# Genetic Improvement Programmes

# Key Considerations

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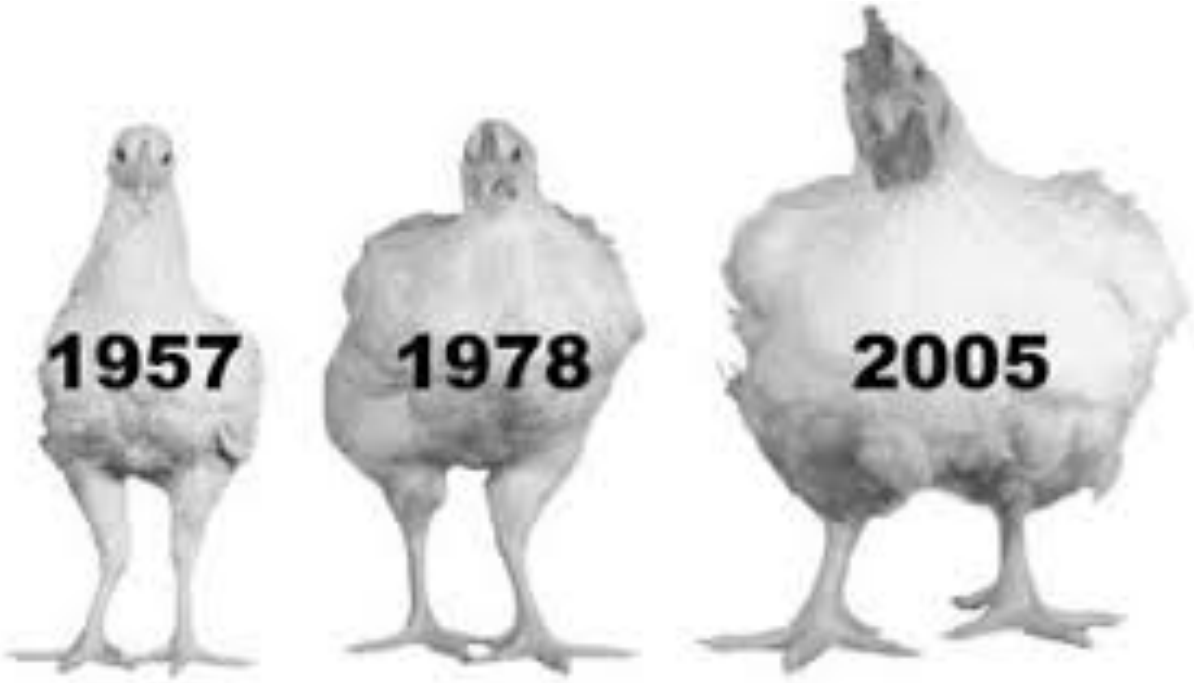
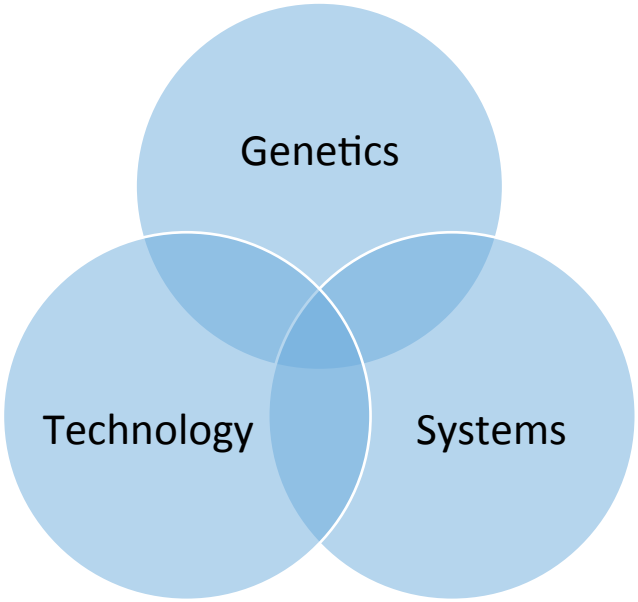
# The power of genetics




**0.9 kg** **1.8 kg** **4.2 kg**

# The practical application of genetics




# Genetic improvement programme

- Key principals
  - Record performance of animals
  - Use high performing animals as parents of next generation

- Effectiveness
  - how heritable the traits are
  - How much variation exists within the trait

# Three core components


1. Value proposition for farmers
   - Traits selected must be profitable in farm system and for market

2. Simplicity of implementation on-farm
   - Traits are easy to record
   - Data is stored and accessible
   - Outputs are easily understood

