

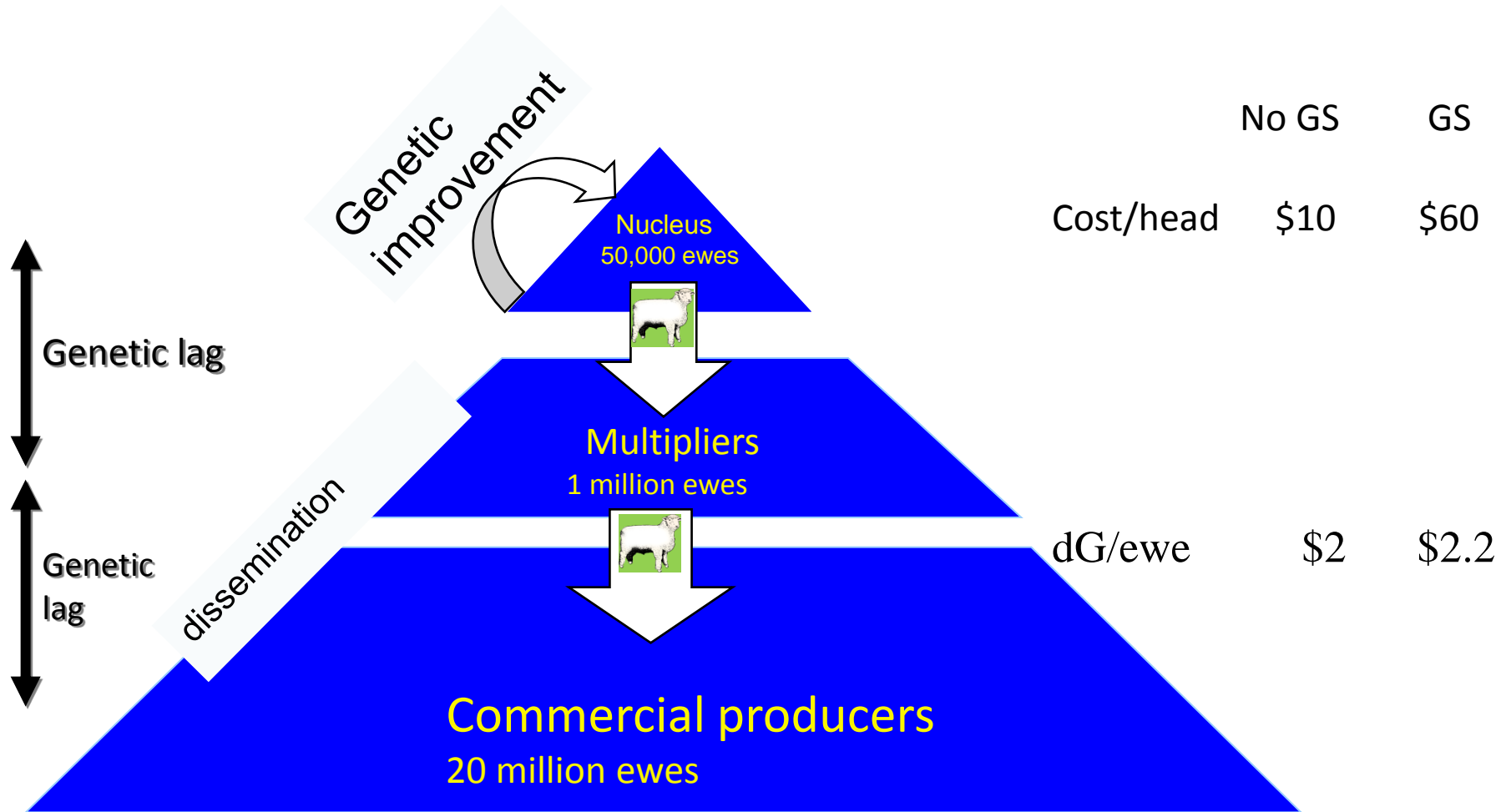
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University of  
New England

