



Basics of Genetic Evaluations

Dr Sinead McParland

Teagasc Moorepark

Advances in Animal Breeding Webinar

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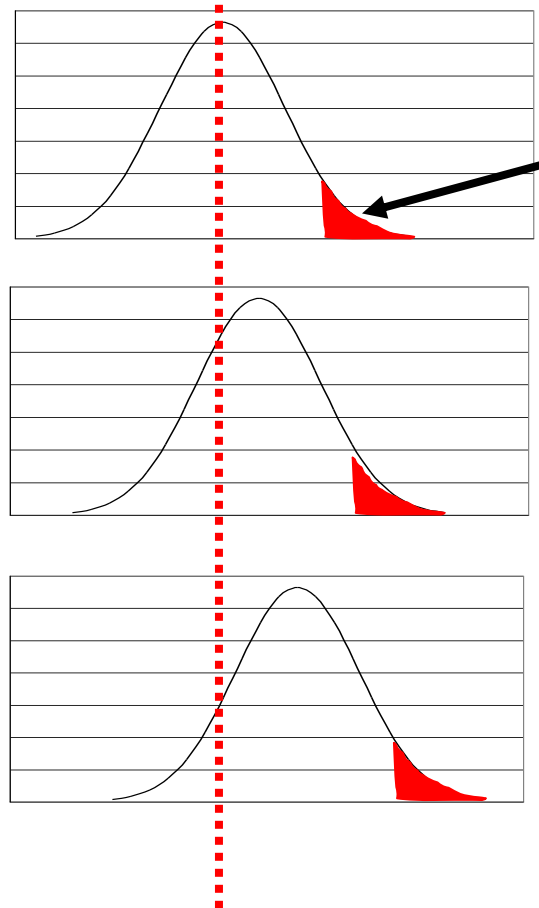
1957
905g



