The Future Cow

The Science of ....Beef Breeding

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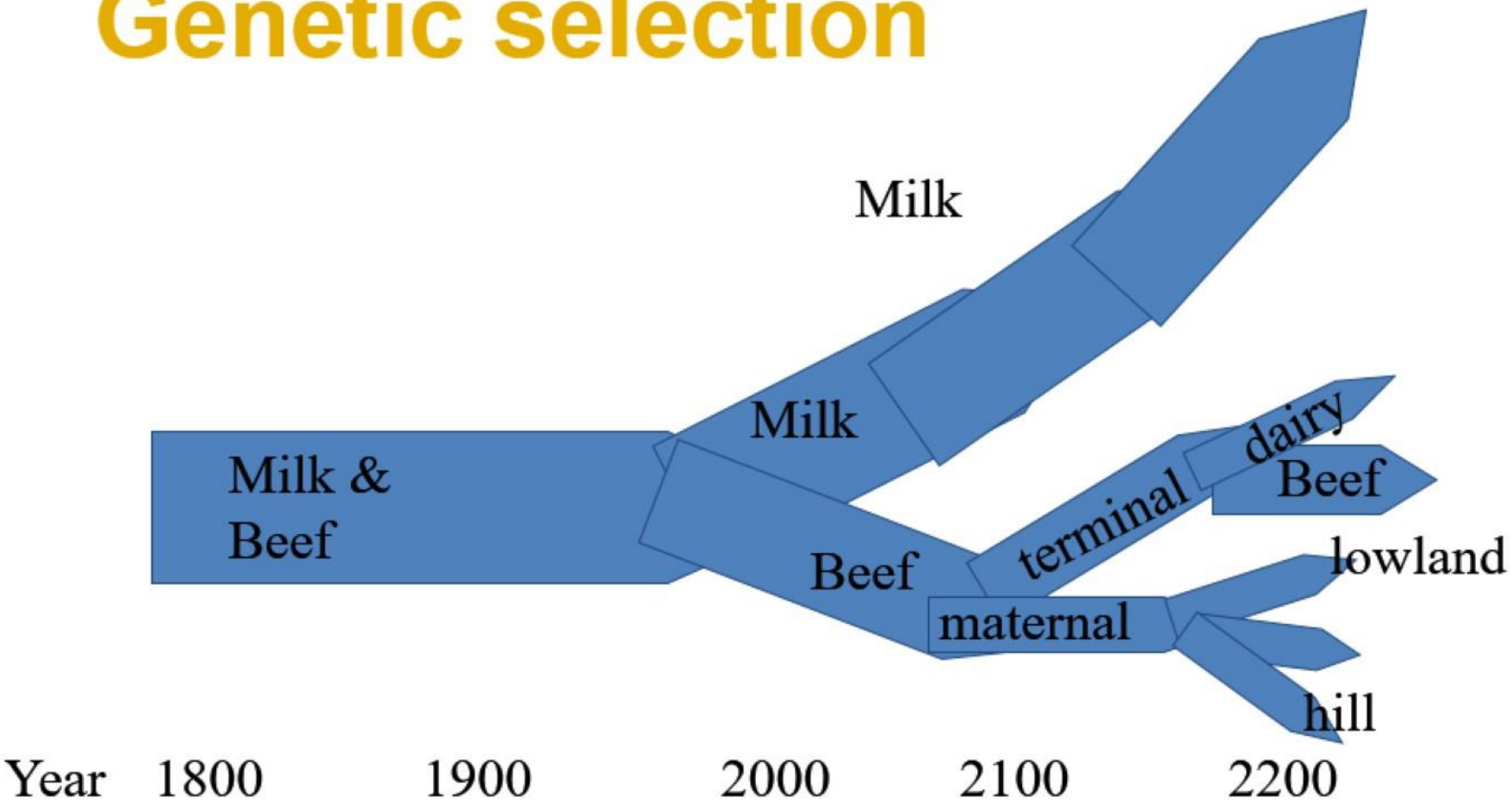
Overview

