What can R&D in animal breeding programs deliver?

Nexus webinar 28 August 2020

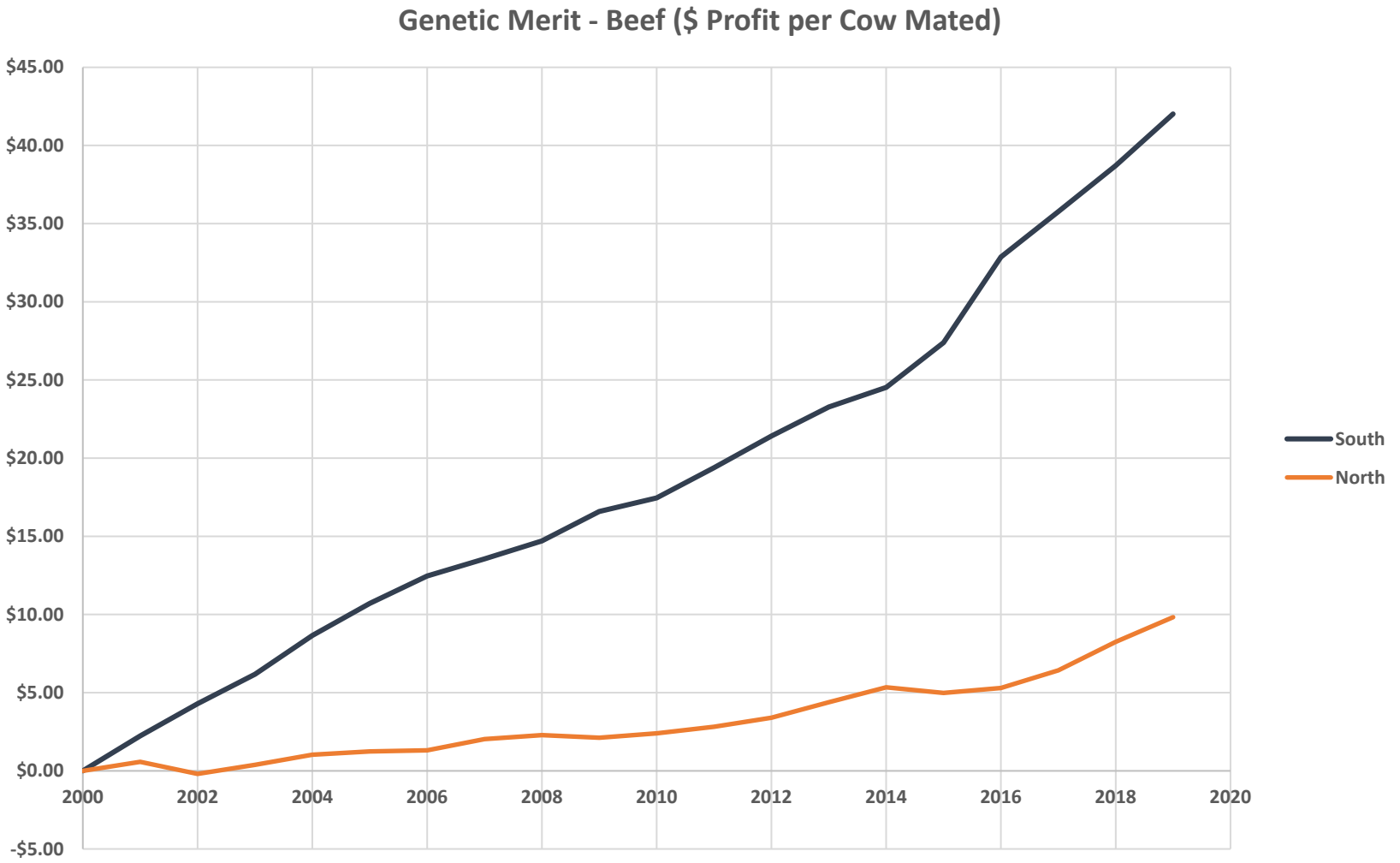
Robert Banks & Brad Walmsley

AGBU

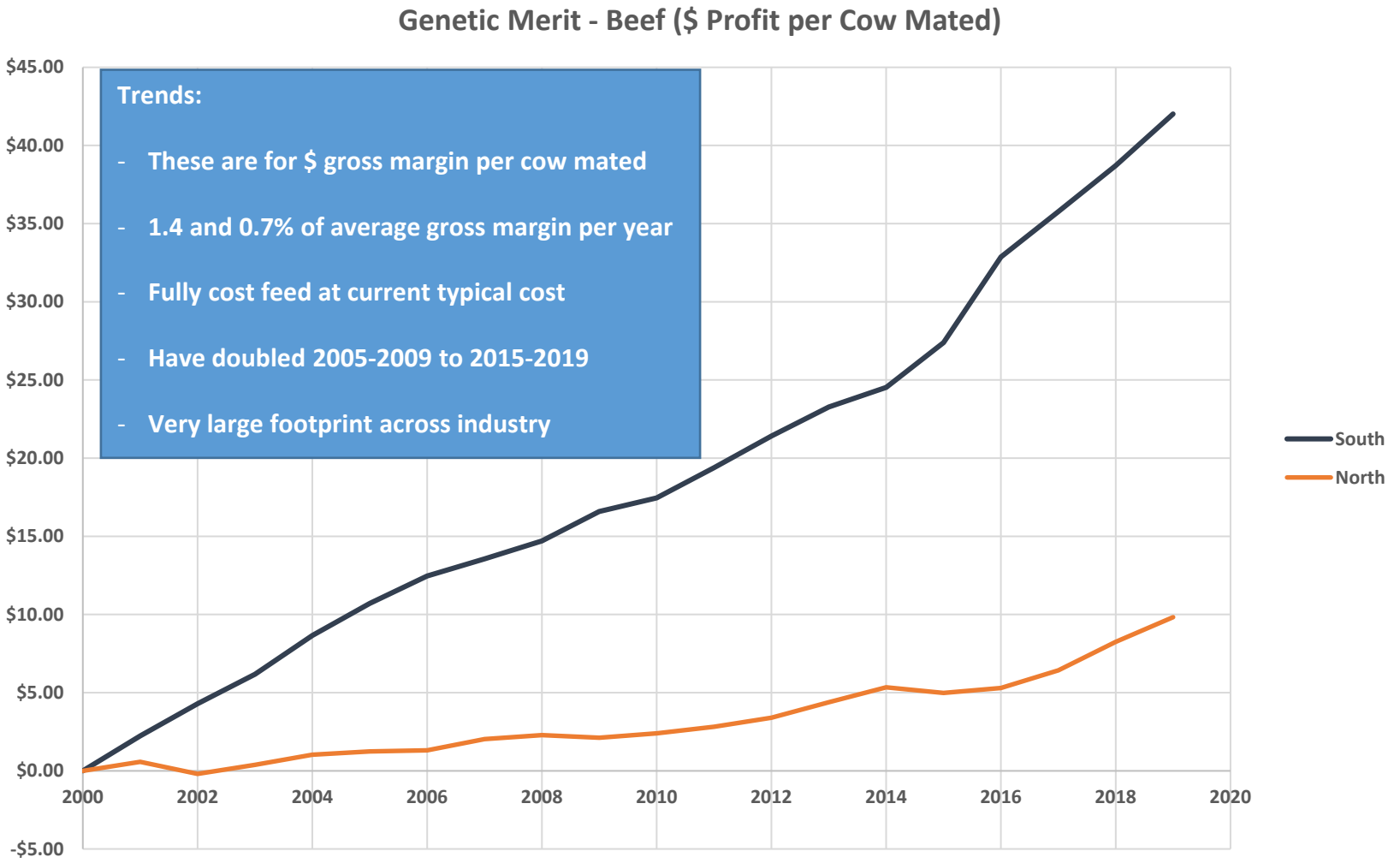
Topics:

- What is animal genetic improvement delivering (focus on beef cattle)
  - developments
- Thinking about climate change – how does it guide selection and R&D
- Investment strategies for genetic improvement and R&D

What is happening – genetic change (beef):



What is happening – genetic change (beef):



Southern Livestock Adaptation R&D Program:

Some key findings

Modelling suggests:

- Climate change and impacts vary across locations.
- Increased temperatures and decreased rainfall
- Shorter growing seasons reduced stocking rates

reduced profit

- Some areas positive.
- Small rainfall changes - big impacts on farm profit.

agbu

Southern Livestock Adaptation R&D Program:

Australian Government
Department of Agriculture, Fisheries and Forestry

mla
MEAT & LIVESTOCK AUSTRALIA

Southern Livestock Adaptation 2030

Some key findings

Modelling suggests:

Simple way to capture possible scenarios:

- **Future will be dryer and warmer in most locations**
- **Feed grown will be likely less, and more variable**
- **Equivalent to cost of feed being higher**

agbu

Genetic studies:

Barwick *et al. Genet Sel Evol* (2019) 51:18
https://doi.org/10.1186/s12711-019-0459-5