2005
4,202g

Genetic Gain: Improvement seen each generation

Parents of the next generation

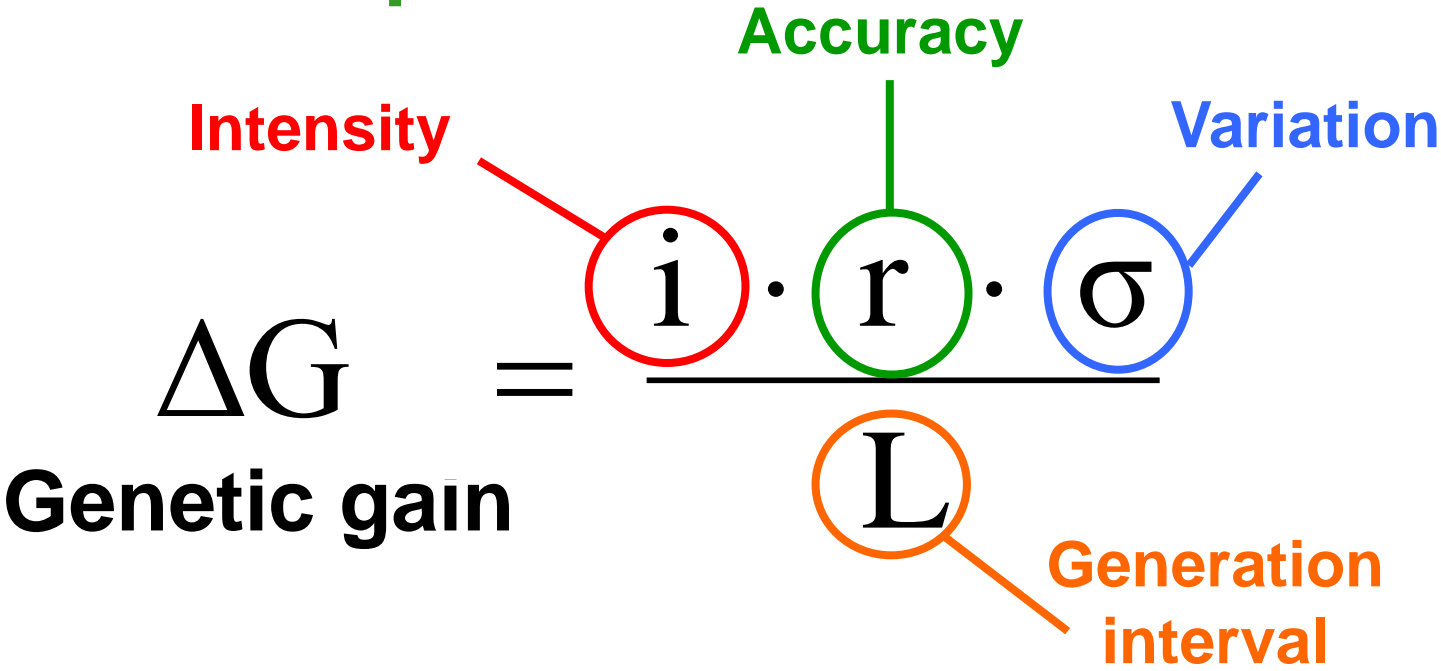


Genetic Gain Equation

Intensity **Accuracy** **Variation**

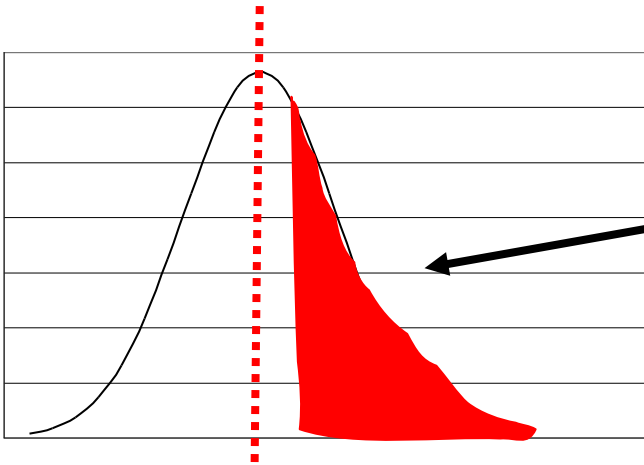
$$\Delta G = \frac{i \cdot r \cdot \sigma}{L}$$

Genetic gain **L** **Generation interval**

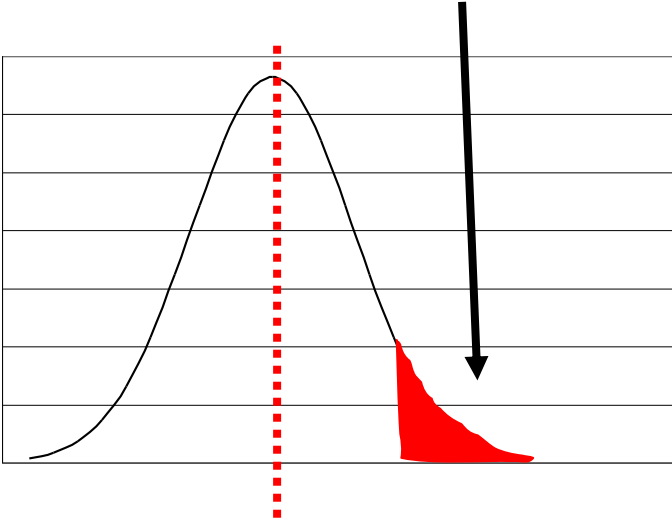
The diagram illustrates the Genetic Gain Equation, $\Delta G = \frac{i \cdot r \cdot \sigma}{L}$. The variables are color-coded and labeled with arrows: 'i' is circled in red and labeled 'Intensity'; 'r' is circled in green and labeled 'Accuracy'; 'sigma' is circled in blue and labeled 'Variation'; and 'L' is circled in orange and labeled 'Generation interval'. The text 'Genetic gain' is positioned to the left of the equation.