- The basic principles
- Application
- Hybrid Vigour
- Breeding plans

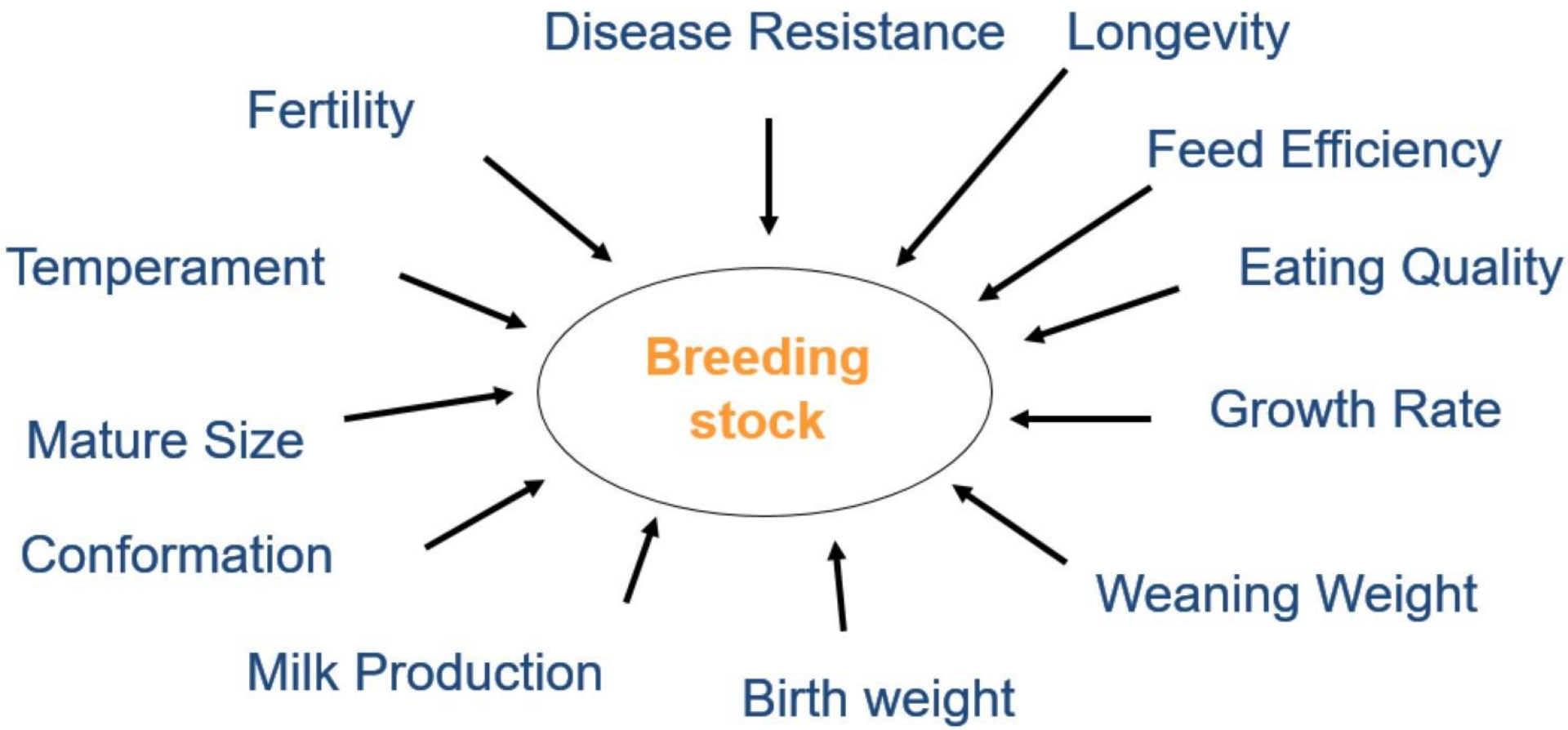
The basics

- Farm resources?
- Species & system? Sheep, beef, dairy?
- Market opportunities?
- Genetics to exploit resources, system & market
- What traits matter?

Genetic selection



What do you want to improve?