# Optimizing Breeding Programs

## COST-BENEFIT of genomics

# Cost - Benefit of breeding programs



# Cost-Benefit industry wide

3 tier benefit

Per annum added

This does not accumulate ←

This accumulates ←

Cost

dG Return

Cum NPV

No GS

GS

\$0.5 M

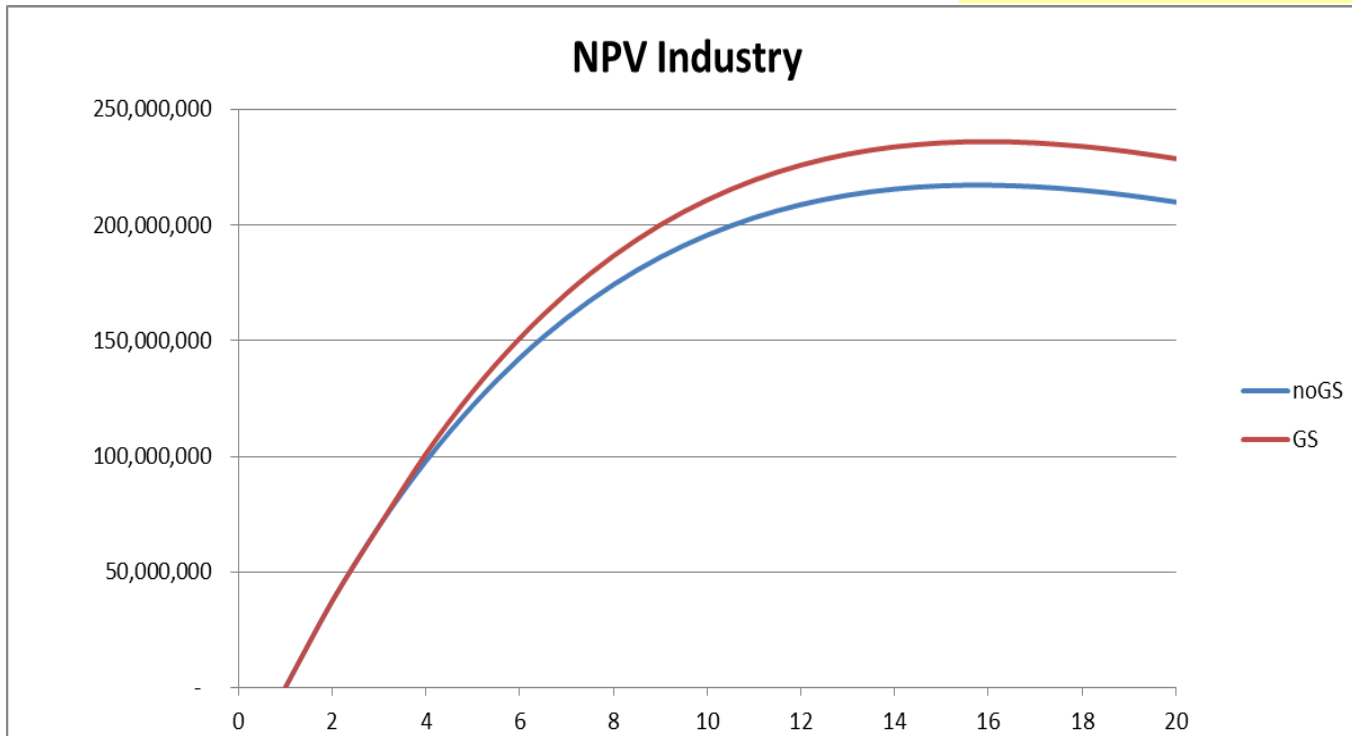
\$ 1.65 M

\$40 M

\$ 44 M

\$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

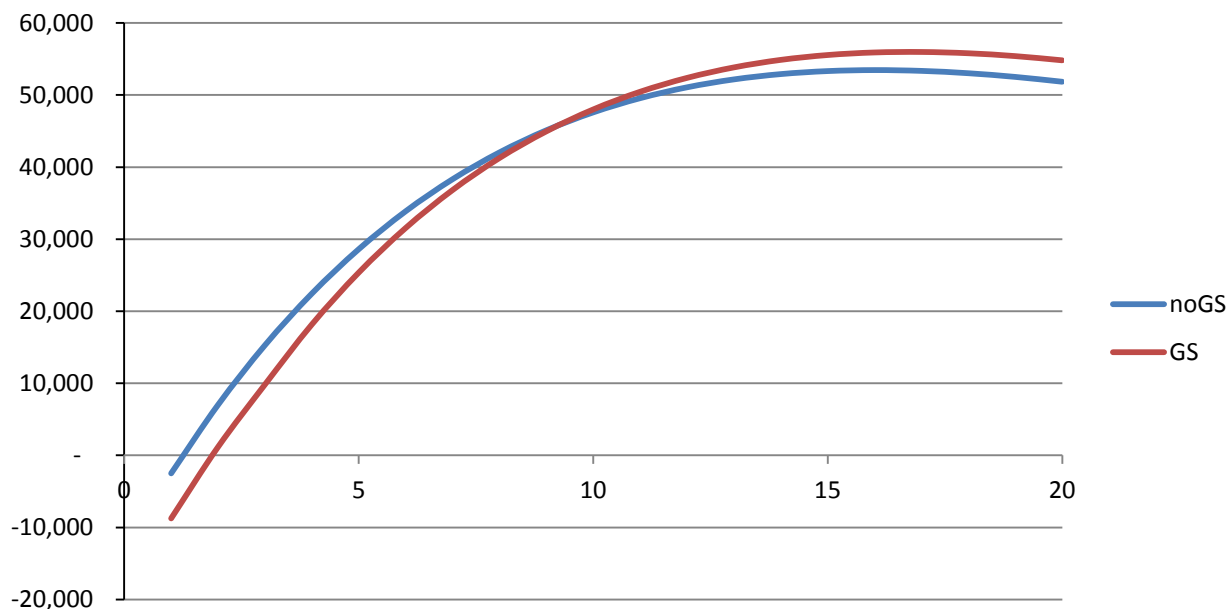
Per annum added

50-50 split of benefit  
between stud and comm