3. Well-designed breeding programme
   - Structured mating
   - Best genetics are cost-effectively disseminated

# 1. The value proposition

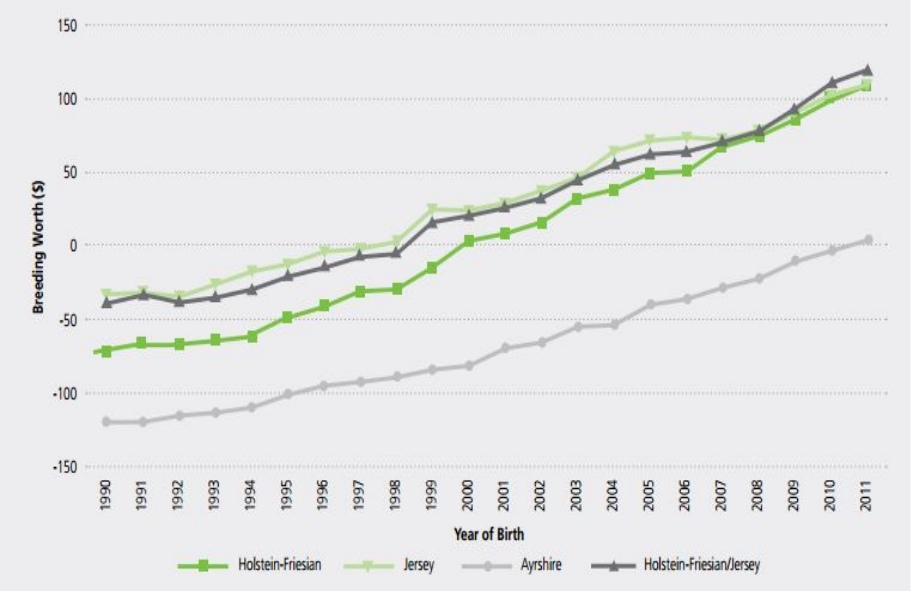
- The breeding goal
  - What is the particular task?
  - What is the ideal animal to complete the task?

  Where does the profit come from?
- What are the main costs?

- The breeding objective
  - Traits with economic weightings
  - Which traits are profit earners and which are not?
  - Relative impact of different traits on overall farm profit

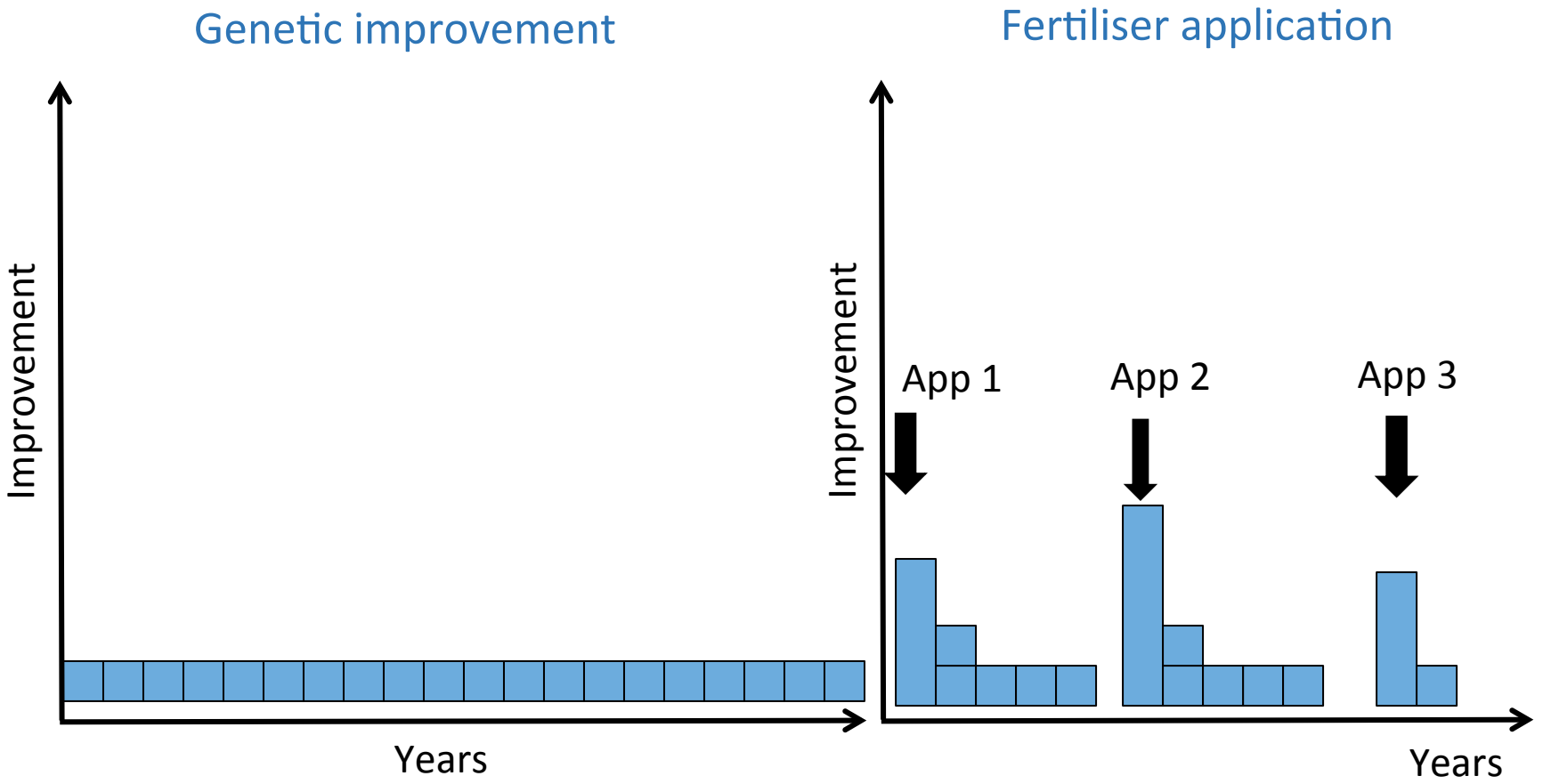
# 1. The value proposition

- Genetic improvement programmes have yielded outstanding results in NZ primary industry
- Example: NZ Dairy cow industry = $300M per year of genetic gain

