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SPIN-OFF BENEFITS FROM CURRENT GENETIC IMPROVEMENT IN THE NZ SHEEP INDUSTRY AND POTENTIAL FOR ENHANCEMENT

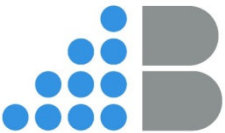
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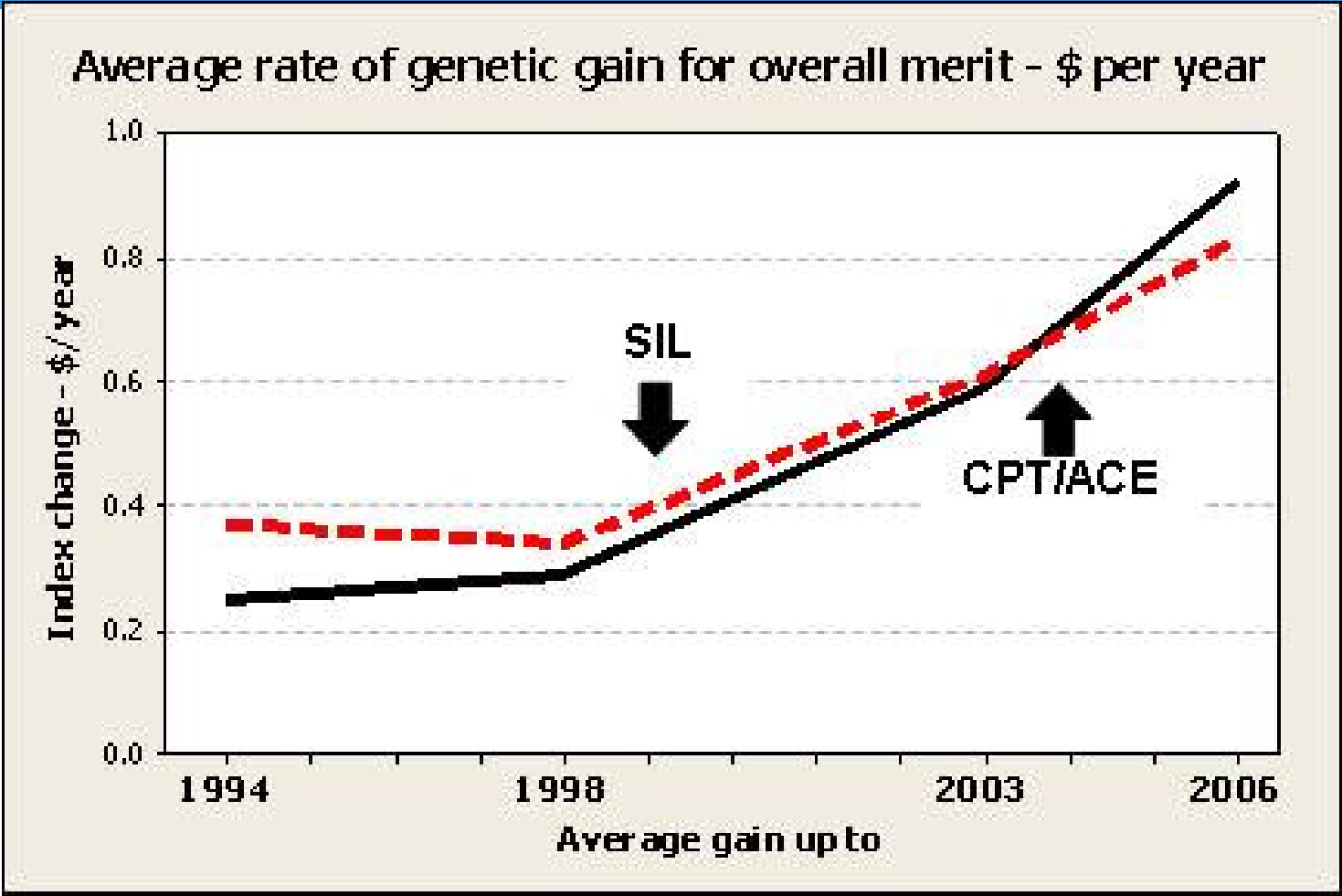
Outline

- Sheep genetic trends in NZ
- Emissions changes from faster growth and more lambs
- Emissions changes with current genetic trends
- Scope for refinement with existing technologies
- Future work