Cost  
Returns dG  
Cum NPV

No GS	GS
\$ 5 k	\$17.5 k
\$20 k	\$ 22 k
\$807 k	\$859 k

NPV Stud



500 Nuc ewes  
10k Comm

# Cost-Benefit Stud + Direct clients

2 tier benefit

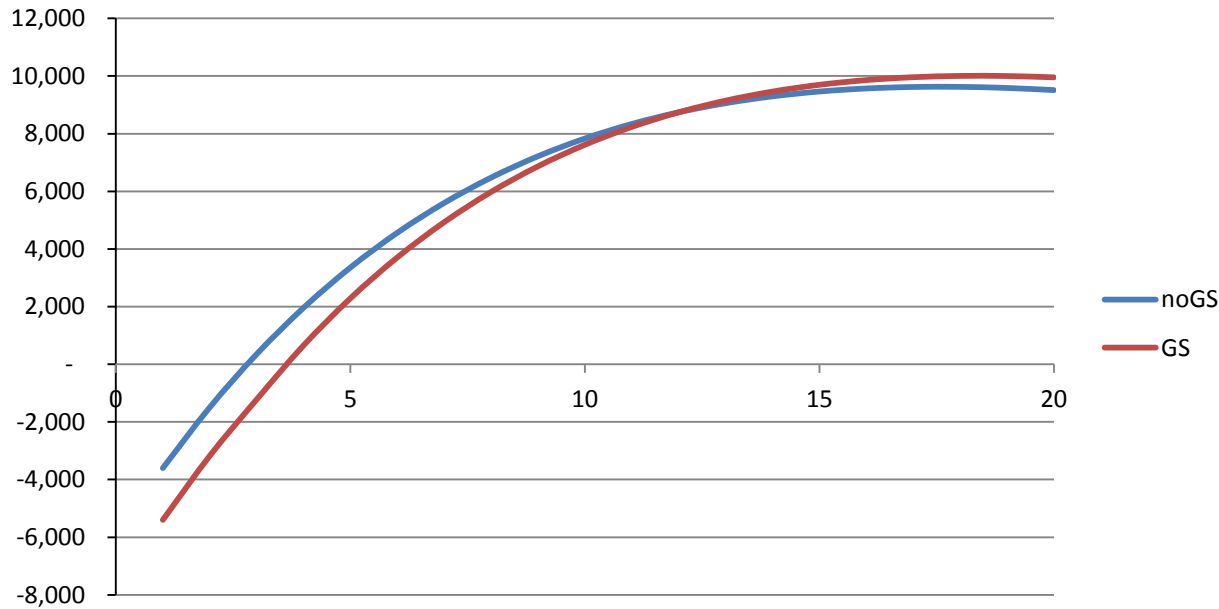
Per annum added

90 -10 split of benefit  
between stud and comm

Cost  
Returns dG  
Cum NPV

No GS	GS
\$ 5 k	\$17.5 k
\$20 k	\$ 22 k
\$125 k	\$117 k

NPV Stud



500 Nuc ewes  
10k Comm

# Value of selecting Stud Rams and Flock Rams

Value of a superior ram