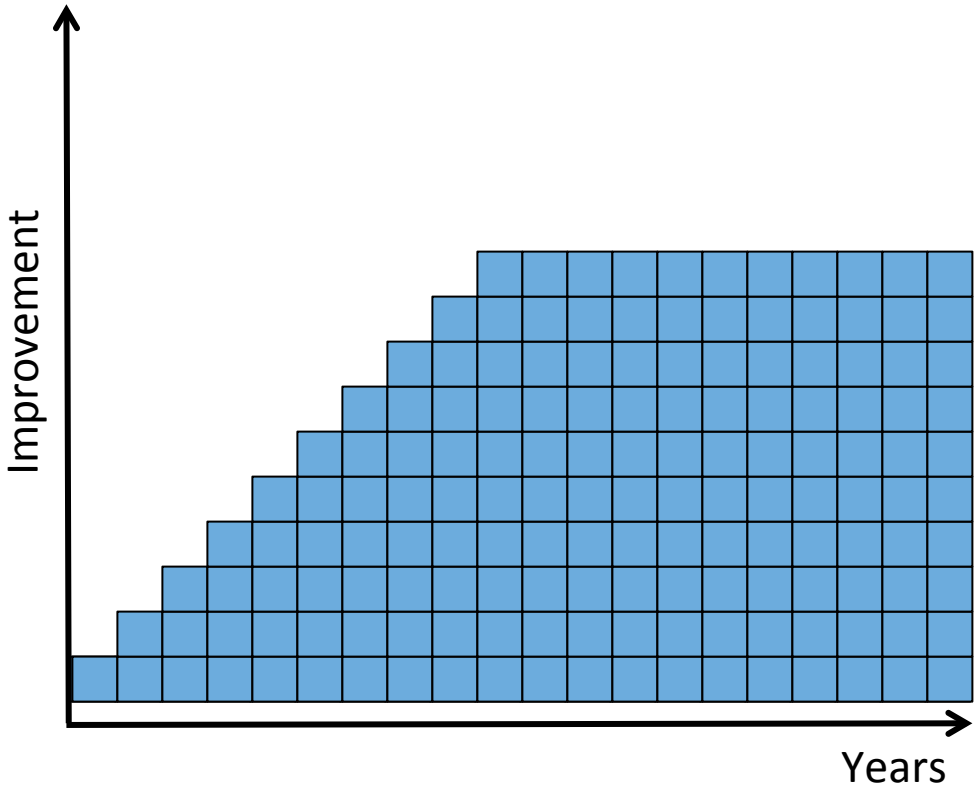



Genetics & Profit
Hand-in-Hand

# How genetics add value?
# It is permanent

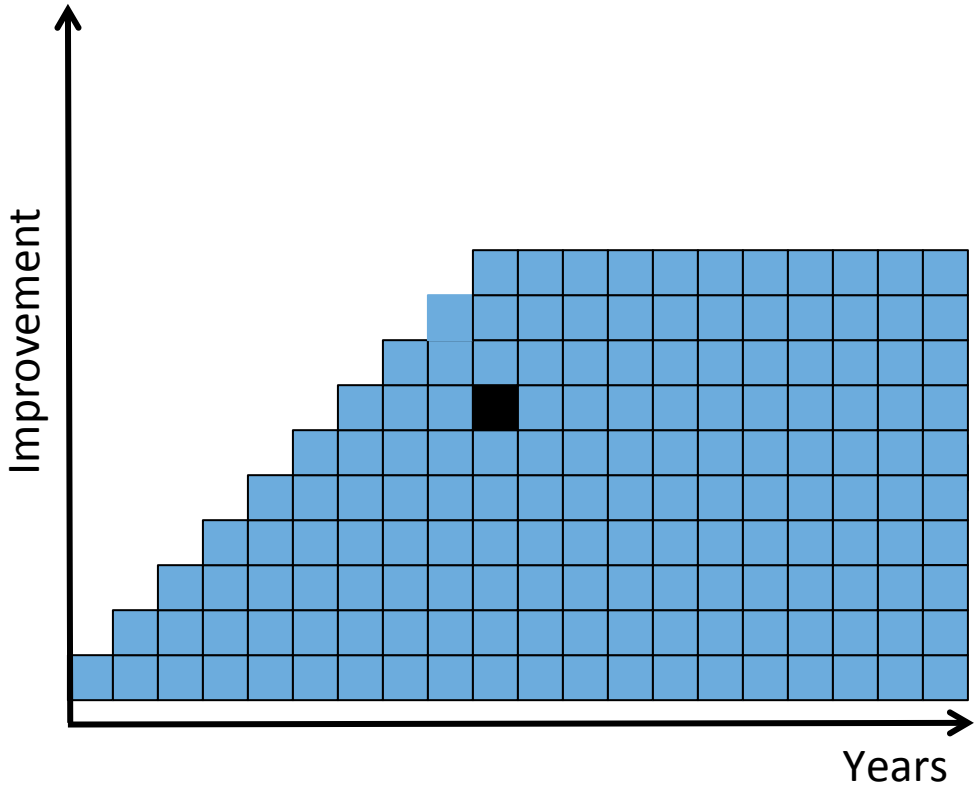