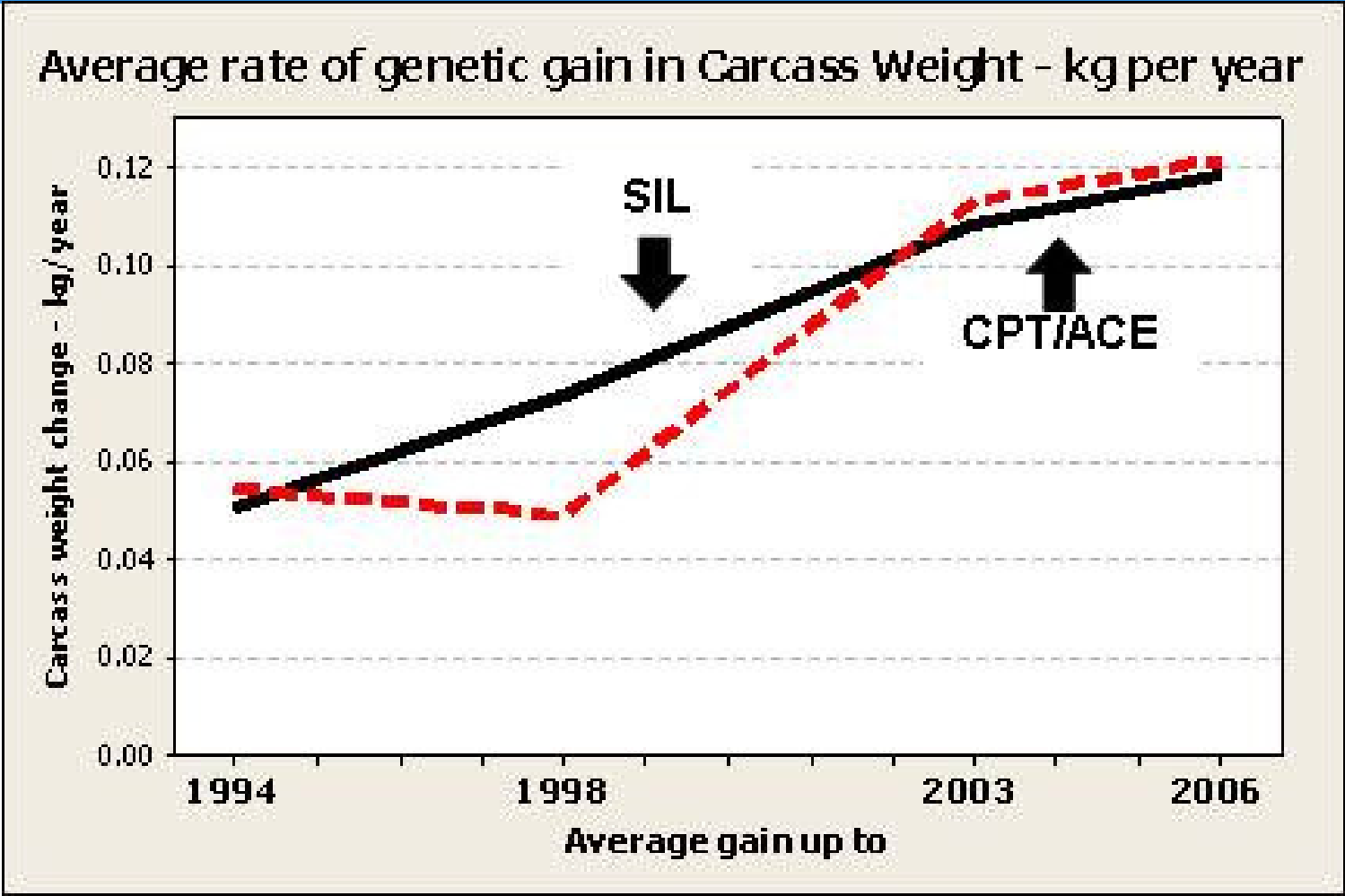
Genetic trends



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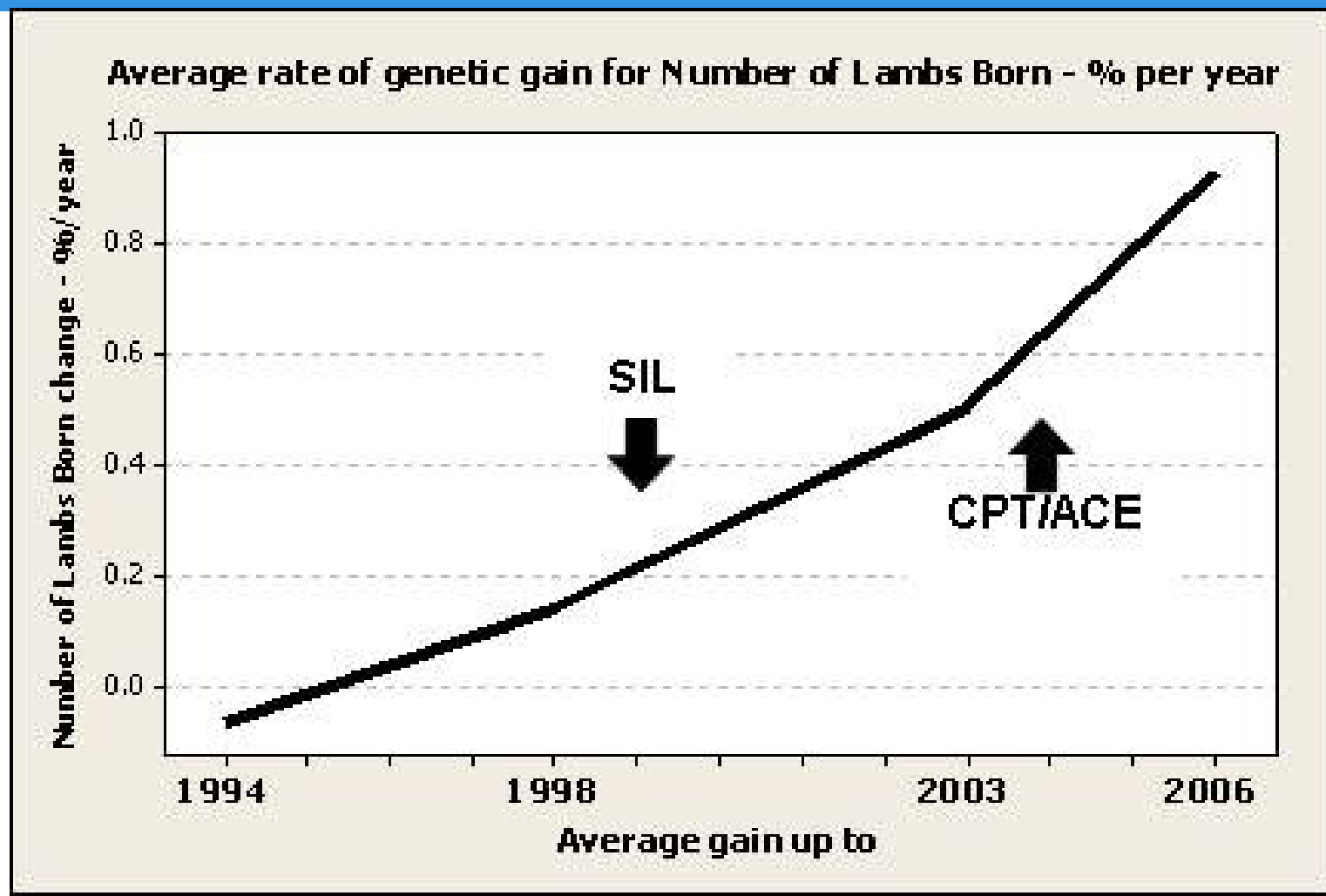
Carcass weight trend



Litter size trend



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What impact on GHG emissions?



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- We have made