1. Intensity of Selection

$$\Delta G = \frac{\dot{i} \cdot r \cdot \sigma}{L}$$



Parents of the next generation



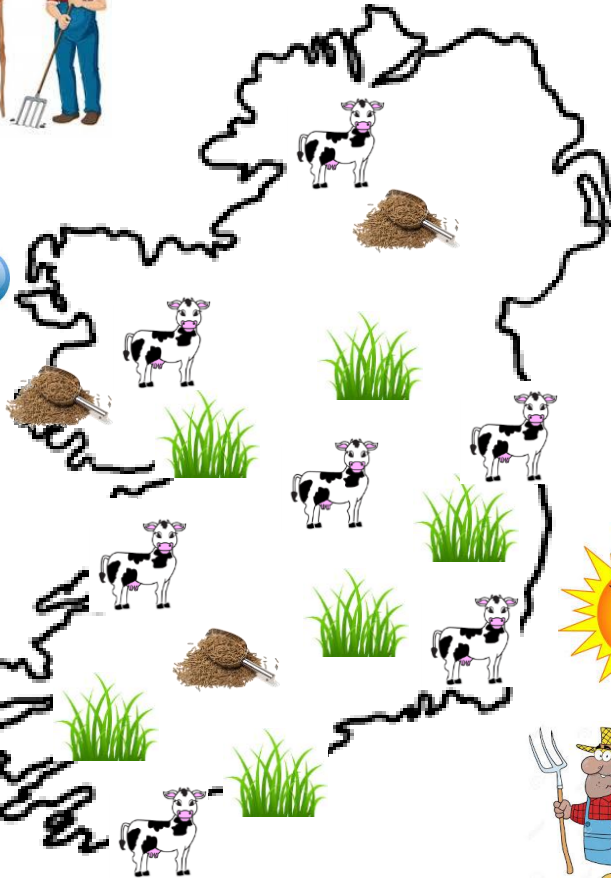
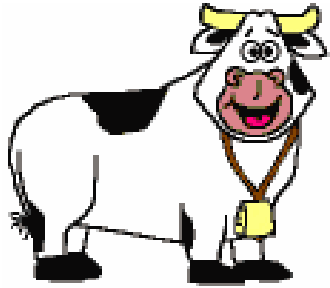
2. Accuracy of Selection

$$\Delta G = \frac{i \cdot r \cdot \sigma}{L}$$

How well can we identify the best animals?

- Is the trait highly heritable?
 - Is variation passed from parent to offspring?
 - Management influenced traits need representation from a wider variation of environments





~~Height~~

~~Milk / Meat Production~~

Fertility



Essential to record performance data representing different

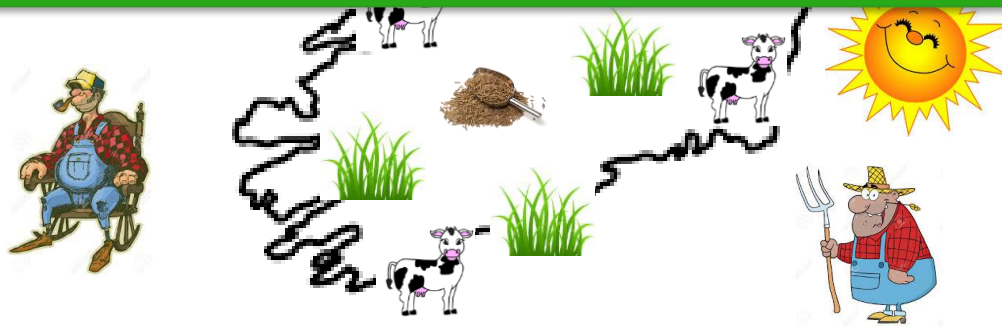
- Production environments
- Management systems
- Animal characteristics (age, breed . . .)