# How genetics add value? It is permanent & cumulative




10 years genetic improvement over 20 years

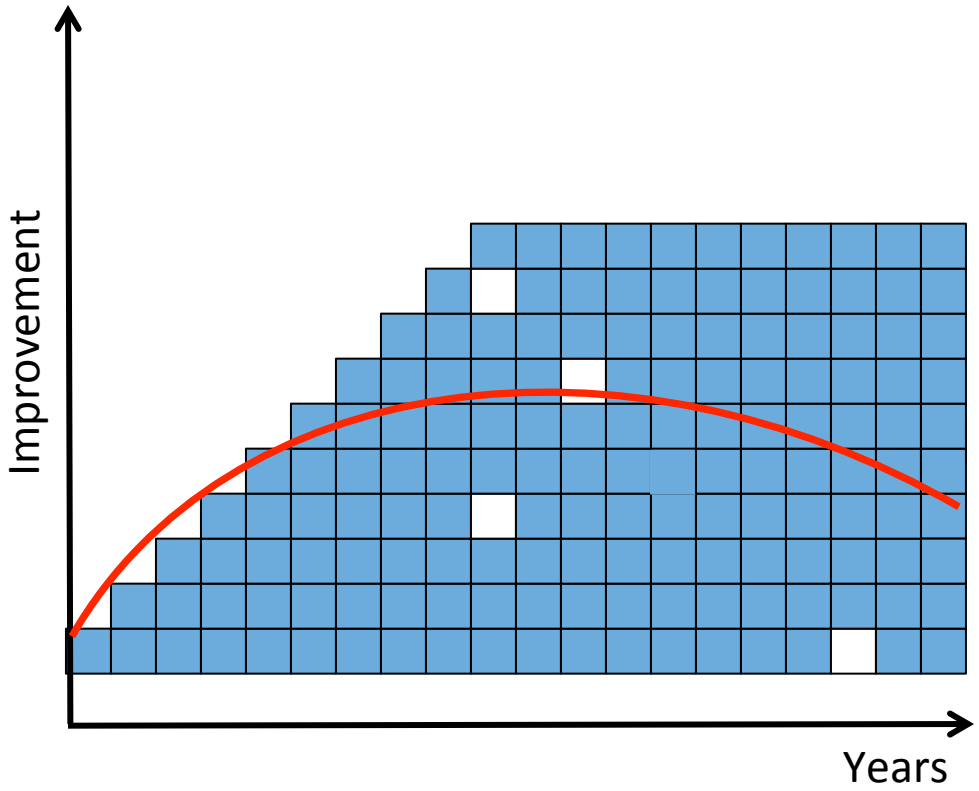
# How genetics add value? It is a multiplier