the assumption that genetic improvement has not changed the relationship between GHG emissions and dry matter intake

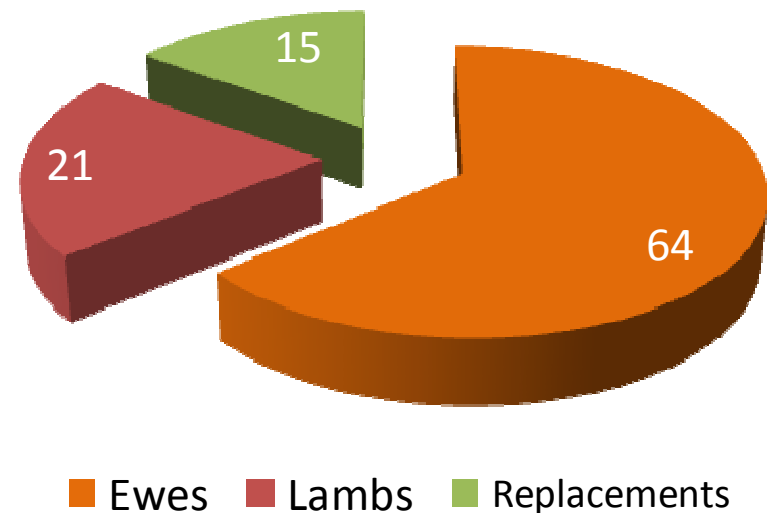
Quantifying emissions

Assumptions

- 65kg ewe
- 434 kg DM for ewe maintenance
- 186 kg DM for preg and lactation
- 204 kg DM for 1.3 lambs to a 17 kg CW
- 146 kg of DM for replacements (per ewe)

