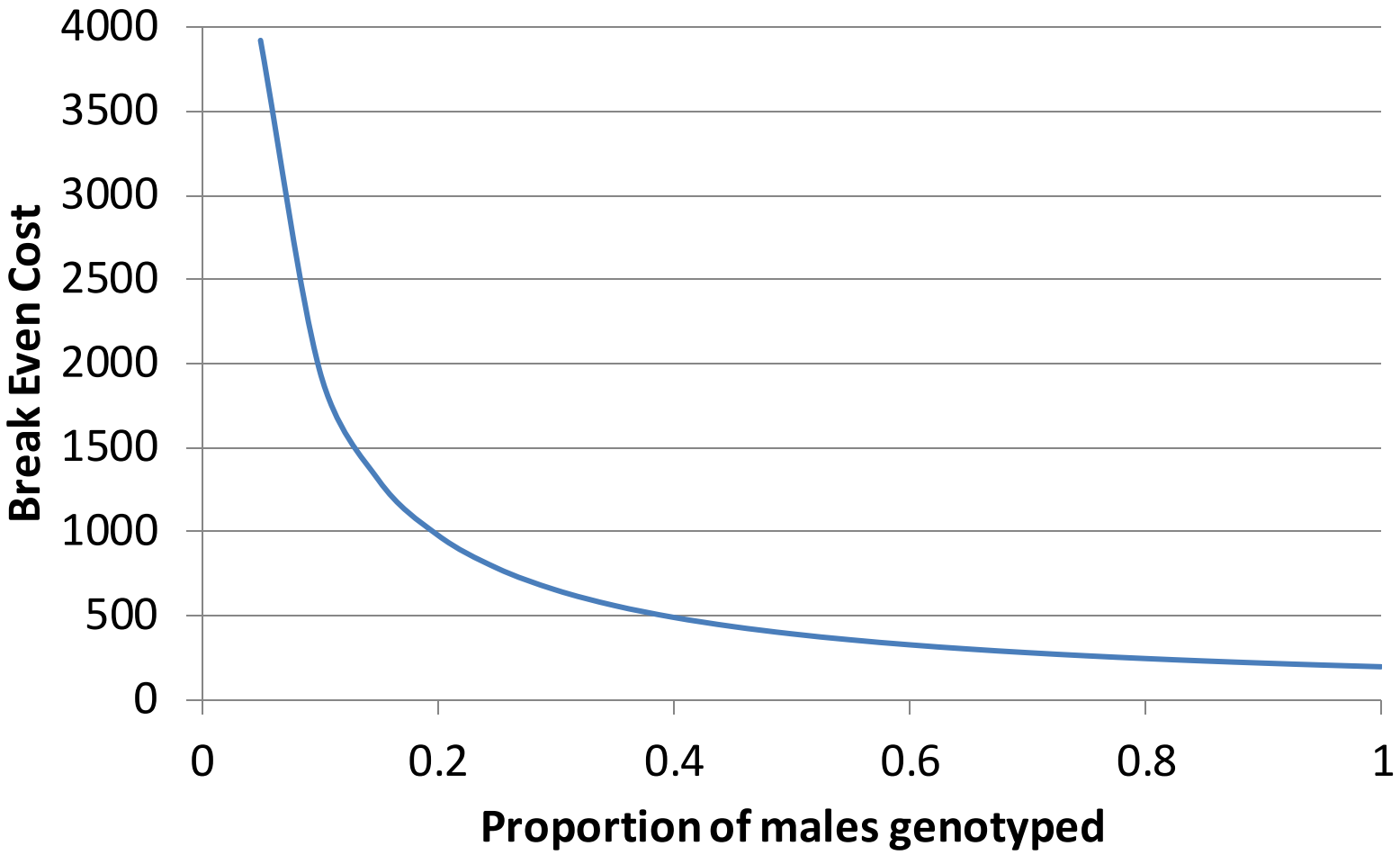
Cost benefit analysis

- Extra benefit per stud sire $817
- Extra Cost If all young stud males tested:

  20 young males/stud sire

- Break even: $817 / 20 = $41 per DNA test

Breakeven cost and proportion genotyped (no loss assumed!)



1yo male, 2yo female, Fine10% + SS, 40% males sold as rams

une

2 stage selection

How many bulls to genotype?