10 years genetic improvement over 20 years

Multiplier = 155 gains

# It has multiple gains but long-term game

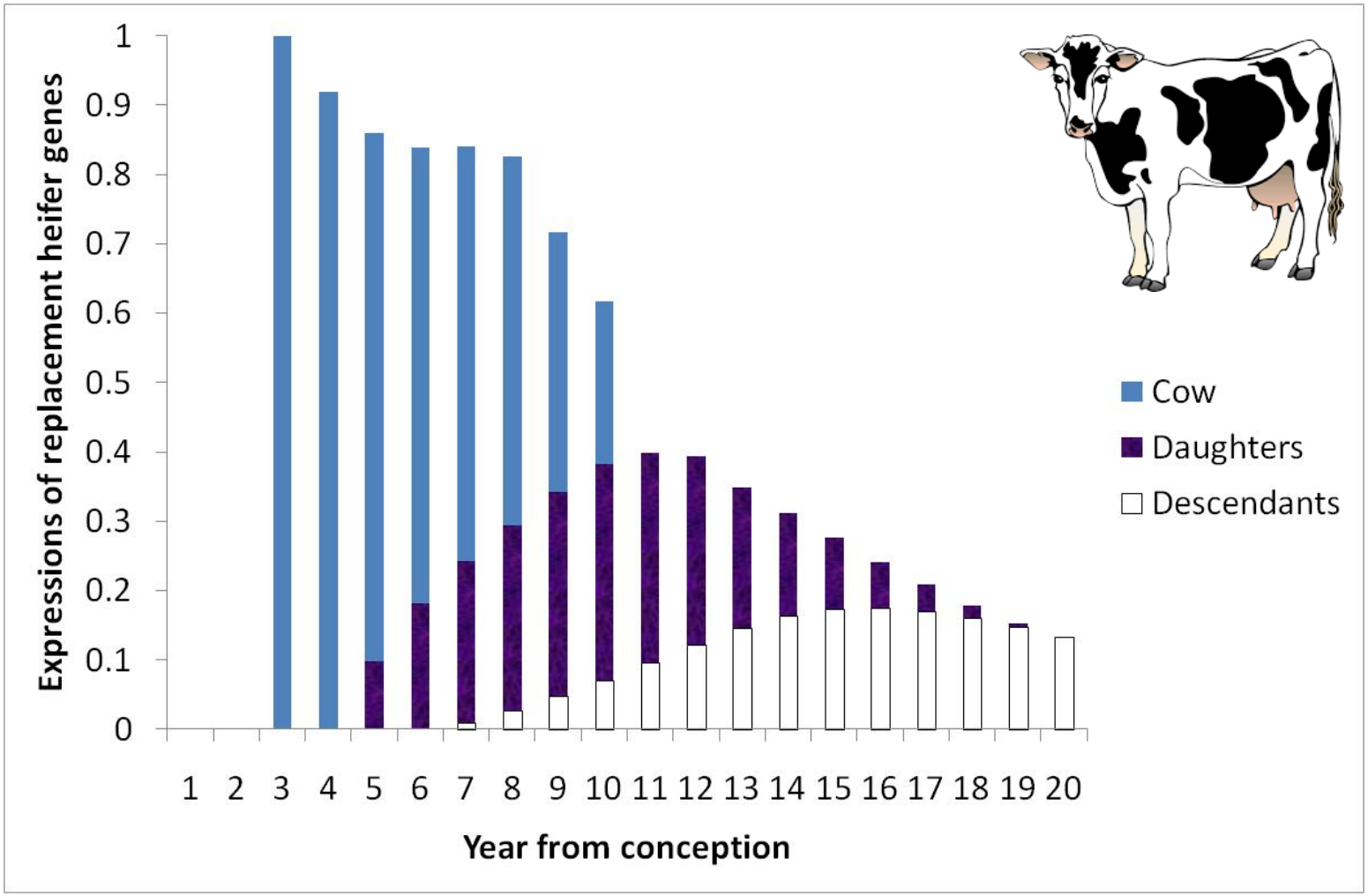



10 years genetic improvement over 20 years

Multiplier = 155 gains

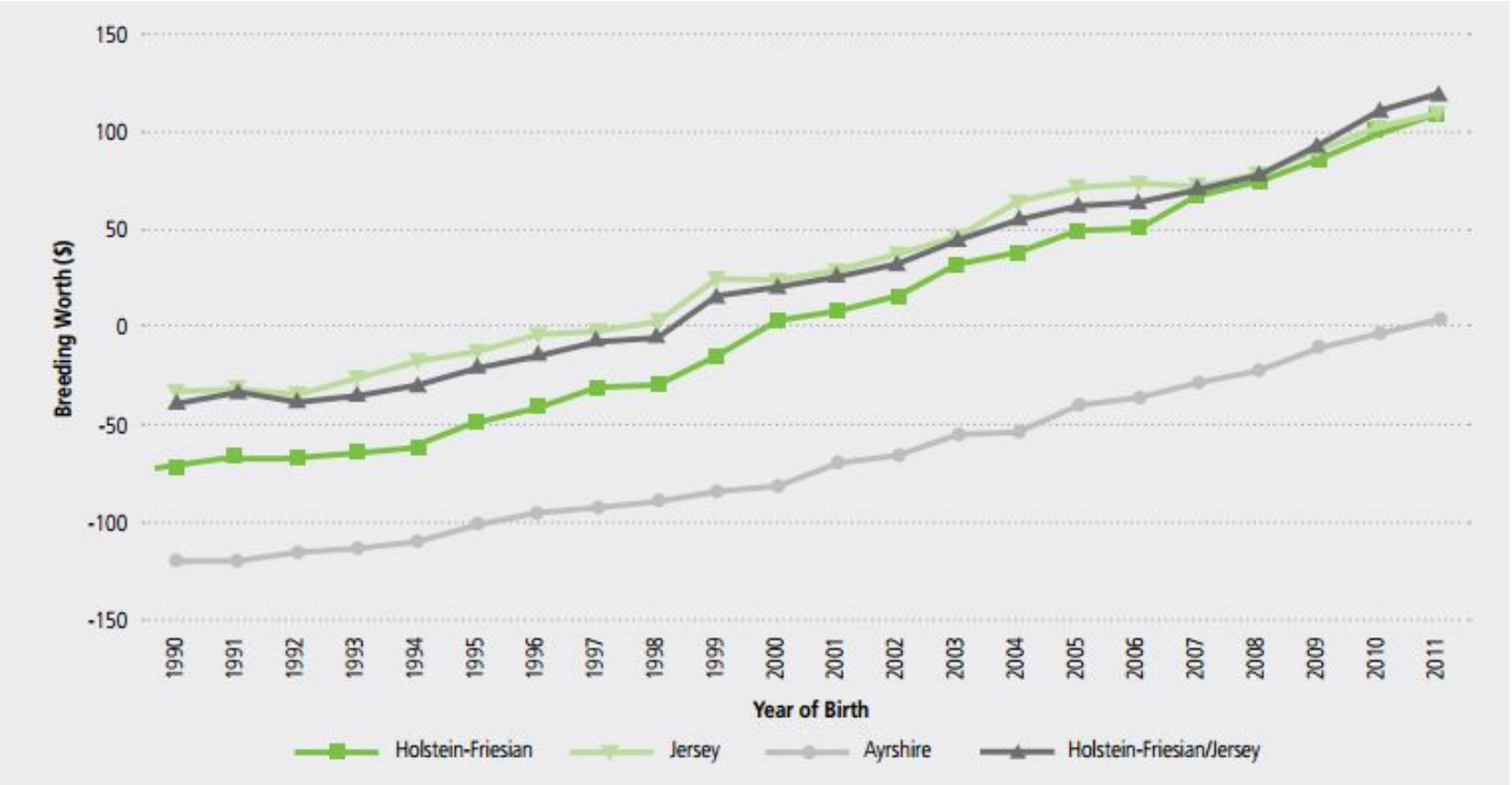
Discount 7% = 75 gains

# Gains have to be disseminated

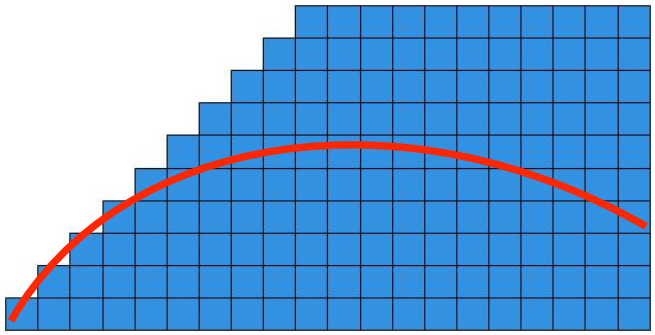


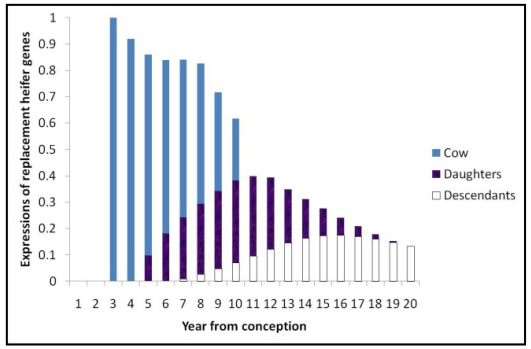
# What are the gains worth per cow?

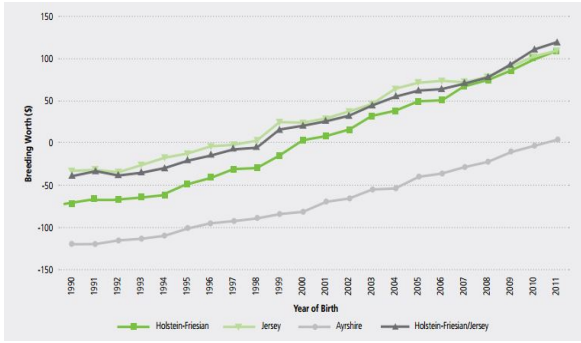
Profit Δ = $10/ cow/ year



# How genetics adds value to industry?






75 × 5.4 × $10 per year

= $3 billion
$300M per year of genetic gain

× 740,000 heifers per annum

# 2. Simplicity of implementation on-farm

- Data required for breeding objective needs to be easy to record
  - Parentage
  - Selection criteria – traits to be measured

- Milk yield
  - Objective – improve milk yield
  - Selection criteria – daily milk yield OR 7-8 herd test records over lactation

- Reduce Mastitis
  - Objective – reduce mastitis
  - Selection criteria – SCC

# 2. Simplicity of implementation on-farm

- Data can be easily stored
- Data is secure and accessible
  - Genetic evaluations
  - Output interpretable results



Industry options


Private options

# 3. Industry breeding scheme designs

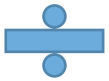
How fast and cost-effective can we get to where we want to go?

**Rate of genetic progress**

Selection intensity

Genetic standard deviation

Accuracy of selection



Generation interval

**What are the drivers?**

- Select and disseminate superior animals
- Scale – within flocks or across industry
- Available reproductive technologies