- 0.019 kg of Methane per kg of DM intake
- 0.00045 kg of NO₂ per kg of DM
- 0.57 kg CO₂e emissions per kg of DMI (77% Methane)

Breakout



600 kg of CO₂e per lamb slaughtered
35.3 kg of CO₂e per kg of lamb CW
(CH₄ and NO₂)

GHG implications – Carcase weight



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Calculation

- 1 kg extra CW at the same age
- Correlated increase in ewe weight (3.19 kg)
 - feed intake increases by 60 kg DM (e + h)
 - equals 34 kg of CO₂e

GHG implications – Carcase weight

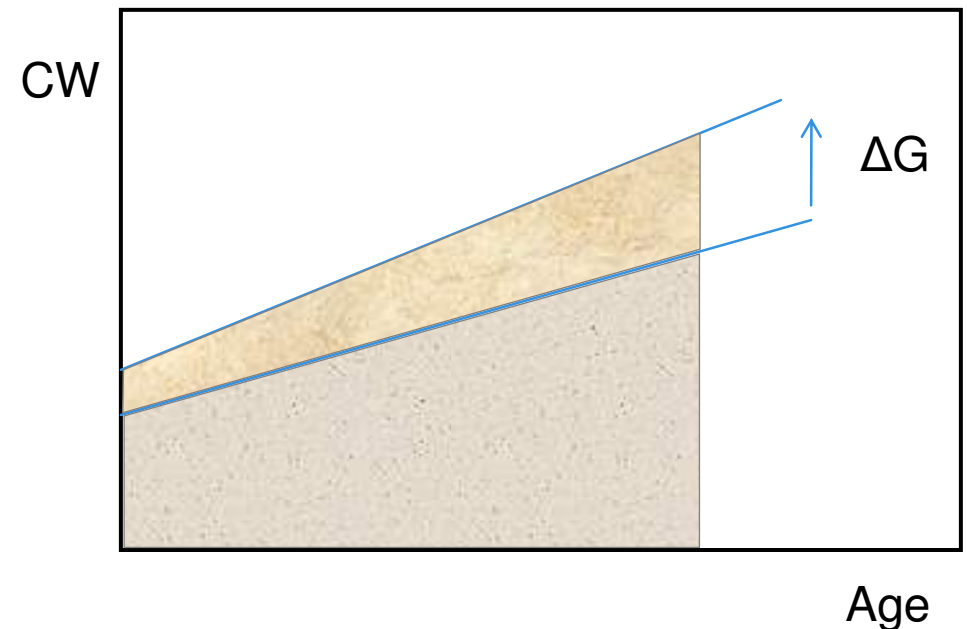


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Calculation

- 1 kg extra CW at the same age
- Correlated increase in ewe weight (3.19 kg)
 - feed intake increases by 60 kg DM (e + h)
 - equals 34 kg of CO₂e
- Slaughter heavier at the same age
 - feed intake increases by 16 kg
 - equals 9 kg of CO₂e