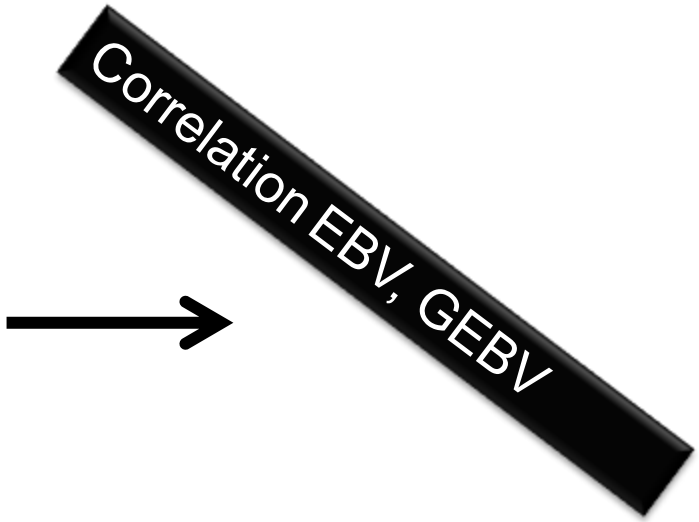
All have a breeding value at stage 1 EBV

Only some get extra info from GBV GEBV

Important parameters:

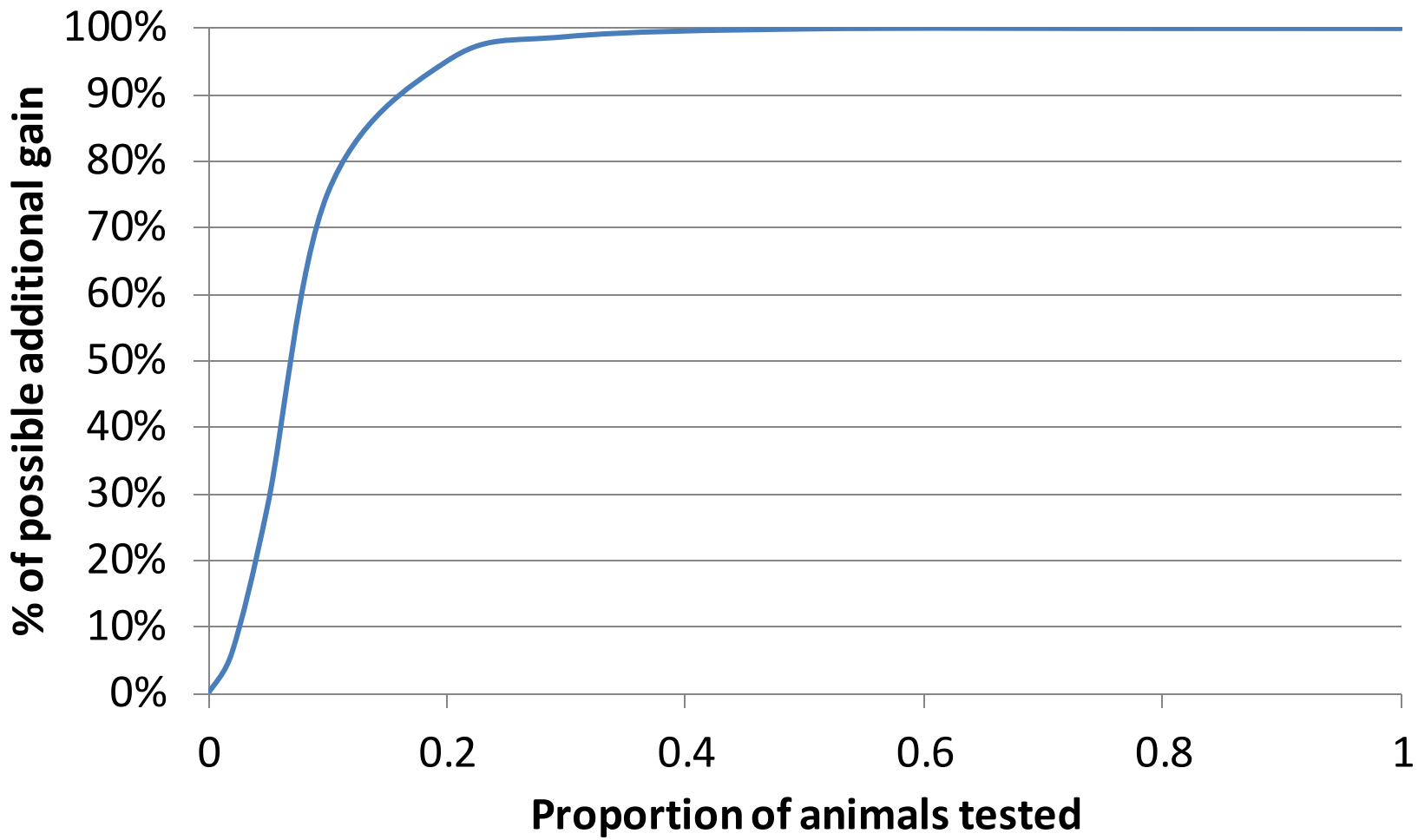
EBV accuracy

added accuracy GBV → GEBV



% gain compared with 100% genotyping

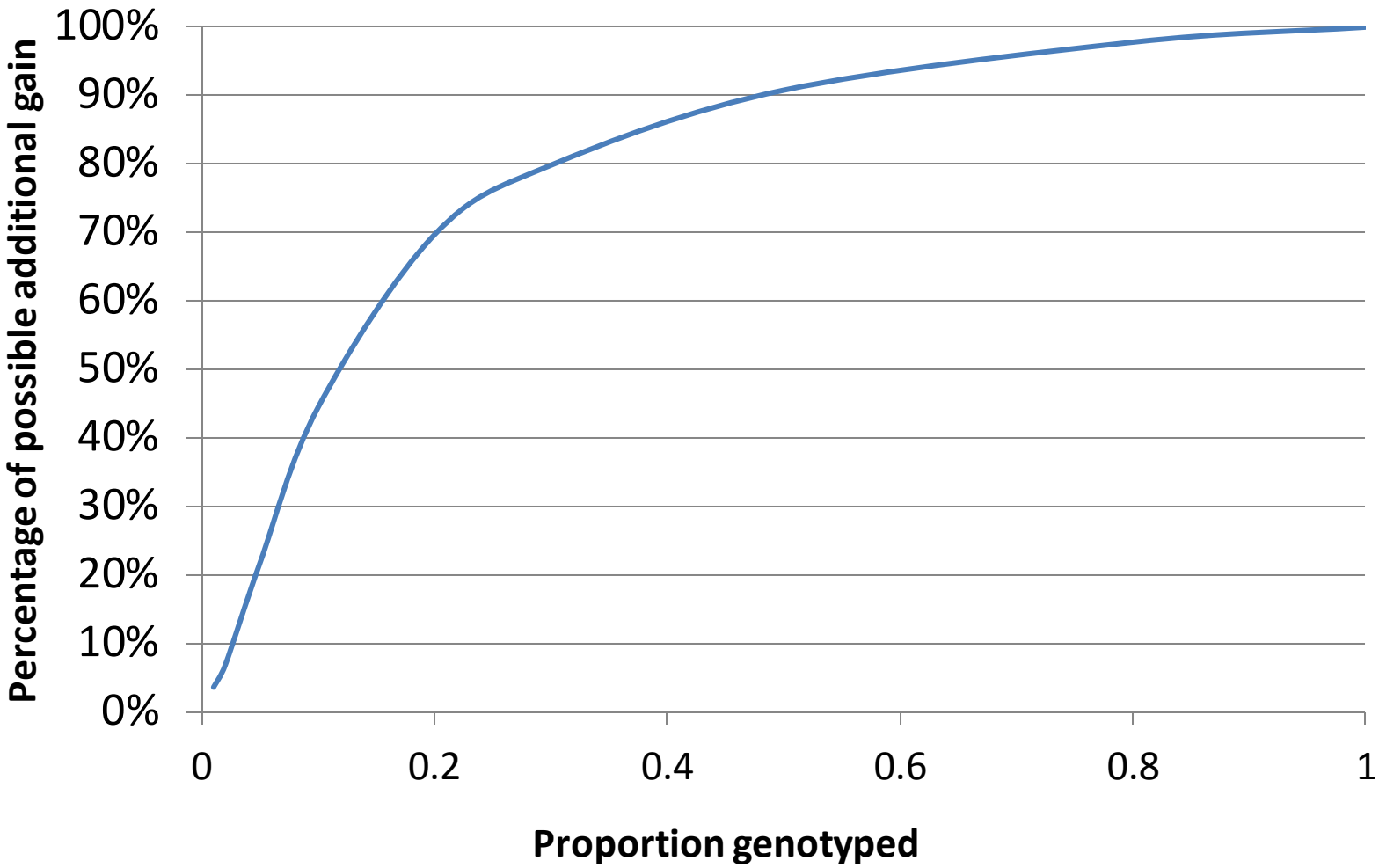
EBV 0.34, GBV 0.39, GEBV = 0.50, $r_{EBV,GEBV}$ = 0.7