GSE Genetics Selection Evolution

REGULAR ARTICLE Open Access

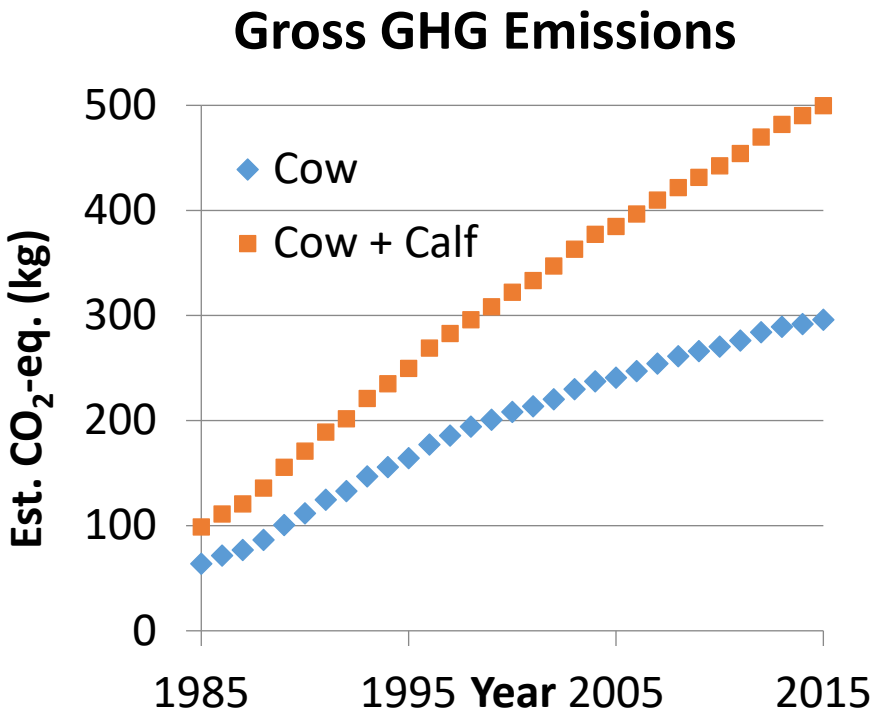
Check for updates

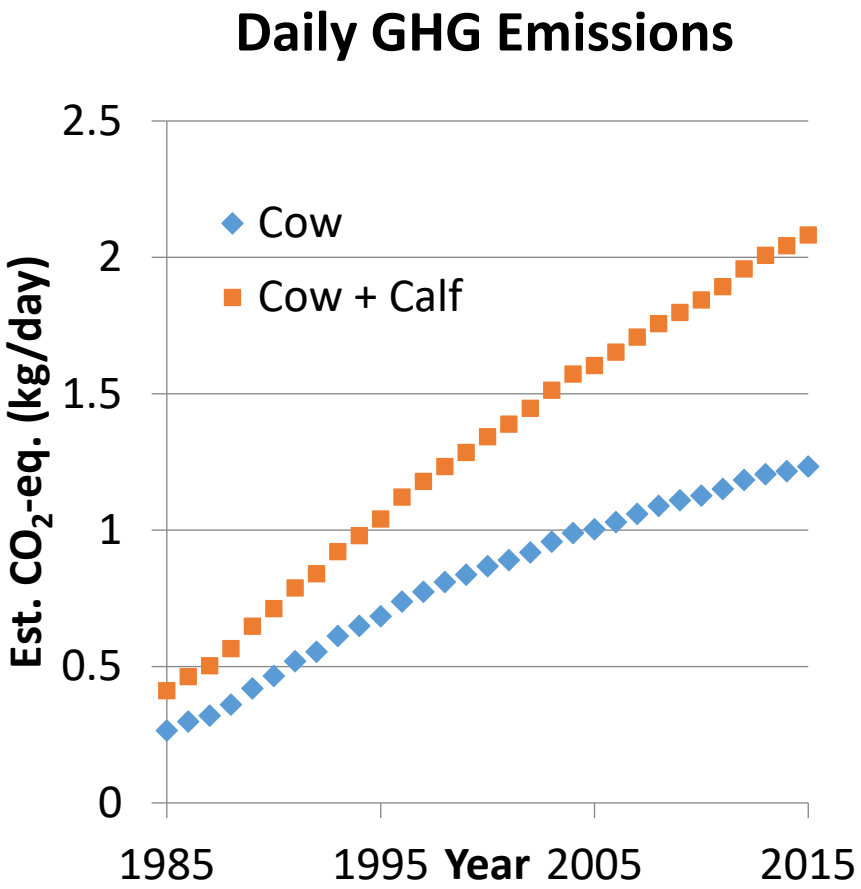
Methods and consequences of including reduction in greenhouse gas emission in beef cattle multiple-trait selection

Stephen A. Barwick[1*], Anthony L. Henzell[1], Robert M. Herd[2], Bradley J. Walmsley[1] and Paul F. Arthur[3]

agbu

GHG Emissions – Cow Herd Pasture





Cow ~ 0.97 kg/day

Cow + Calf ~ 1.82 kg/day

agbu

Multiple Trait Selection

What is Feed Cost? – No GHG Emissions

$$\text{Feed Cost} = \sum_{}^{FP} \left(\text{Daily Feed Intake} \right) * \text{Feed Price}$$