Heig

M

Fertility



2. Accuracy of Selection

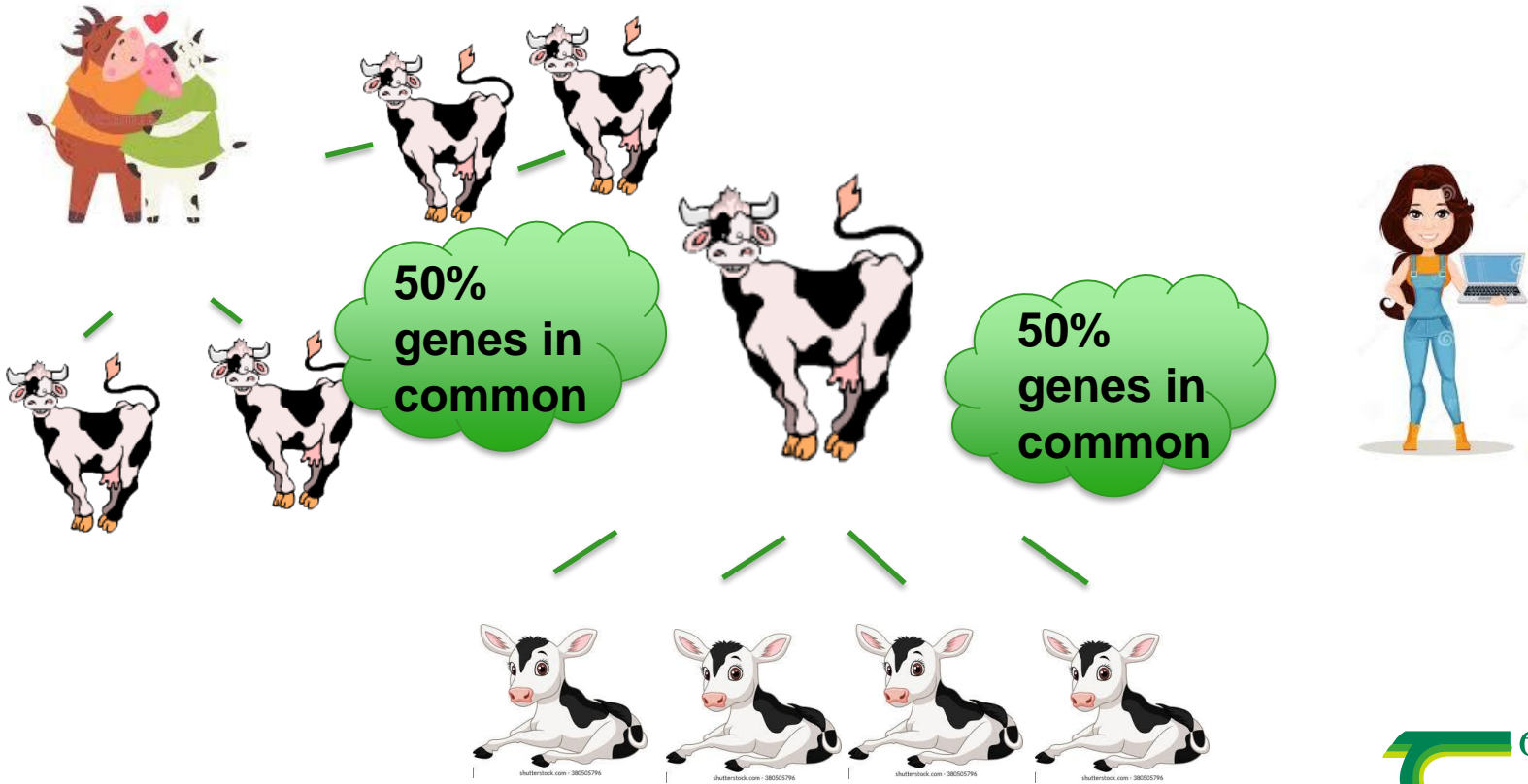
$$\Delta G = \frac{i \cdot r \cdot \sigma}{L}$$

How well can we identify the best animals?