At high(ish) correlation between EBV and GEBV only need to genotype ~20%

% gain compared with 100% genotyping

EBV 0.10, GBV = 0.39, GEBV 0.40, $r_{EBV,GEBV} = 0.25$



At low(er) correlation between ASBV and ASBV1 need to genotype more

Summary

- Can calculate additional gain on a per ram basis, assuming returns in commercial progeny

- Those figures depend on
  - Additional accuracy
  - Age structure
  - Flock parameters such as weaning rate, mating rate, proportion sold
  - Can have strategies to save costs, e.g. test top 20%

Adding accuracy with genomic testing

	EBV accuracies of young males at 18 months		
Trait	W/o GS	With GS	%difference
Birth Weight	0.32	0.48	48%
Post Weaning Weight	0.67	0.79	17%
Post Weaning Eye Muscle	0.66	0.70	6%
Post Weaning Fat	0.58	0.64	9%
Adult Weight	0.49	0.69	41%
Adult Clean Fleece Weight	0.55	0.69	25%
Number of Lambs Weaned	0.17	0.28	60%
Dual Purpose Index	0.24	0.35	46%

Do people use DNA testing?

Only major breeds:

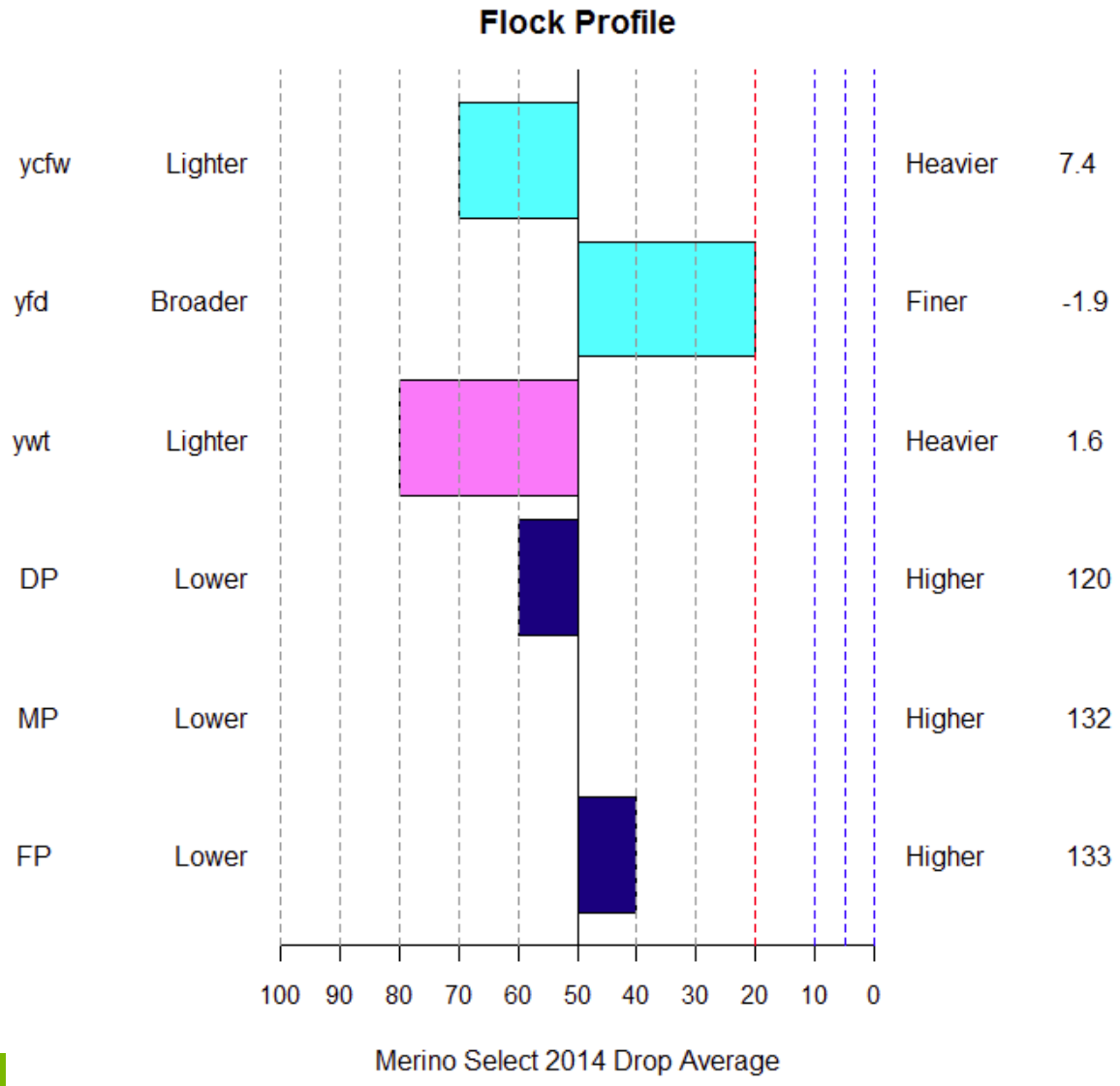
Merino
Poll Dorset
White Suffolk
Border Leicester