FP = Feeding Period

What is Feed Cost? – With GHG Emissions

$$\text{Feed Cost} = \sum_{}^{FP} \left(\text{Daily Feed Intake} \right) * \text{Feed Price}$$

$$+$$

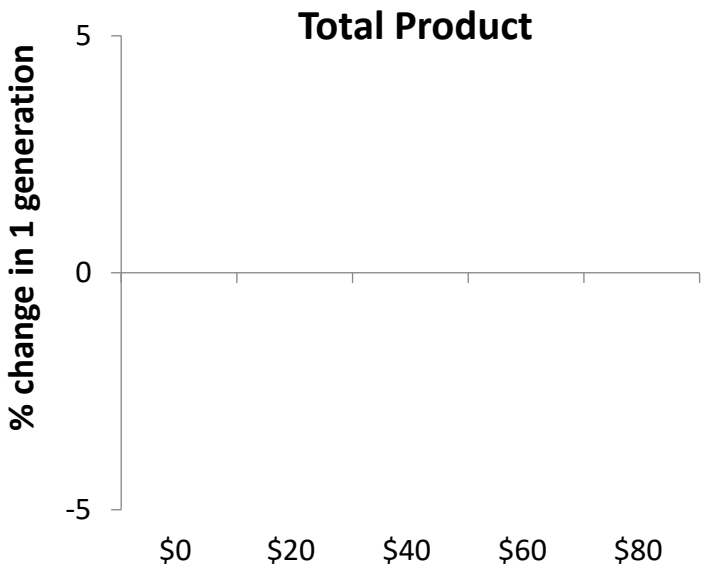
$$\sum_{}^{FP} \left(\text{Daily Feed Intake} \right) * CH_4 \text{ Coef} * CO_2\text{-e Price}$$

FP = Feeding Period

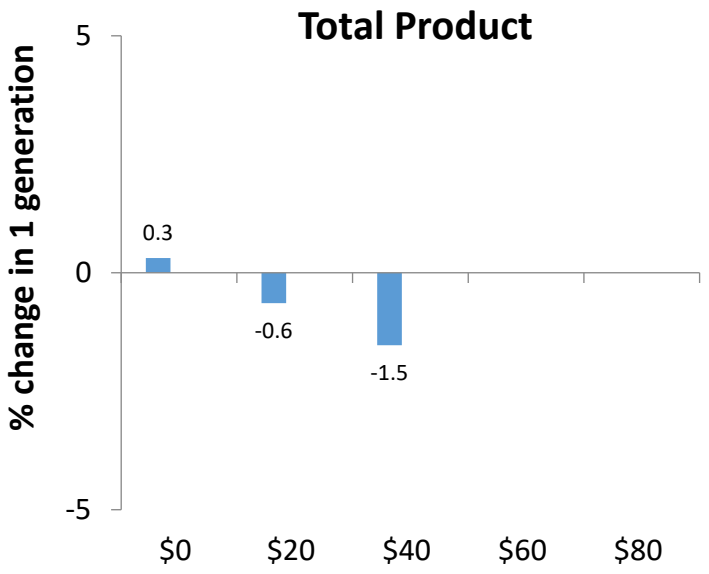
Scenarios Examined

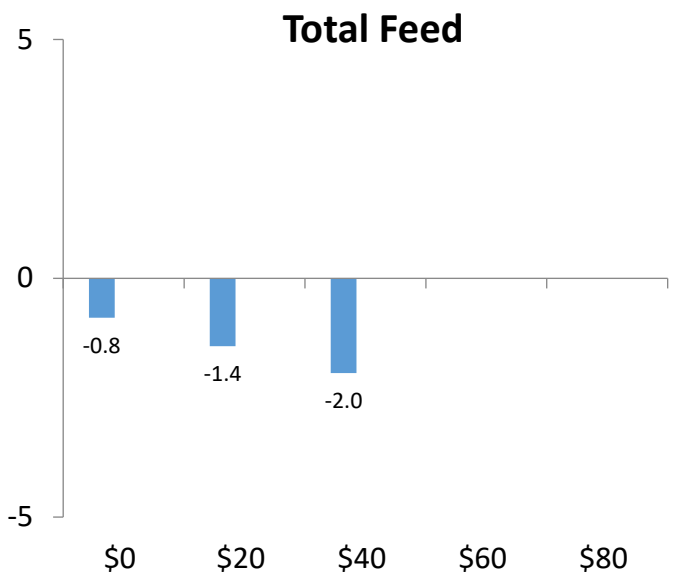
- Base Scenario (feed = $130 / tonne)
  1. $0 / tonne (carbon price)
  2. $20 / tonne
  3. $40 / tonne