- Is the trait highly heritable?
 - Is variation passed from parent to offspring?
 - Management influenced traits need representation from a wider variation of environments
- Who is data recorded on?
 - Sire fertility monitored through daughters

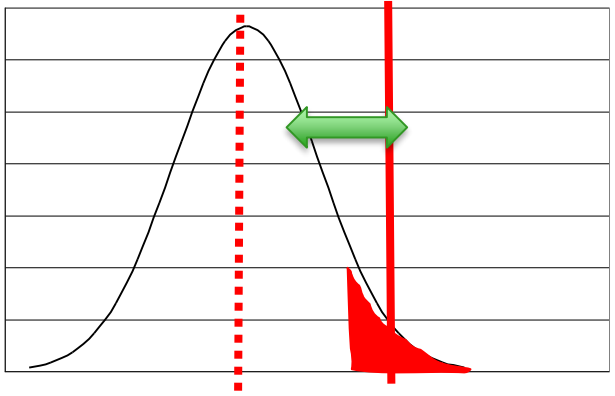


Data sources for genetic evaluations



3. Genetic Variation

$$\Delta G = \frac{i \cdot r \cdot \sigma}{L}$$



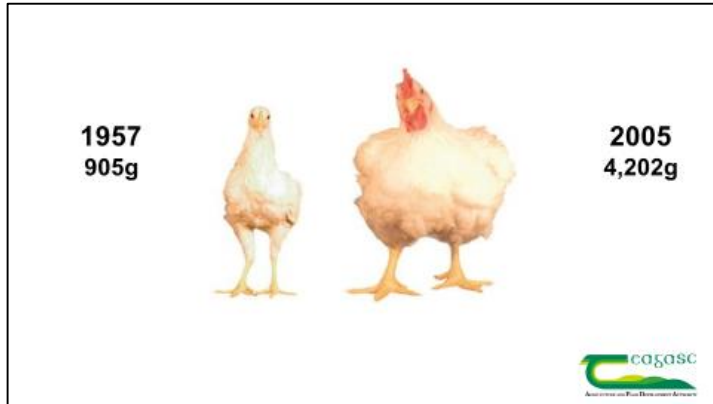
- Many traits are controlled by lots of genes with small effects



4. Generation Interval

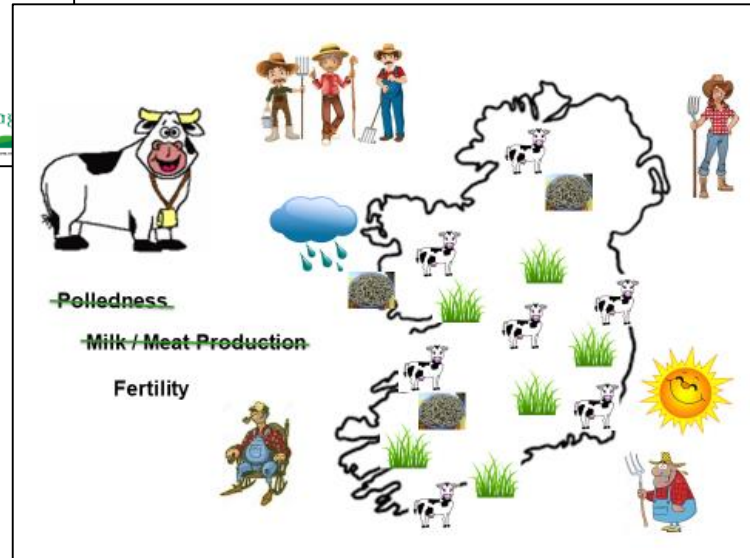
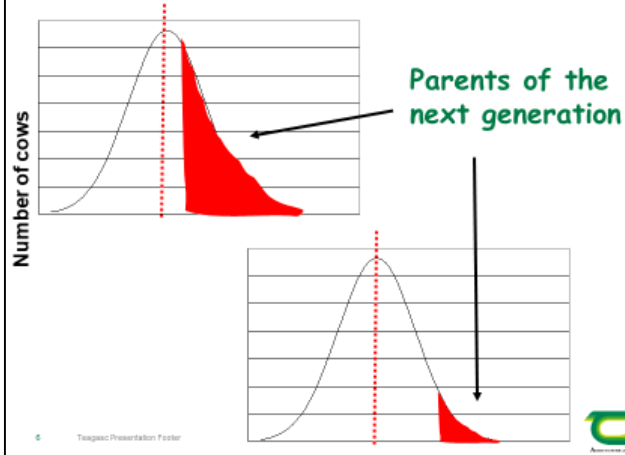
$$\Delta G = \frac{i \cdot r \cdot \sigma}{L}$$