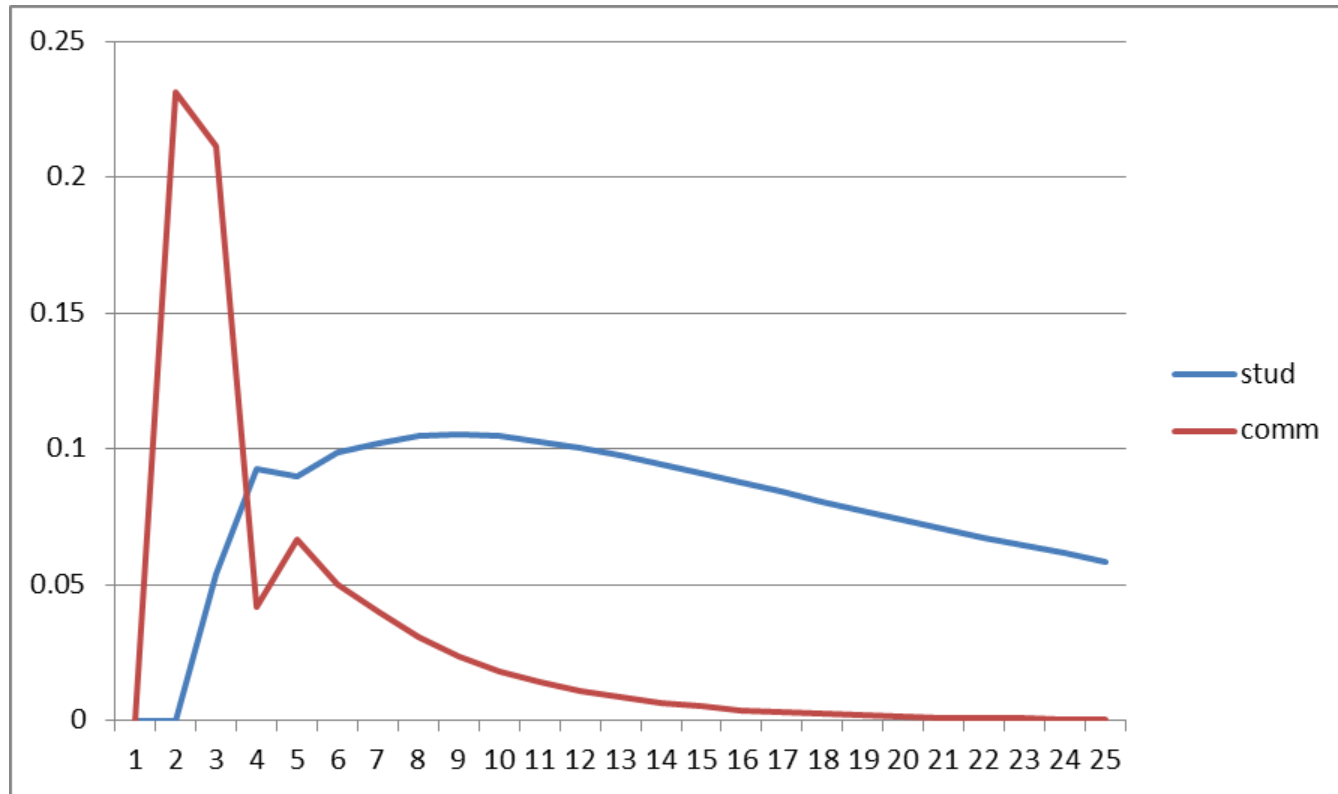
$$= \text{Selection Difference} * \text{Nr.Progeny} * \text{expression per progeny}$$

CDE

Flock Ram	+ 1.4	100	0.55	= \$ 77
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Stud Ram	+ 3.0	400	1.35	= \$ 1,620
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# (allele) frequency of one unit of superiority as expressed in commercial flock



<u>Discount rate</u>	<u>CDE flock rams</u>	<u>CDE stud rams</u>
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