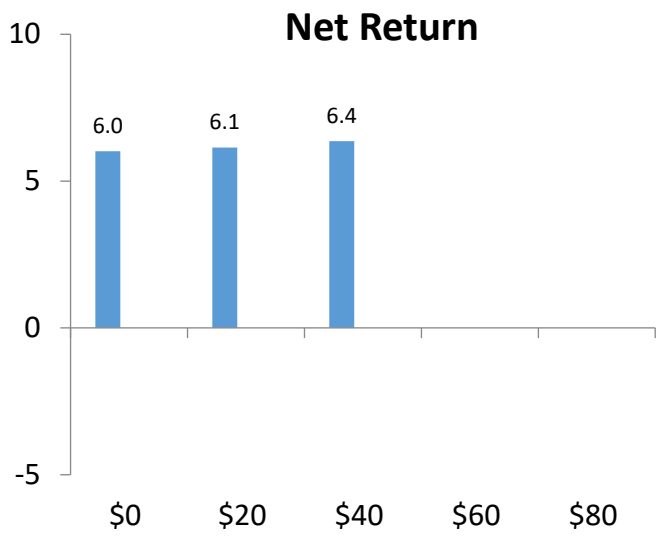
Accounting for CO_2-e

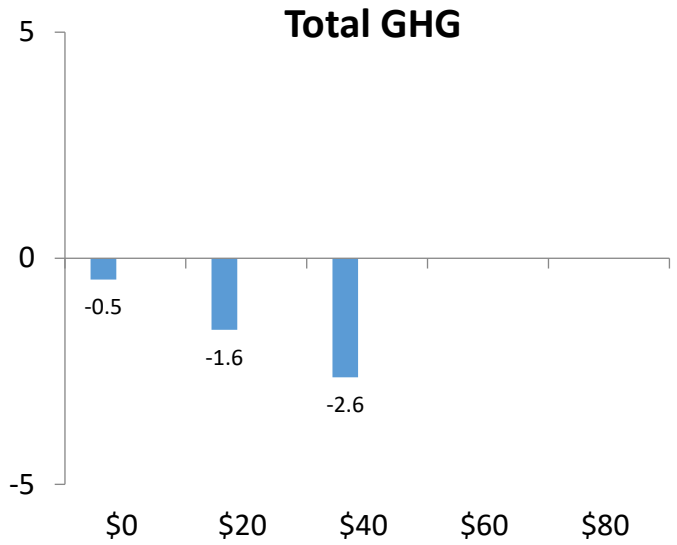


Accounting for CO_2-e

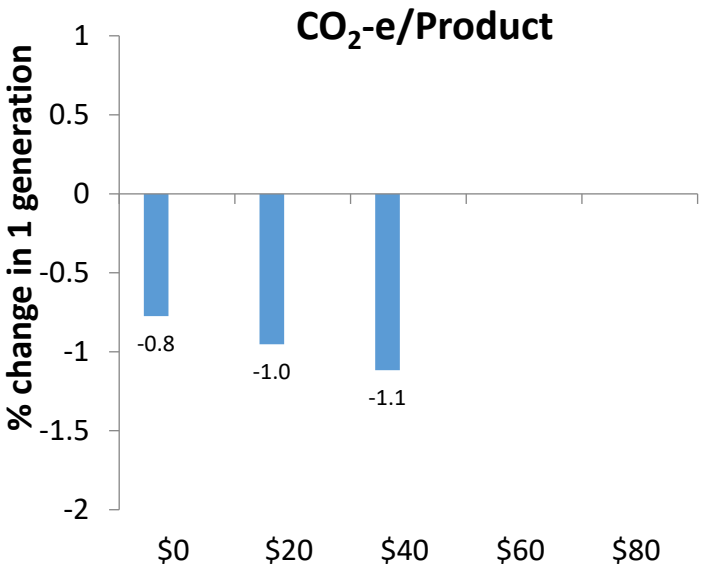


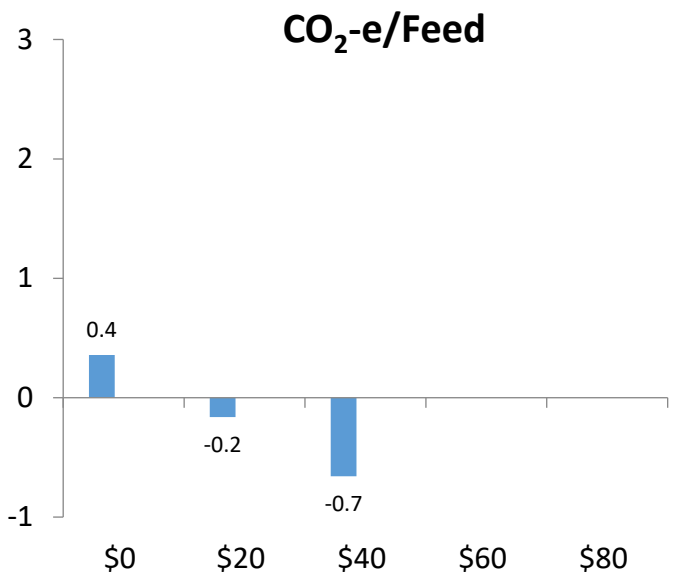


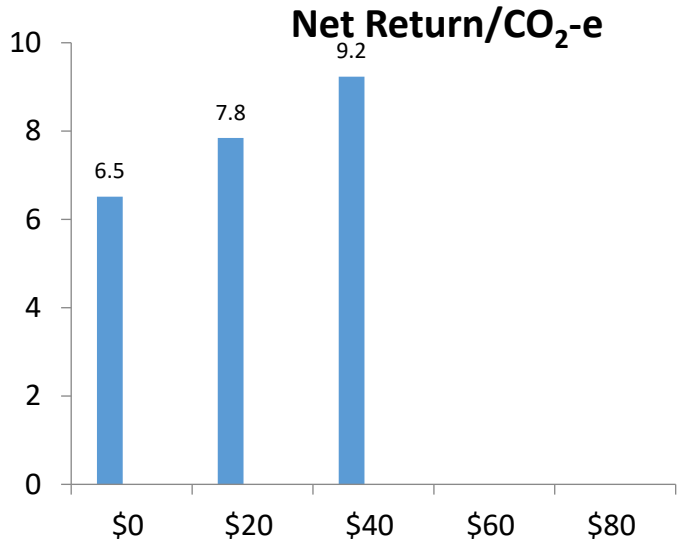