- Average age of parents when offspring are born
- Shortening this leads to faster genetic gain



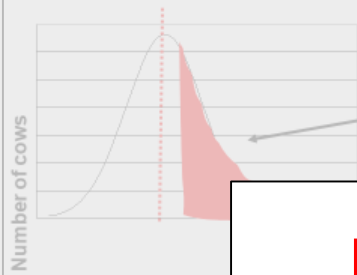
Intensity of Selection

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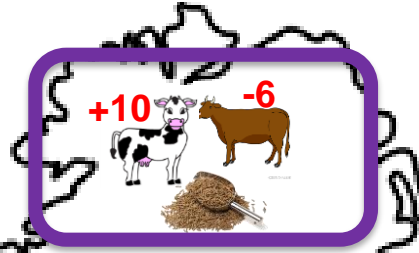
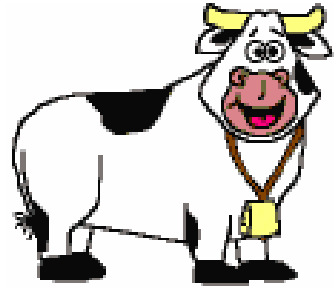


Parents of the next generation

How do we identify the best animals? Genetic evaluations: Disentangling management from genetics



Contemporary Comparisons



-6



+4



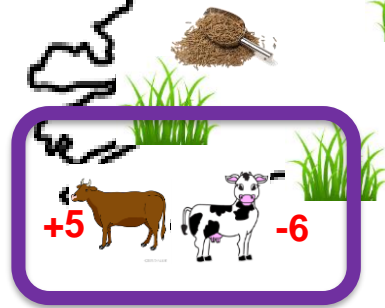
+6



+8



+5



+5



-6



What you see. . .

Star Rating (within breed)	Economic Indexes	Euro value per progeny	Index reliability	Star Rating (across all beef breeds)
★★★☆☆	REPLACEMENT	€84	36% (Low)	★★★★☆☆
★★★★☆	TERMINAL	€133	42% (Average)	★★★★★★
★★★★☆	DAIRY BEEF	€97	36% (Low)	★★★★★★

Source: ICBP, Oct. 2018

Fiona covering later this morning

Calving Difficulty (births requiring considerable assistance; % 3 & 4)		Calving Records: 0
When Mated With:	%	Reliability
Beef Heifers <small>Breed avg: 9%, All breeds avg: 11%</small>	12.2%	33% (Low)
Beef Cows <small>Breed avg: 8%, All breeds avg: 15%</small>	5.9%	61% (High)

Star Rating (within breed)	Key profit traits	Index value	Trait reliability	Star Rating (across all beef breeds)
EXPECTED PROGENY PERFORMANCE				
★★★★☆	Gestation Length (days)	3.6d	33% (Low)	★☆☆☆☆
★★★★☆	Docility (1-5 scale)	-0.05 scale	32% (Low)	★★☆☆☆
★★★☆☆	Carcass weight (kg)	23.4kg	42% (Average)	★★★★★★
★★★★★★	Carcass conformation (1-15 scale)	2.87 scale	39% (Low)	★★★★★★
EXPECTED DAUGHTER BREEDING PERFORMANCE				
	Daughter calving difficulty (% 3 & 4)	6.7%	50% (Average)	
★★★★☆	Daughter milk (kg)	0.6kg	32% (Low)	★★☆☆☆
★★★☆☆	Daughter calving interval (days)	1.4d	32% (Low)	★☆☆☆☆

Expected performance of progeny

Genotype included in evaluation

What you see. . .

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Genotype included in evaluation

Fiona covering later this morning

What confidence do we have in these figures?

- heritability
- number of records

Summary of Genetic Evaluations

Disentangle management from genetics



Accurately, intensely, identifying the **best** animals at a **young** age as parents will maximise genetic gain



Data recording is vital

Accurate

Across production environments