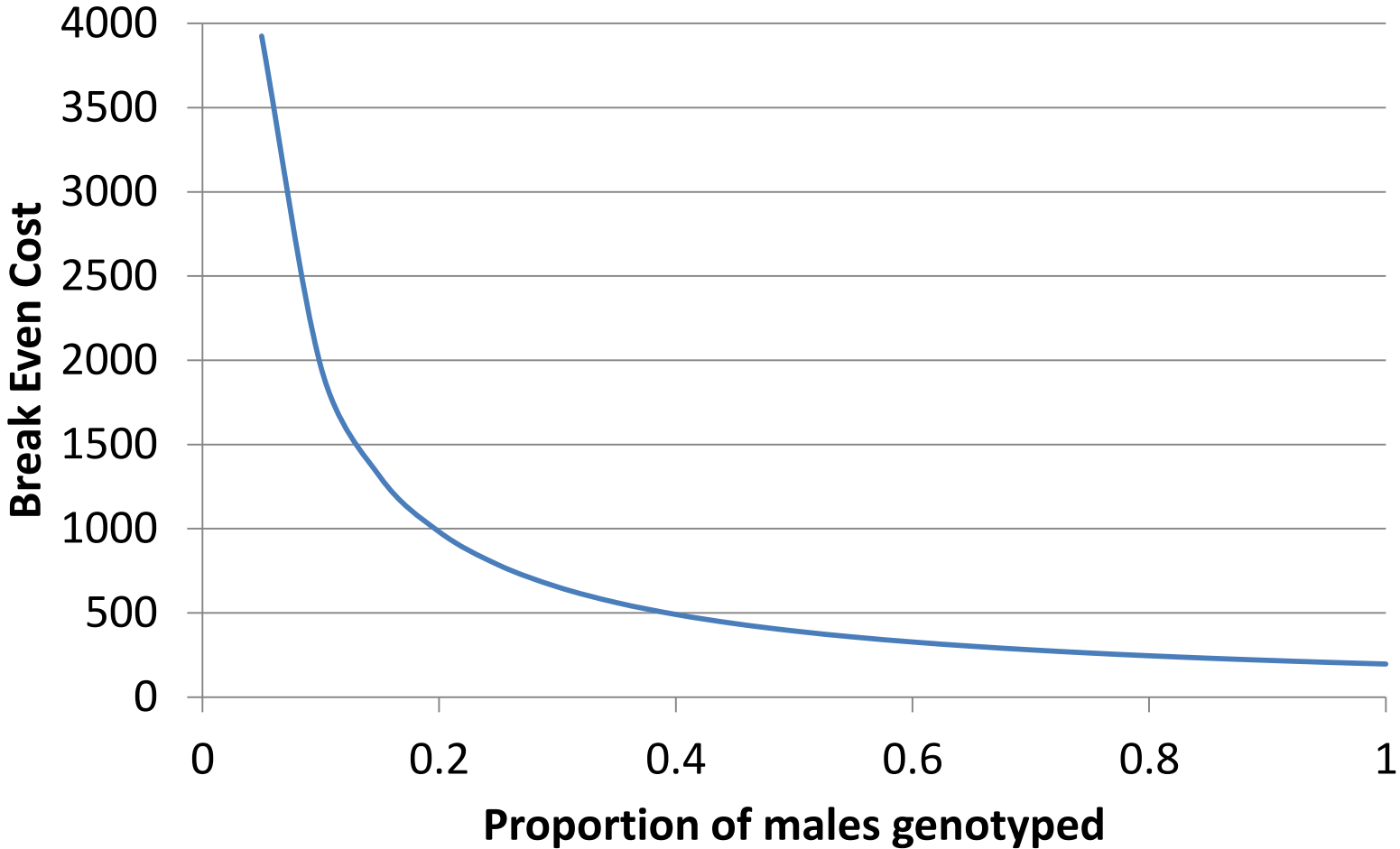
+ 9.8                      400                      1.36                      = \$ 8,011

+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

## 2 stage selection

How many bulls to genotype?