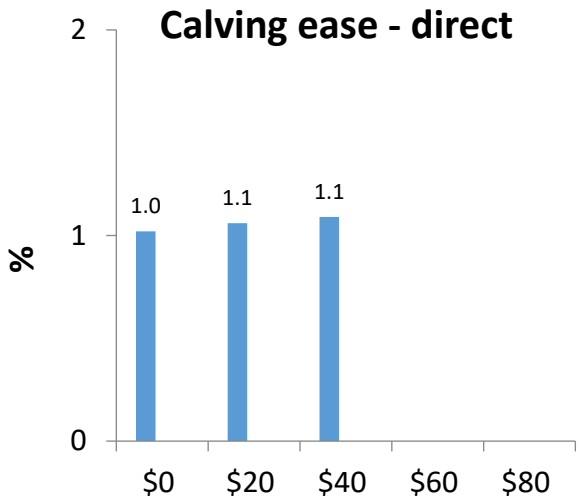
Accounting for CO_2-e

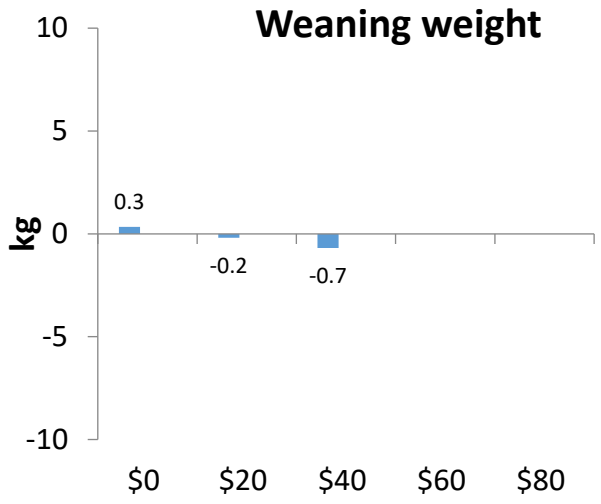


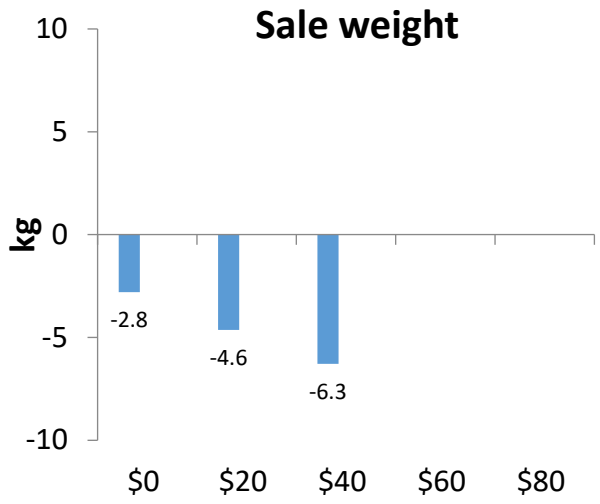


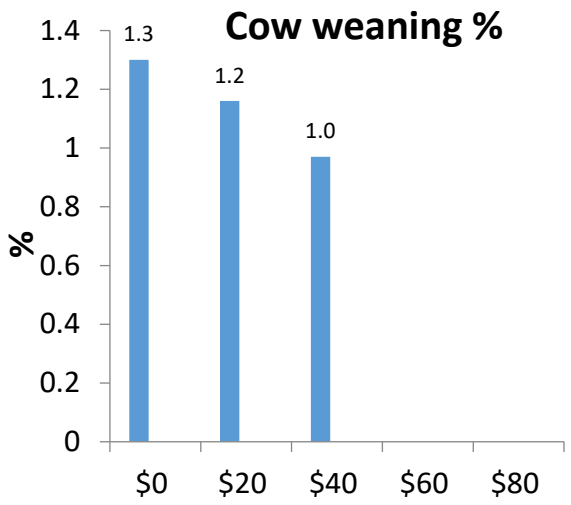


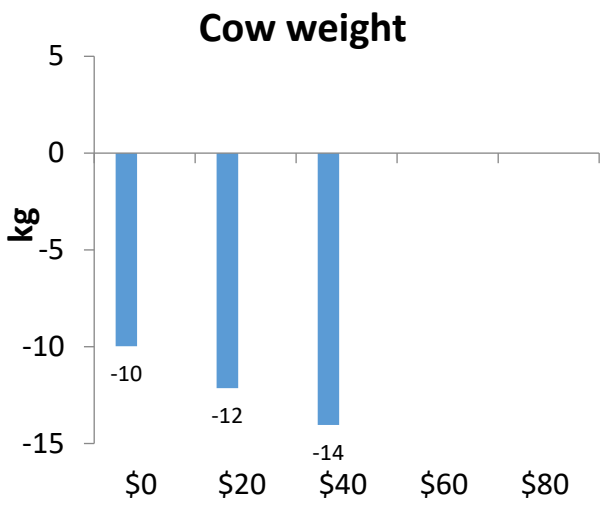
Accounting for CO_2-e – Trait changes