- Heritability of trait
- Variation of trait in population

- Quality of records
- Amount of information from relatives

- How long it takes to disseminate genes through the population

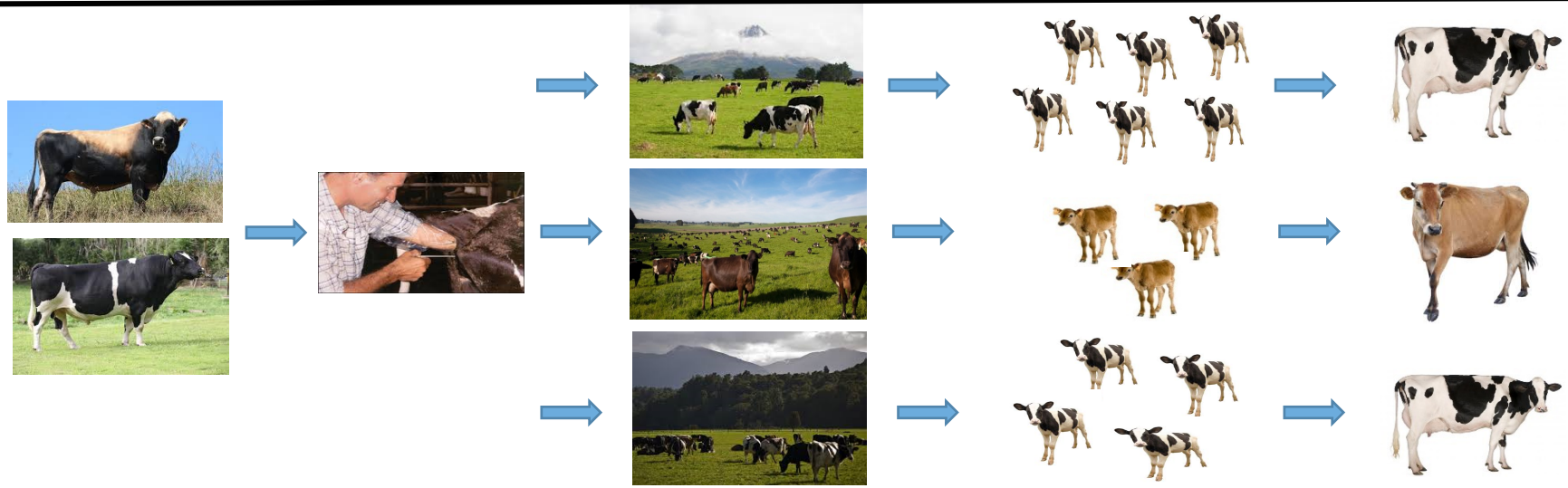
# 3. Industry breeding scheme designs

- Number of different designs
  - Used exclusively or in combination

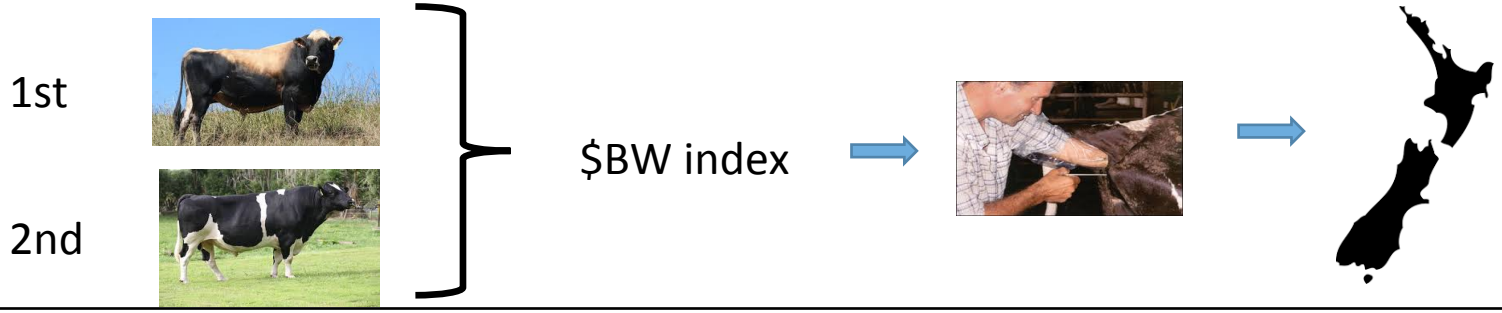
  - Progeny testing
  - Genomic selection
  - Cross breeding

# Classical Progeny Testing: NZ Dairy Industry

*Sire proving scheme*



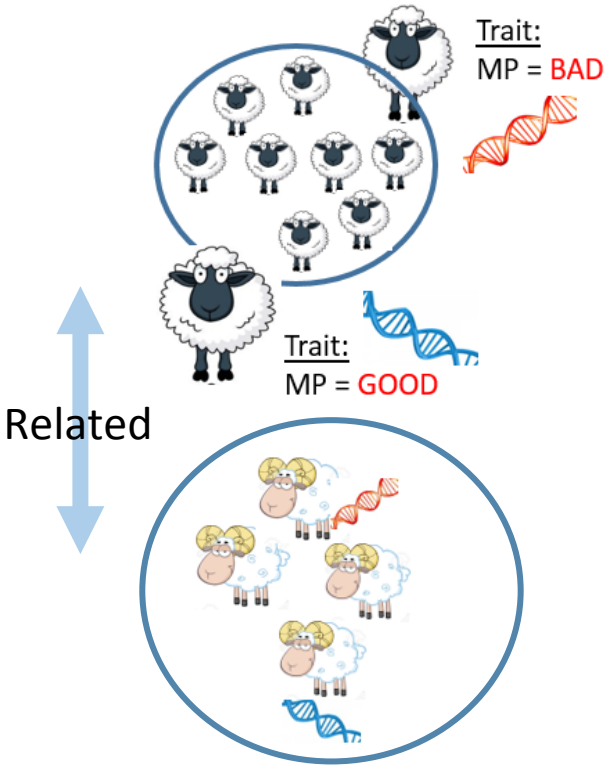
*Effective dissemination*



# Genomic selection

Genetic markers associated with performance traits

*Training population: genotyped & well recorded performance traits*




- If two animals share same markers they are likely to be genetically similar
- If they carry a specific marker and have performed better in the past, having a copy now is favourable
- Better use of information from relatives