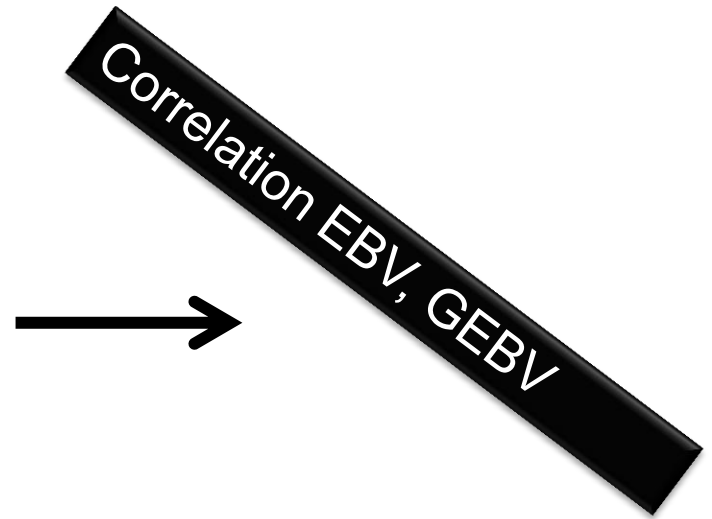
All have a breeding value at stage 1      EBV

Only some get extra info from GBV      GEBV

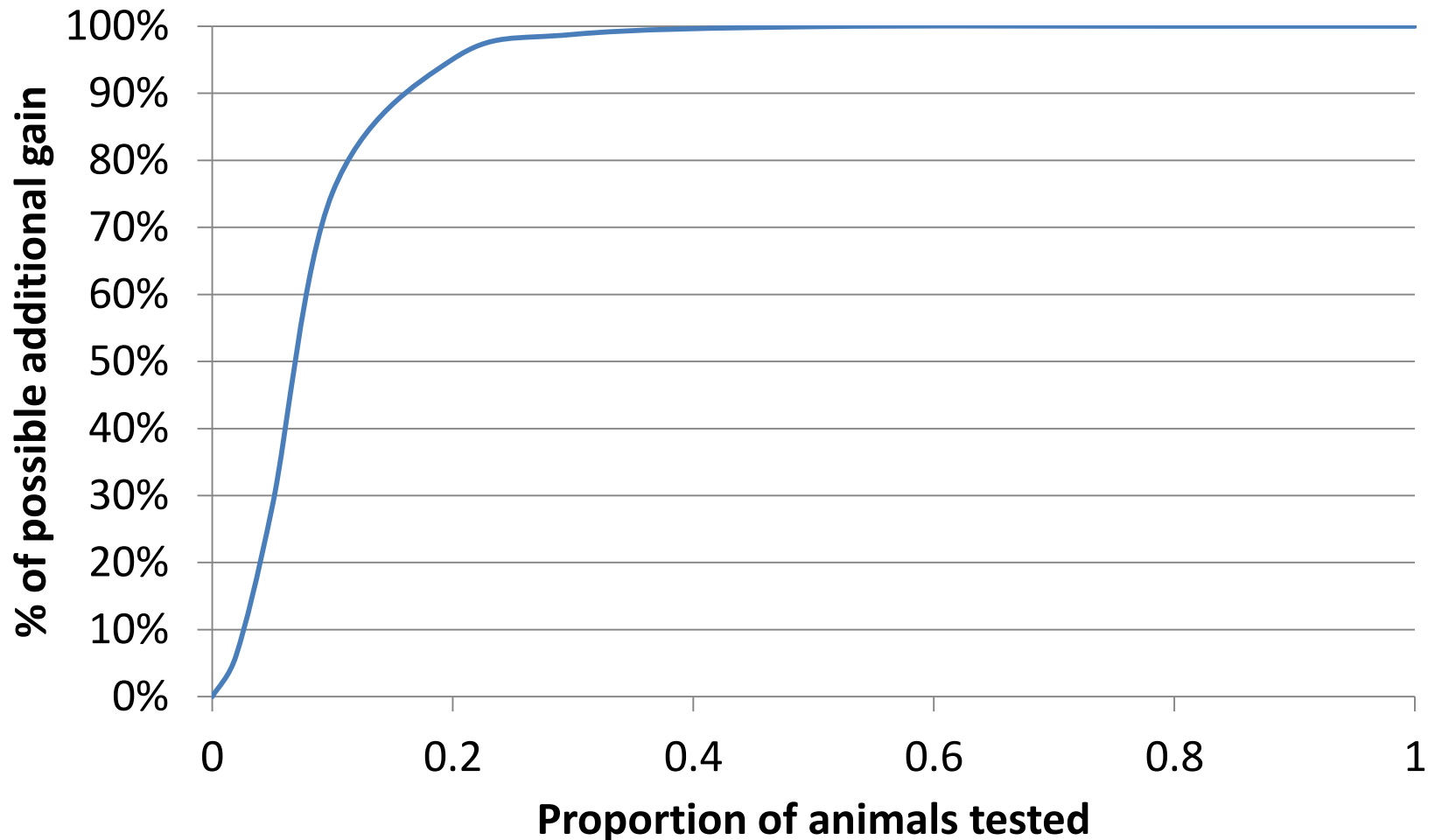
Important parameters:

EBV accuracy

added accuracy GBV  $\rightarrow$  GEBV

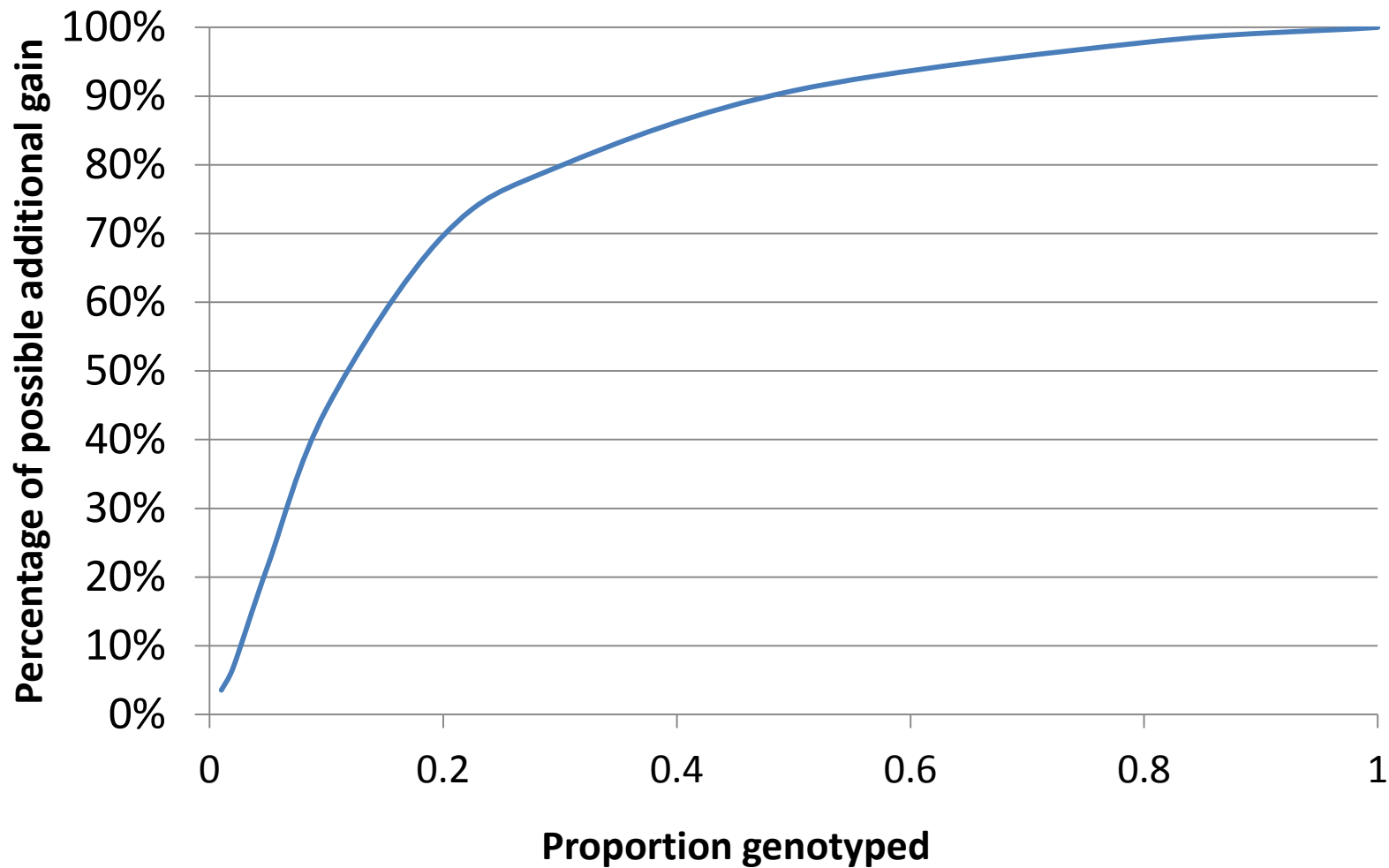


% gain compared with 100% genotyping  
EBV 0.34, GBV 0.39, GEBV = 0.50, **r = 0.7**



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 = 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%