Diagram



GHG implications – Carcase weight

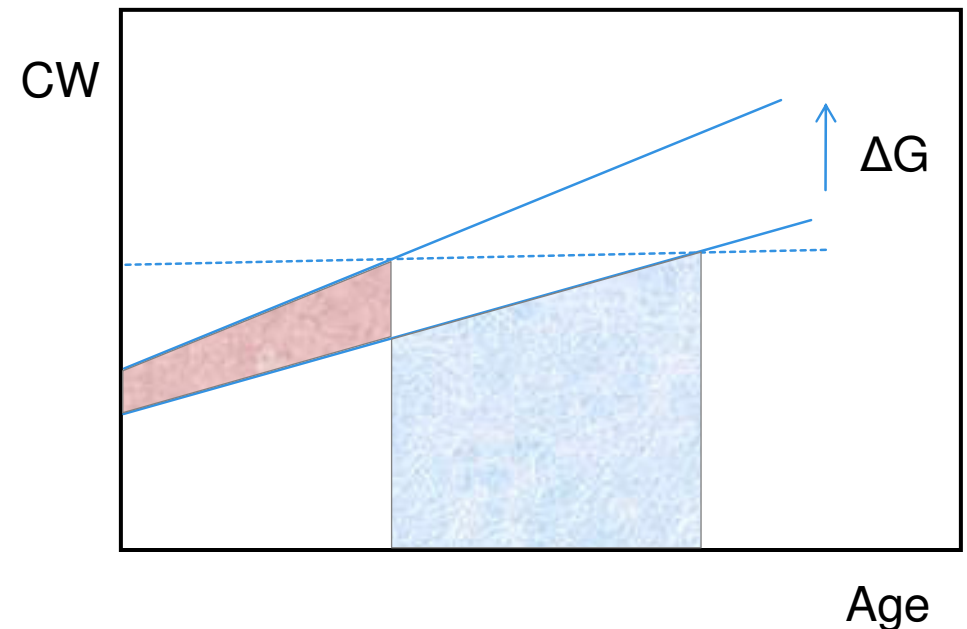


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Calculation

- 1 kg extra CW at the same age
- Correlated increase in ewe weight (3.19 kg)
 - feed intake increases by 60 kg DM (e + h)
 - equals 34 kg of CO₂e per lamb
- Slaughter heavier at the same age
 - feed intake increases by 16 kg
 - equals 9 kg of CO₂e
- Slaughter earlier at the same weight
 - feed intake decreases by 25 kg
 - equals -14 kg of CO₂e

Diagram



Implications for Carcass Weight per unit product



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- Slaughter heavier at the same age
 - 7% increase in emissions
 - 6% increase in product
 - 1.2% increase in emissions per kg of CW
 -
- Slaughter earlier at the same weight
 - 3% increase in emissions per kg of CW

Terminal sires

- Slaughter heavier at the same age
 - 1.5% increase in emissions
 - 6% increase in product
 - 4% reduction in emissions per kg of CW
- Slaughter earlier at the same weight
 - 2.3% reduction in emissions per kg of CW

GHG implications litter size



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- 10% extra lambs born
- 8.5% extra lambs slaughtered
- DM intake increases
 - ▣ 13kg extra DMI for ewes
 - ▣ 9kg extra DMI for lambs

- 2.1% increase in emissions
- 9.5% increase in product output
- 6% reduction per kg of lamb CW

Industry implications

Carcase weight (1 kg - same age)

Litter size (10%)

Maternal

1.2 % increase

6 % reduction

Terminal

4 % decrease

**30% of lambs slaughtered are by terminal sires

Breeding implications

Dual purpose

- ❑ Carcase weight takes an economic weight of approx \$2.00 per kg improvement
- ❑ Accounting for GHG emissions would take off approx 40 cents (20% decrease)

- ❑ Litter size takes an economic weight of \$24.30
- ❑ Accounting for GHG emissions would add on approximately \$6.80
- ❑ (28% increase)

Terminal sire

- ❑ Carcase weight takes an economic weight of approx \$2.00 per kg improvement
- ❑ Accounting for GHG emissions would add on approx 40 cents (20% increase)

Breeding implications

Dual purpose

- 20% smaller weighting for carcase weight
- 28% bigger weighting for litter size

Terminal sire

- 20% bigger weighting for carcase weight

Industry trends

- Current genetic trend 0.12 kg CW per annum
- 0.02 less kg of CO₂e per kg CW per year

- Current genetic trend 1% NLB per annum
- 0.21 less kg of CO₂e per kg CW per year

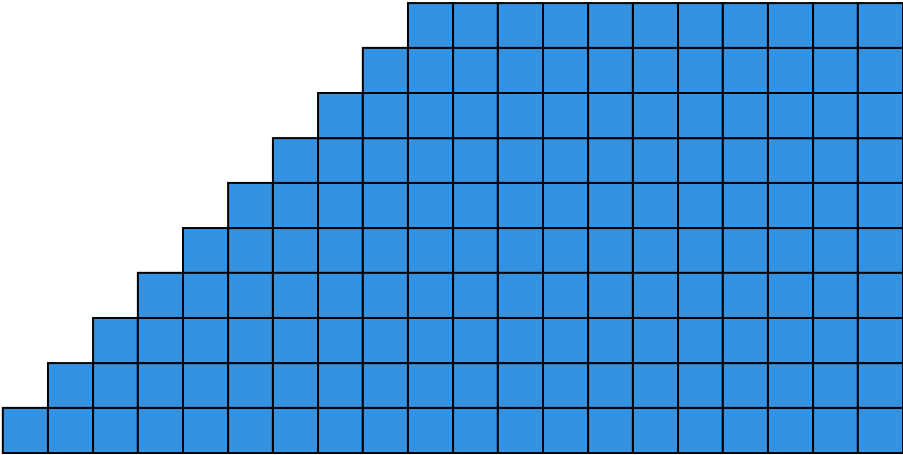
- combined 0.23 less kg of CO₂e per kg CW per year
- 360,000 tonnes of CWe exported
- $0.23 \times 360,000 \times \$25 = \$2.07\text{M}$ per annum compounding