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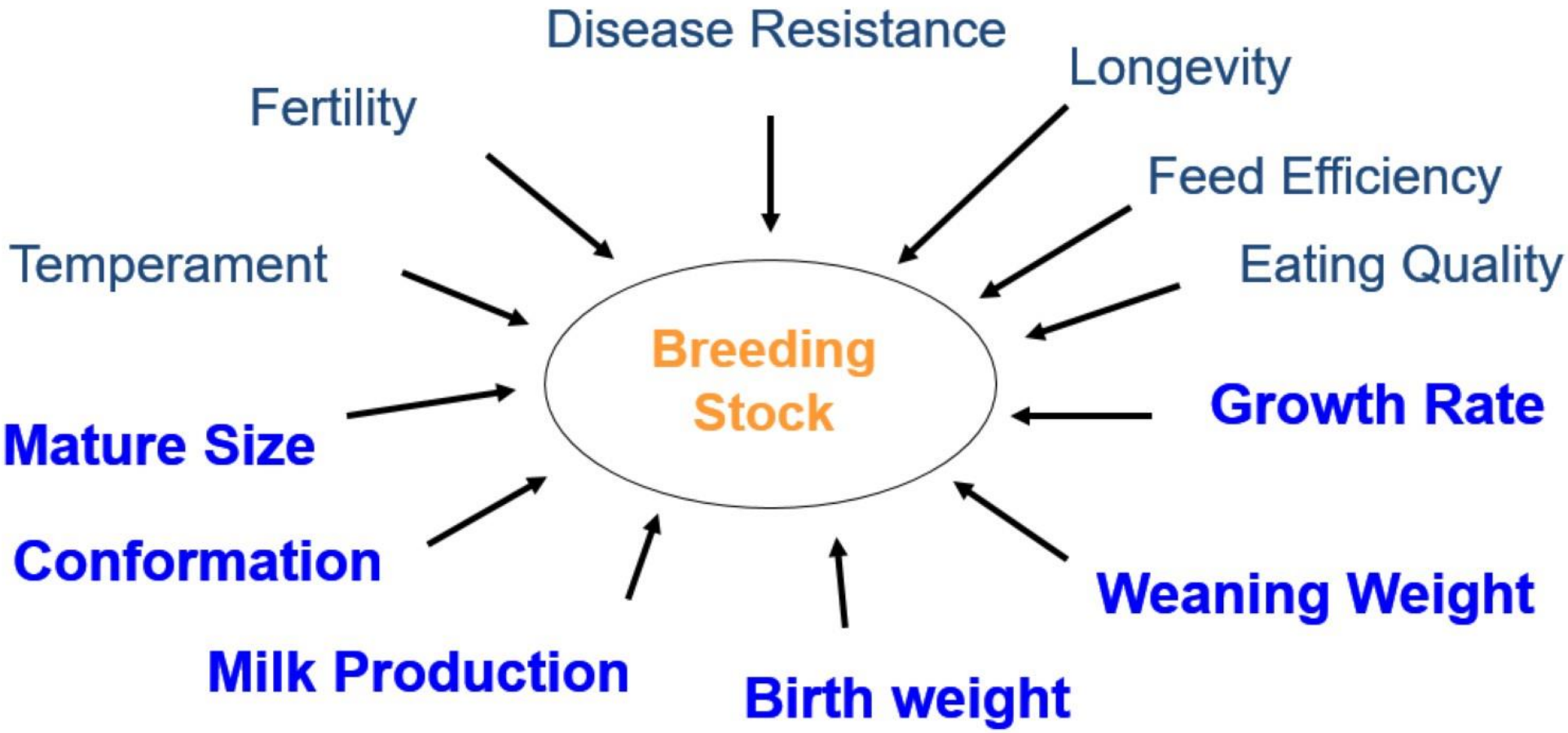