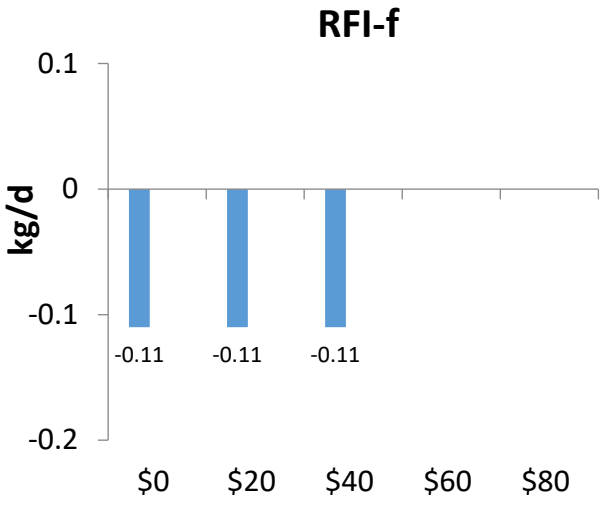




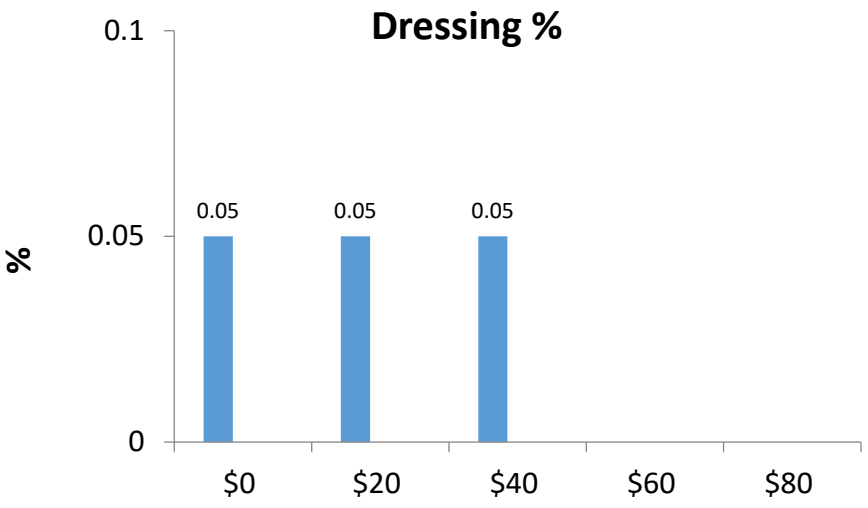




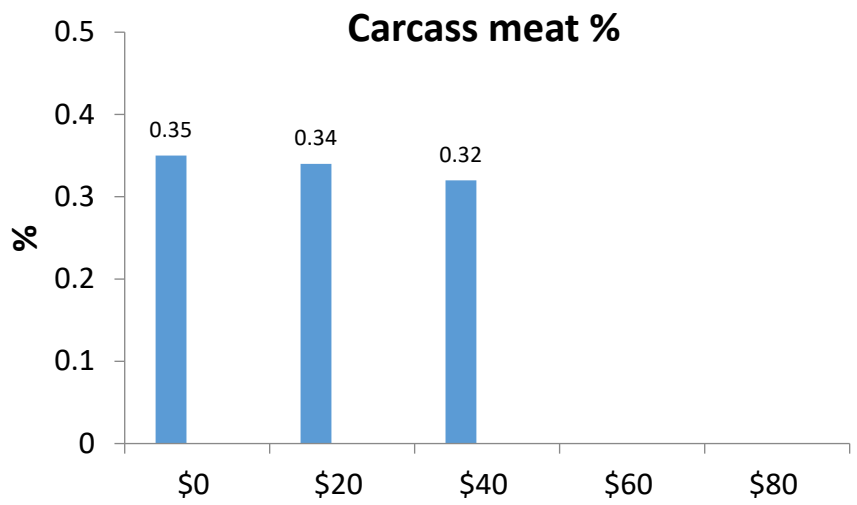




Accounting for CO_2-e – Trait changes



Marbling = 0.02 of a score
= ~ 0.7 - 0.8 IMF



Impacts on Selection Indexes:

Pricing carbon is equivalent to increasing price of feed

- Rankings are sensitive to CO_2-e cost
- Rankings are sensitive to the extent to which feed costs are taken into account
  - Including CO_2-e cost
- Simply pricing feed properly will result in reduced emissions
- The more representative the feed cost
  - less emphasis needed on CO2-e cost
- $0/tonne – can't assume nothing needs to be done

Consequences for Selection Indexes:

- Important to understand cost of feed
  - Frame shift from endpoint targeted $Indexes, to feed cost and endpoint (quality) targeted $Indexes
- Challenge
- Opportunity
  - Under cost = loss in $ return as feed will actually cost more
    = excessive CO_2-e cost needed

Opportunity: Genomic Prediction

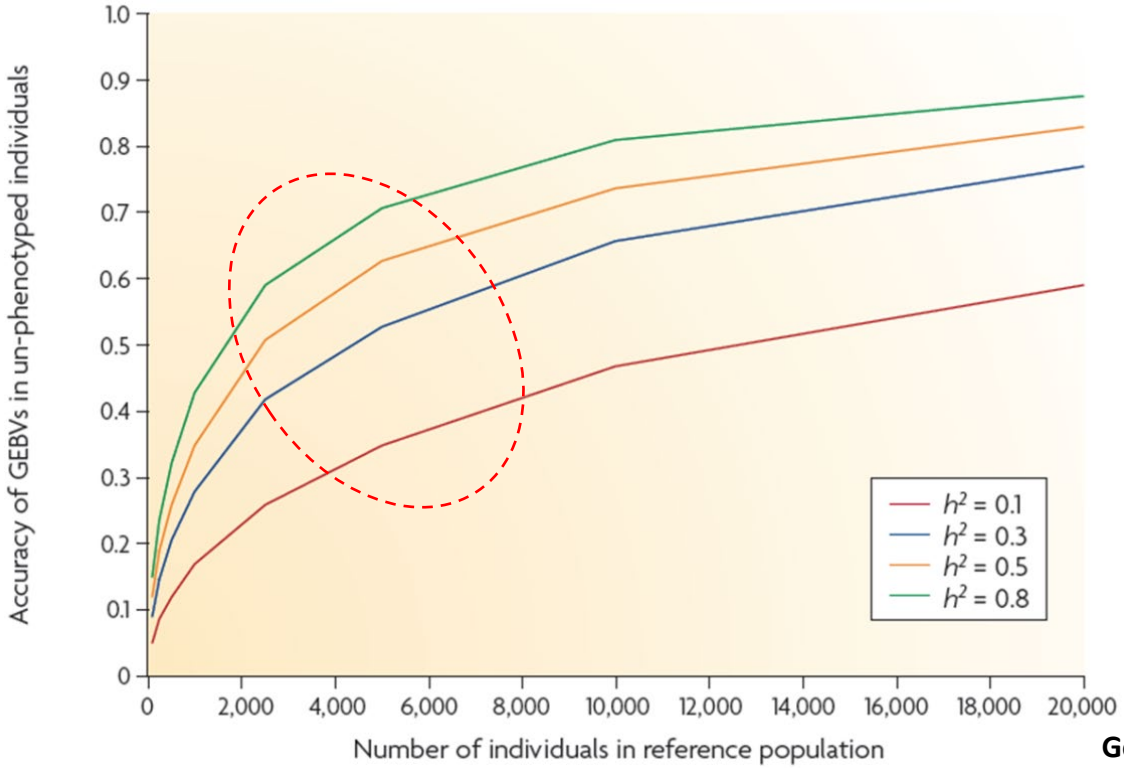
1) measure lots (of animals) phenotypes and their DNA
→ Reference population

2) A breeder tests DNA on young animals

Prediction from DNA → genomic breeding values

Genomic prediction - performance records are Gold:

- The 3 P's of genomics – phenotypes, phenotypes, phenotypes



Goddard & Hayes (2009)

Developments and R&D & Adoption opportunities:

- Current selection emphasis reflects perceived price of feed, and received price of carbon
- Genomics offer scope to accelerate progress in reduction of methane output
- Animal genetic improvement is complementary to plant improvement, and to non-genetic strategies such as supplements
- Investment for the future:
  - Identify best-bet future price of feed
  - Invest in feed intake and methane data in genomic reference populations (eg Beef Information Nucleus etc)
    - @$100 per animal, annual cost ~ $250k; spread over all animals genotyped, could be as little as $0.25 per head
- Selection indexes will optimally weight all traits:
  - Key choice is feed + carbon price 10-15 years out

Livestock of the future:

Traits:

- Similar or smaller adult size
- Improved fertility and product quality
- Improved feed utilisation (=efficiency) and reduced methane output

Production systems:

- Genetic improvement within breeds will potentially enhance value of cross-breeding
  - Driven by the genetic relationships between eating quality and system efficiency (including methane production) (weak), and adaptation and system efficiency (including methane production)