- 10 years national discount rate of 3.5% = \$93M

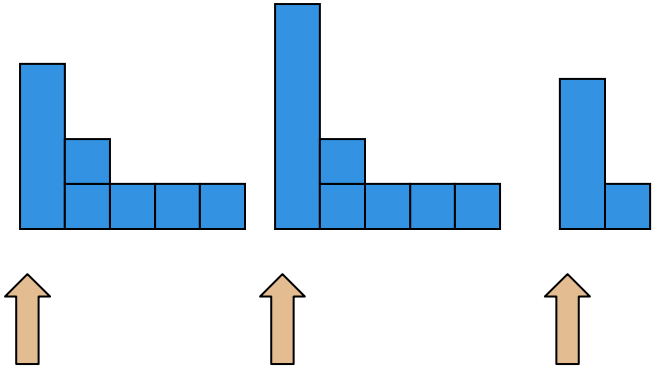
- In 10 years time emissions per kg of lamb 6% lower due to genetics

Permanent and Cumulative

Genetic Improvement



Nitrification Inhibiting Fertiliser



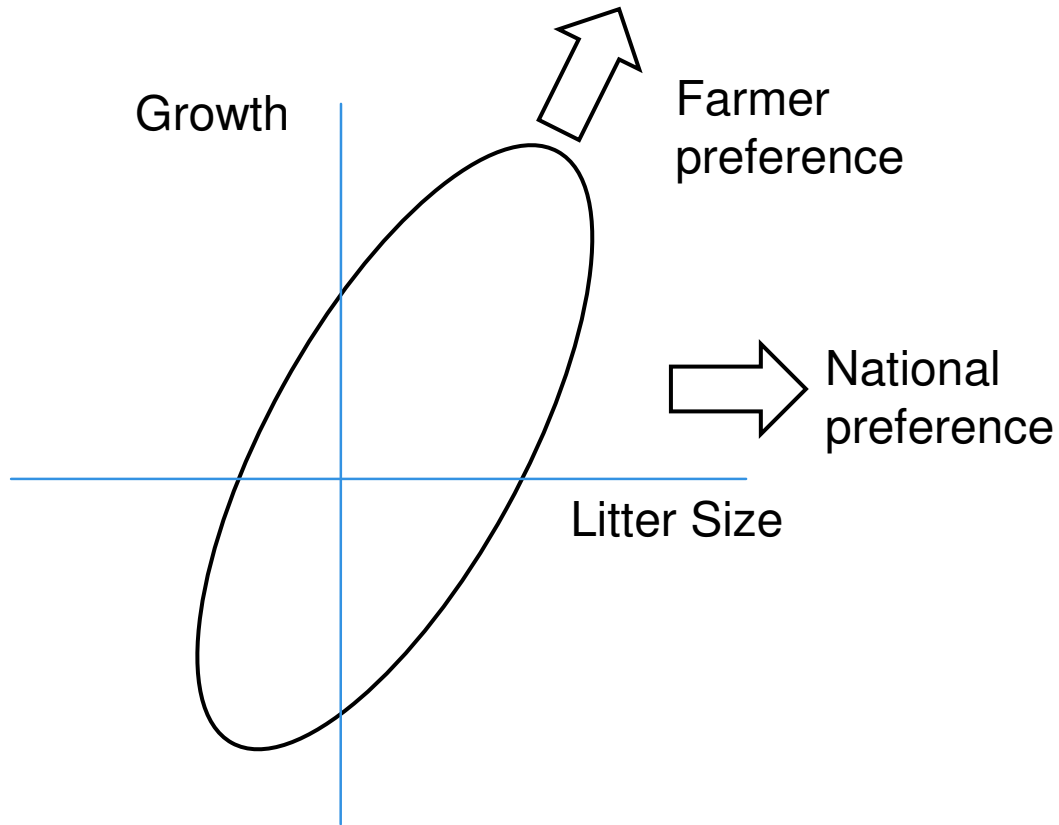
Scope for refinement

- Improve rate of response (Genomic technologies)
- Redirect response to GHG friendly traits
 - ▣ Change index weightings
 - ▣ Make friendly traits easier to improve (Genomic technologies)
- Research needed for better understanding of what traits to focus effort on (farmer motivation vs. technical limitation)
 - ▣ Less kg of ewe weight per kg of CW
 - ▣ Lamb survival
 - ▣ Ewe survival
 - ▣ Disease resistance