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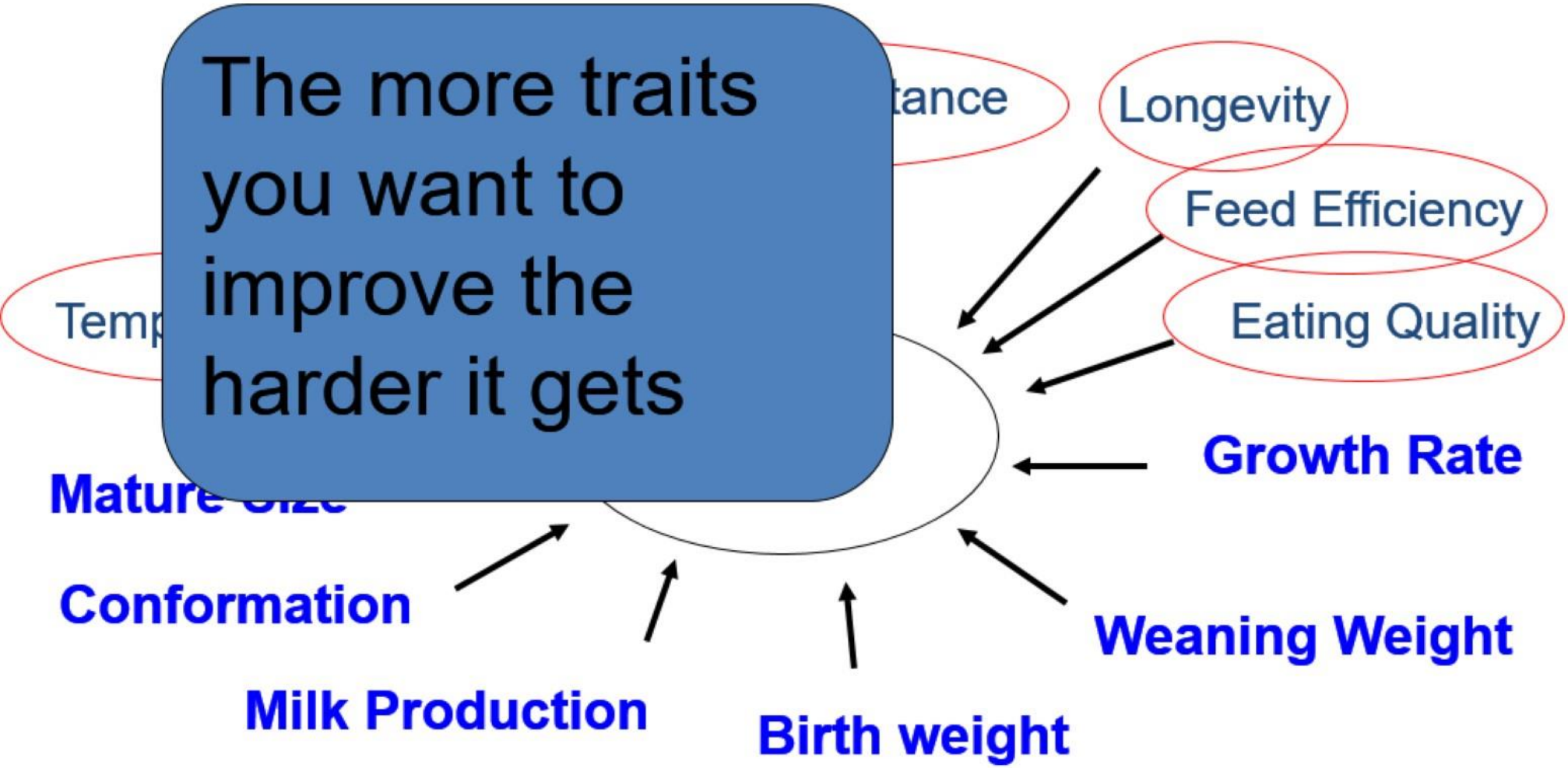
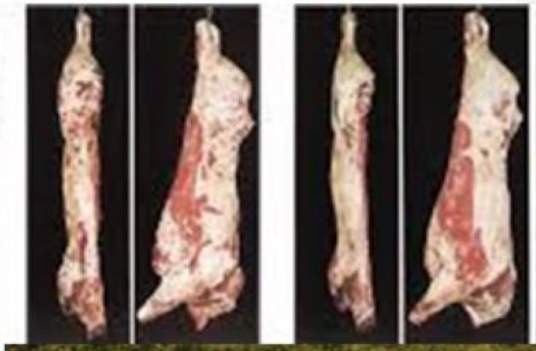


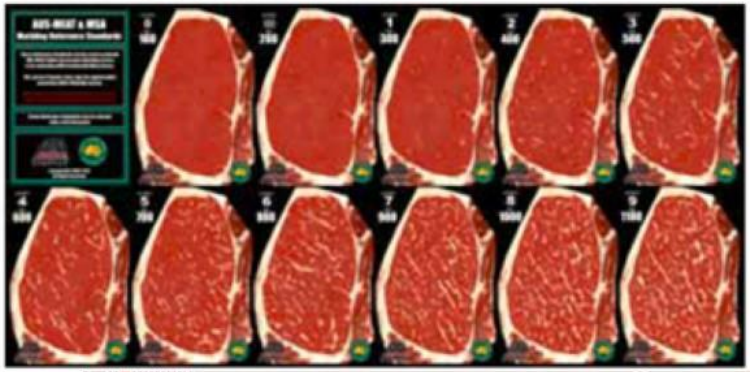
Selection pressure
- 50 years of selection