*Young selection rams: genotyped*

# Crossbreeding: NZ Deer Industry

- Producing an animal by mating two different species or breeds

International park deer

NZ wild deer

NZ farm deer

# Sheep milk genetic improvement in NZ?

EMERGING

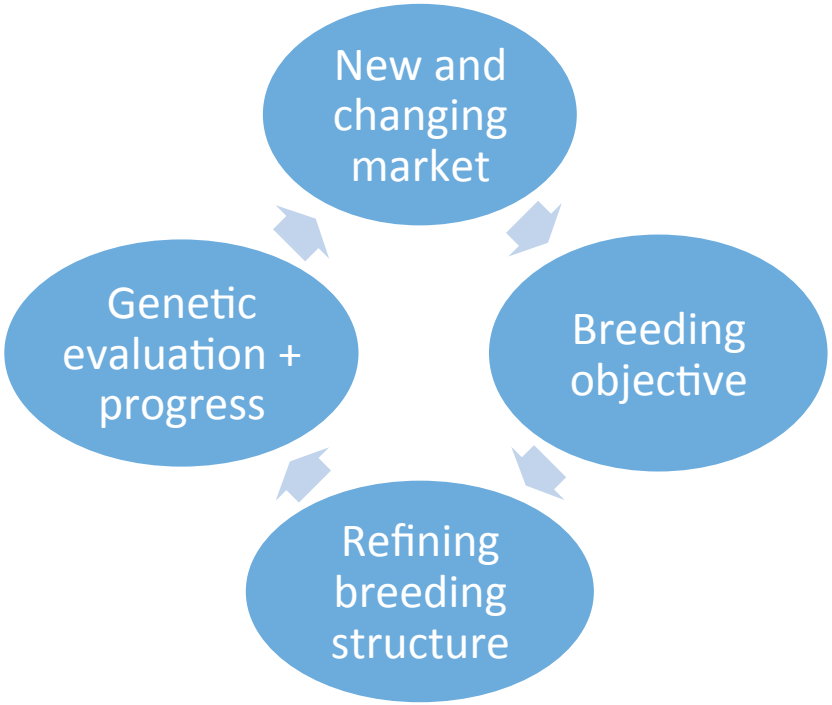
**Genetics**

Gene pool establishment
Gene pool assessment
Gene pool expansion

**Management**

Formation and refinement of management

MATURING



# Challenges for an industry improvement programme

- Developments will need driven by entrepreneurs
  - no co-ordinated industry body to fund development
- During emergence difficult to establish industry breeding objective
  - Rapid changes in desired genotypes and production systems
- Entrepreneurs can view formal involvement in an industry genetic improvement as threat to their own marketing strategies

# Co-operation or Competitive or Co-opetition?

- Is it the right time to have industry genetic improvement programme?
- What would a good business model look like?

- Co-operation advantages
  - Scale - identify the best of the best in NZ
  - Avoid duplication costs of infrastructure

- Competitive advantages
  - Motivation, speed and effectiveness

- Co-opetition advantages
  - Share costs of infrastructure
  - Allows for market differential

# Thank you

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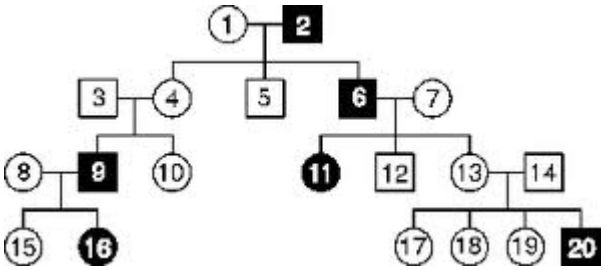
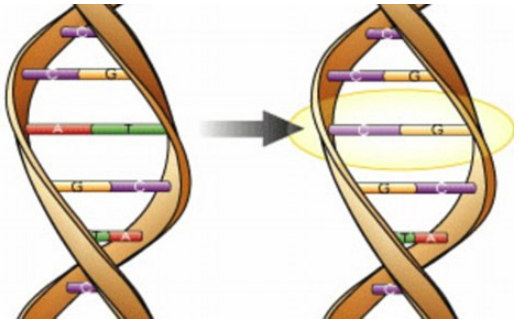
# Genomic selection



Better use of information from relatives

If two animals share many of the same markers they are likely to be genetically similar

Tracking individual genetic loci

Animals that carry a specific marker have performed better in the past, so having a copy now is favourable