Redirecting trends



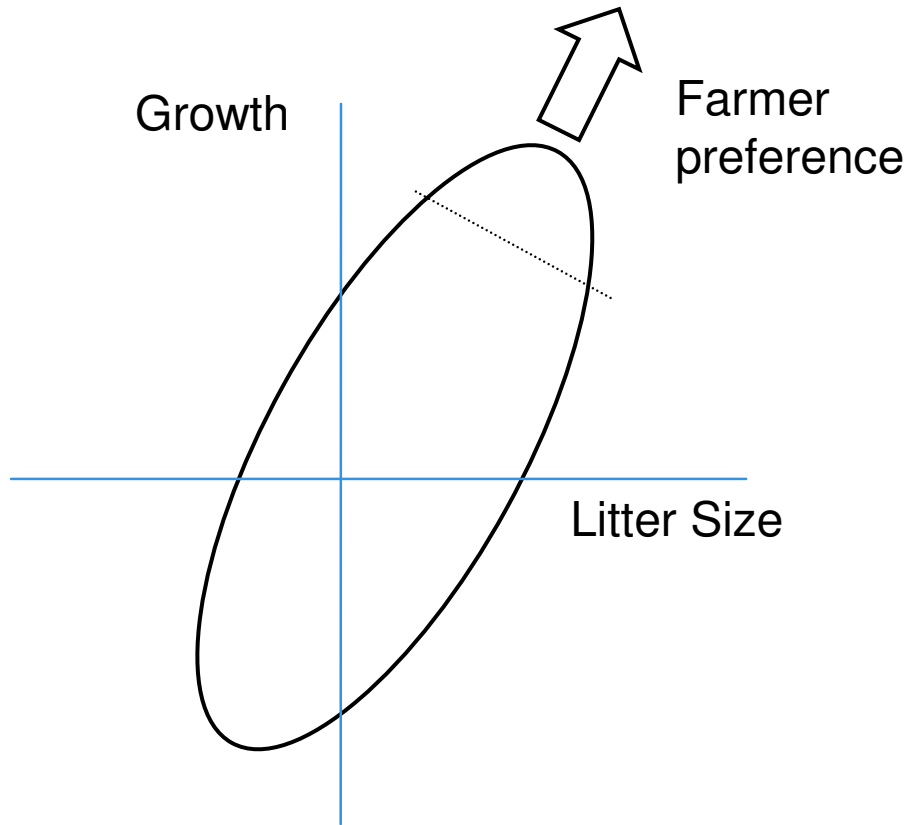
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Redirecting trends



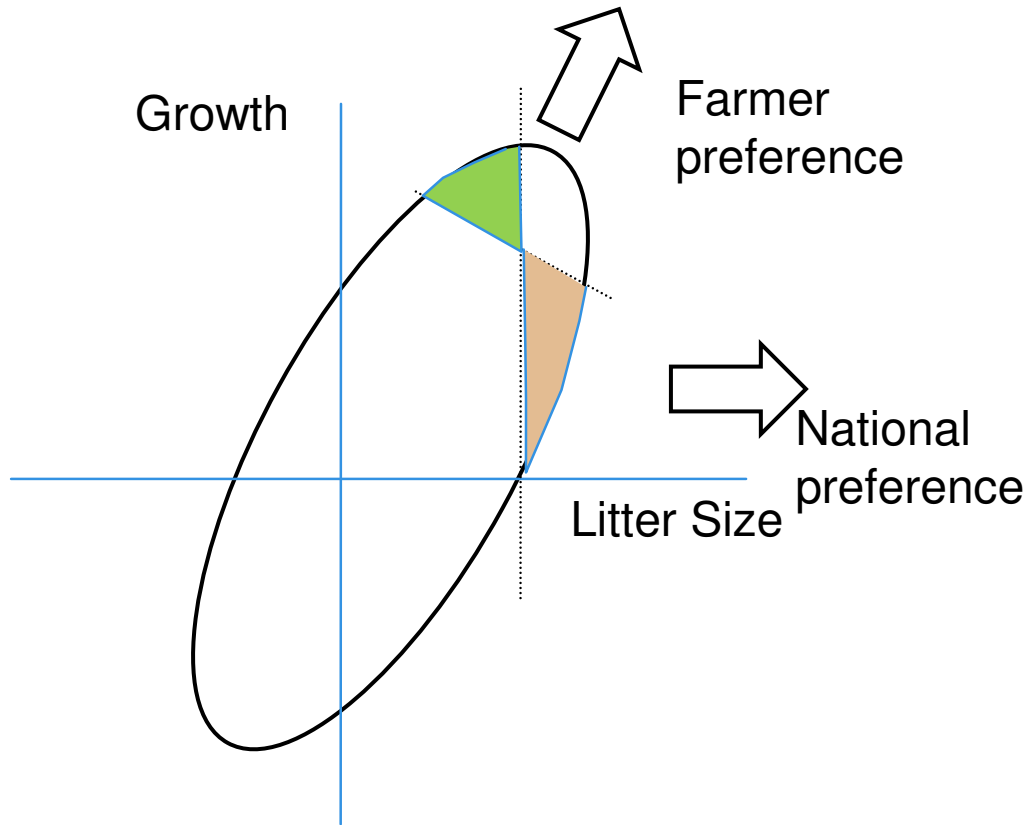
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Redirecting trends