Year	50k	700k	LD	Parentage/Pol l
2012	1,519	0	0	10,073
2013	3,313	920	5,386	20,011
2014	1,144	1,430	4,123	13,909
2015	240	151	4,183	27,956
Total	6,408	2,502	14,309	81,543

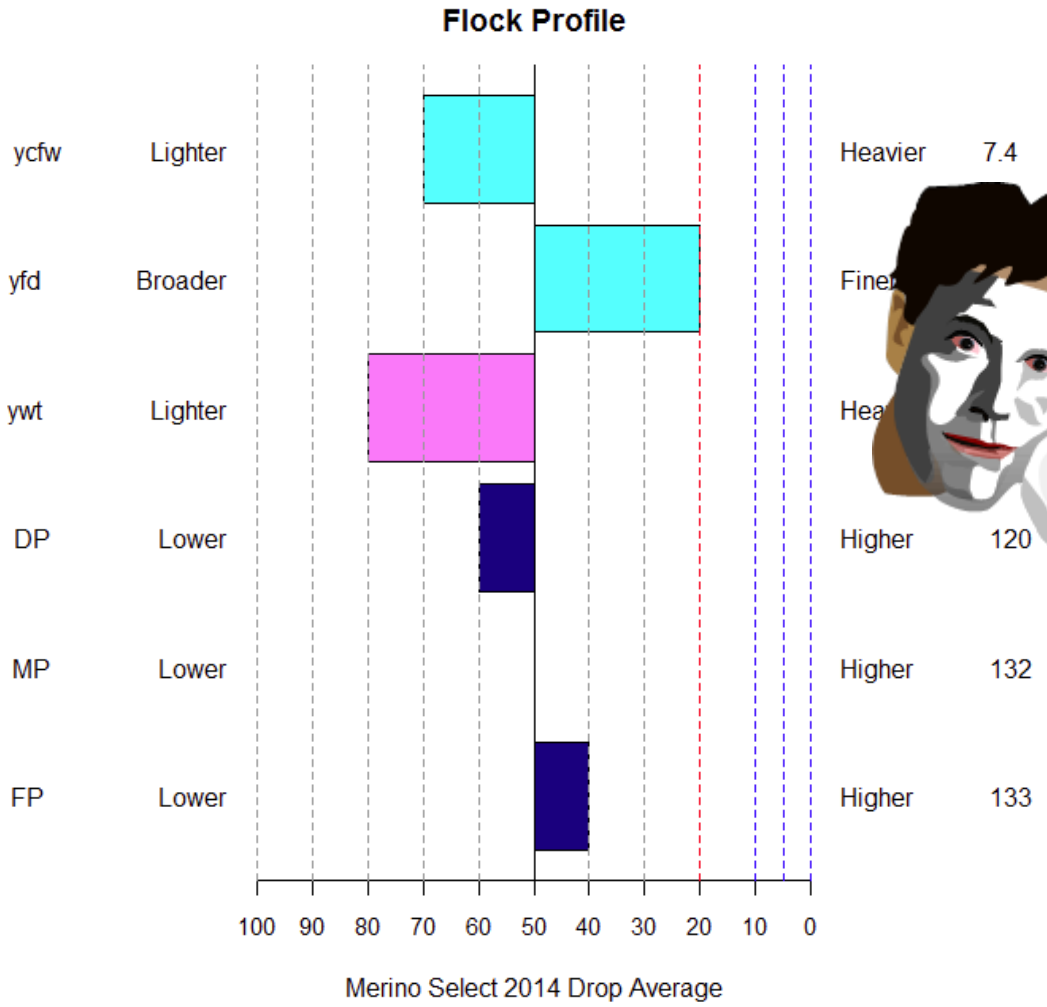
research

industry

Report back to producer



Feed back into



RamSelect Plus .com.au

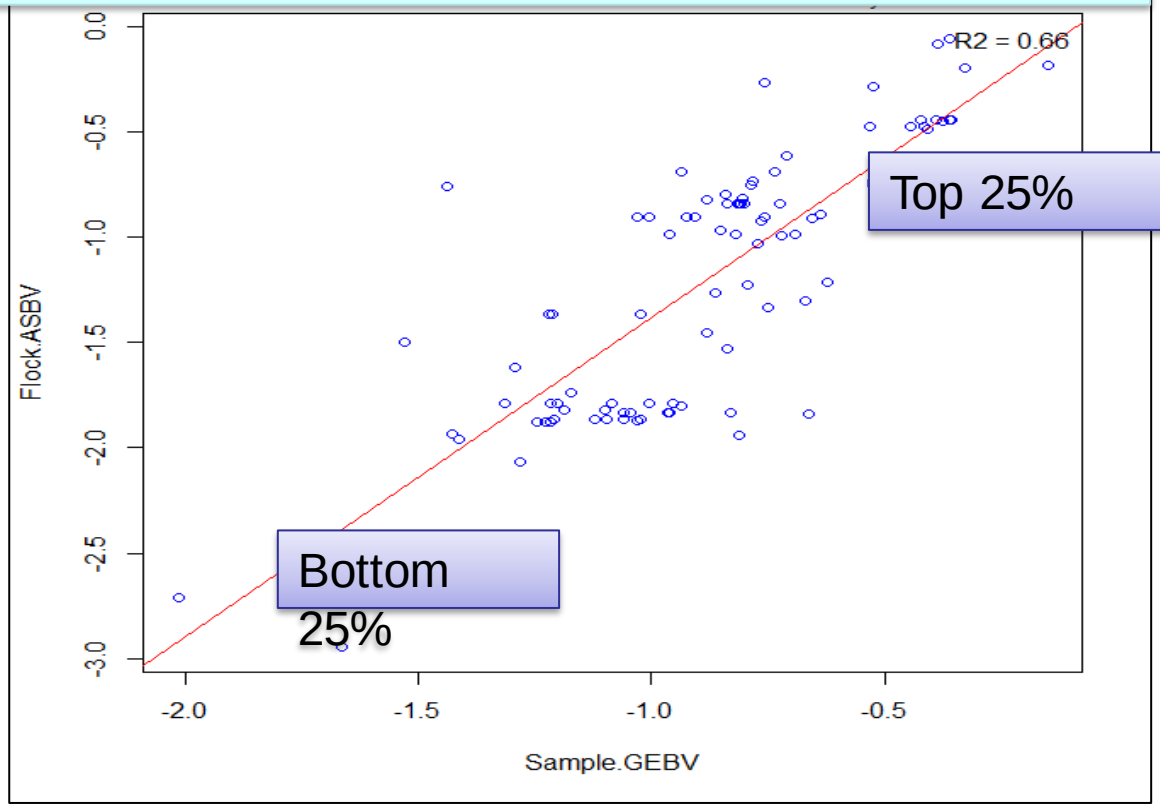
Validating results of Genomic Profiling

Data from 65 pilot project flocks (2010-2014)

Fibre Diameter mean breeding values

$R^2 = 0.66$

Flock mean predicted from **performance and pedigree**



Flock mean predicted from **genomic test** (mean of 15 samples)

What next?

- Further delivery: aim for delivering to 100 commercial flocks
- Ram breeders with their clients
- Testing usage in a lamb supply chain
- Use wether trail (samples form 50 flocks, compare with phenotypic means)
- Explore the potential of sample pooling

Need to develop value propositions

Improved Delivery Genom Profiling

Objectives

Benchmark **commercial flocks based on genomic testing,**
by estimating the genetic mean of the flock for various traits.

Outcome:

Estimating genetic merit in commercial sheep cohorts can

- help with more informed ram buying decisions > RamSelect
- create a pull for ASBVs from ram buyers
- create more awareness about importance of good genetics in the flock
- assist in defining cohorts in supply chains or other management practices driven by performance predictions

Project 3.2 Better delivery: understanding benefits

Cumulative net present value (profit) – Fully integrated, 7,000 Mult., 180,000 Comm.