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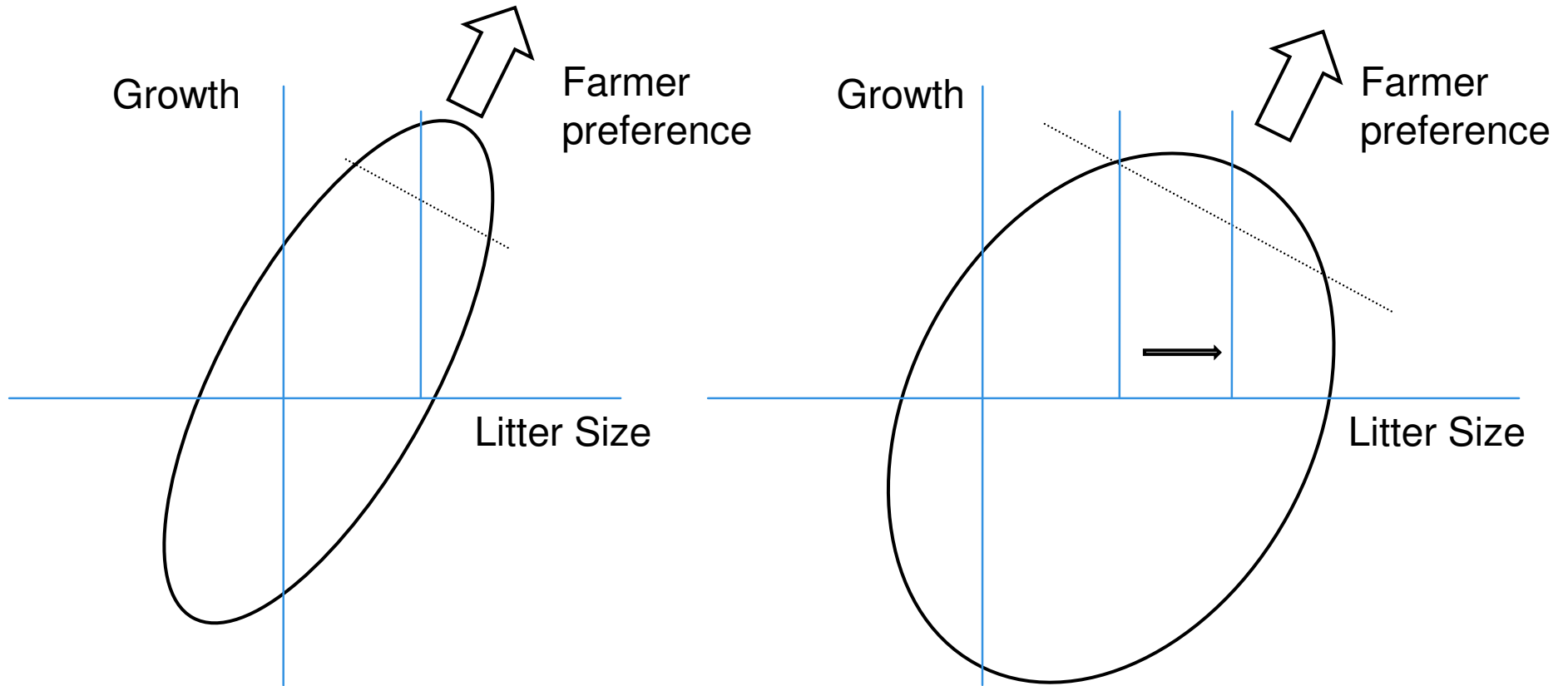


Ram sellers competing for market share in a declining market!!

Redirecting trends



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Make it easier for farmers to meet their preferences using trait changes that fit the national benefit

Scope for refinement

- Develop selection methods to improve feed efficiency
 - ▣ what value for GHG emissions reductions and what adoption by breeders and farmers?
- Develop selection methods to reduce emissions per unit of feed
 - ▣ What will drive farmer adoption?

Implications

- Modest benefits from conventional selection
- Modest scope to improve these without complex and expensive measurement
- Development of new selection criteria will magnify benefits but we need to be mindful of practical implications and breeder uptake
 - ▣ Ewe efficiency ✓✓✓
 - ▣ Methane output ???