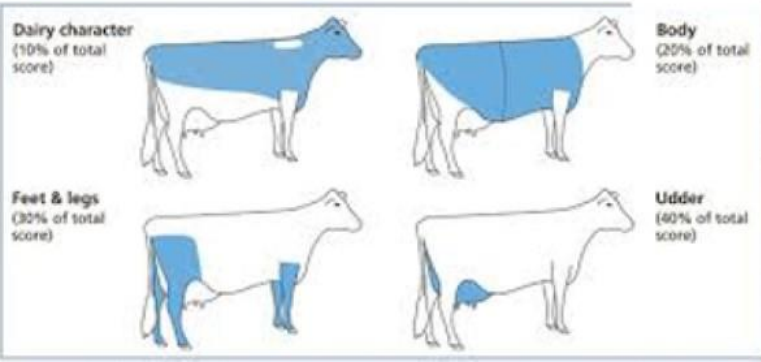
Basics -4 key elements

- Measure performance
  - phenotype
- Know how animals are related
  - Pedigree
- Calculate breeding values
  - Genotypes- takes account of environment
- Create an economic index
  - Make progress on several traits at once and factor in profit

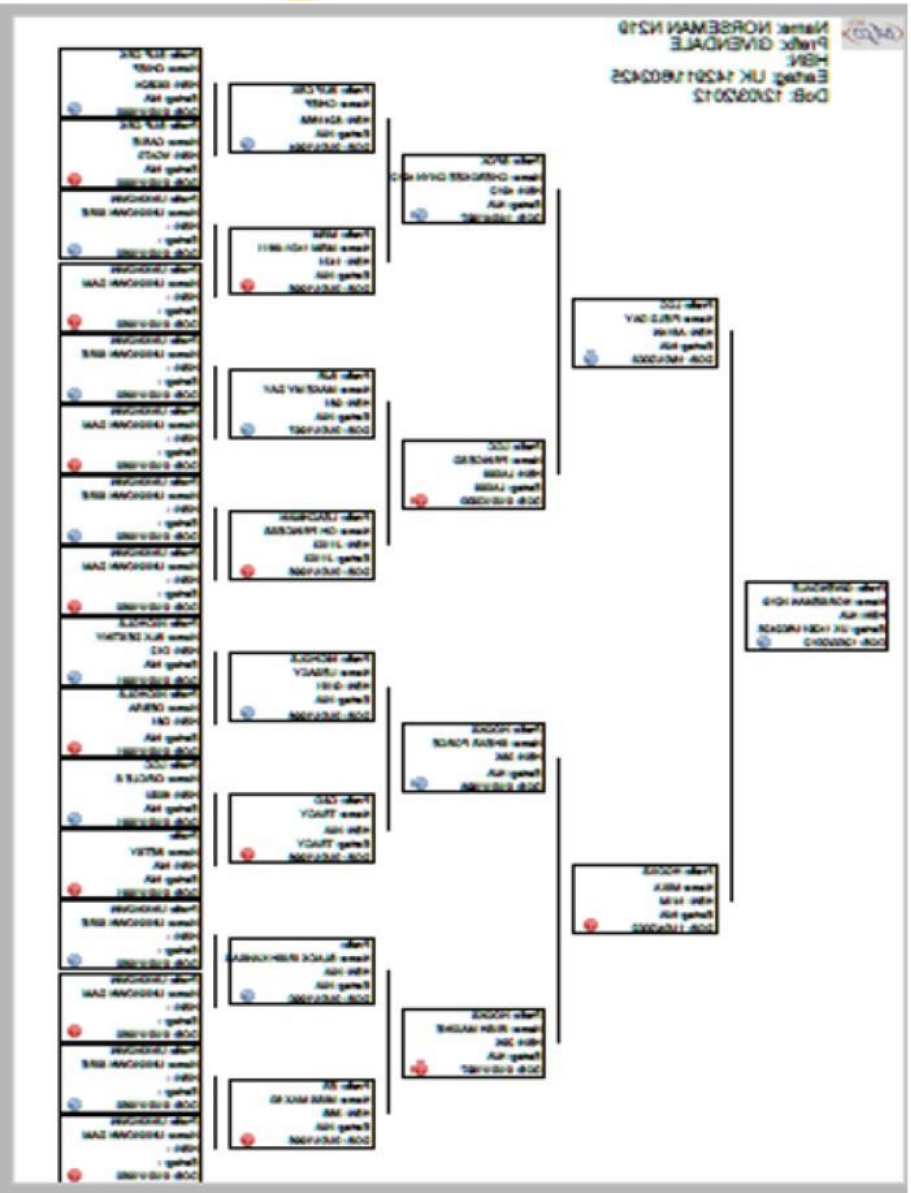
Measuring performance

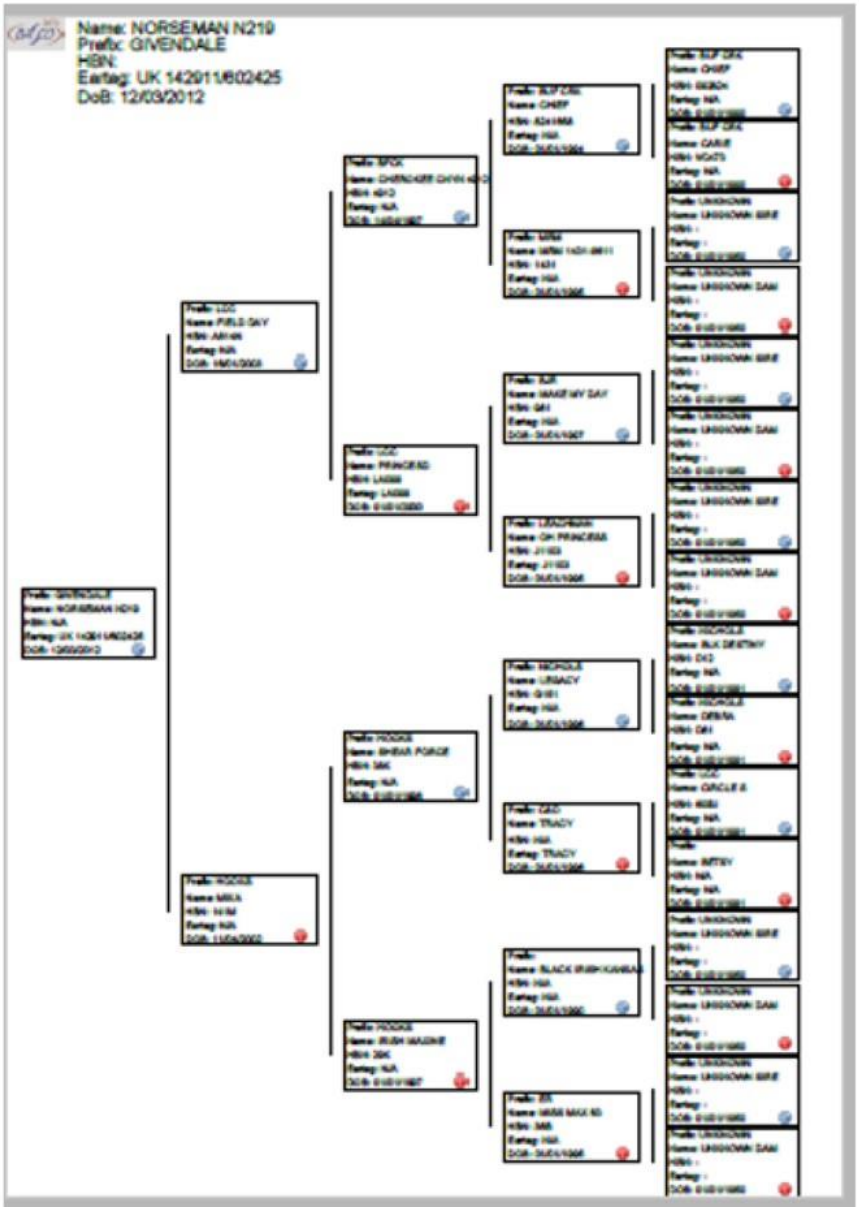




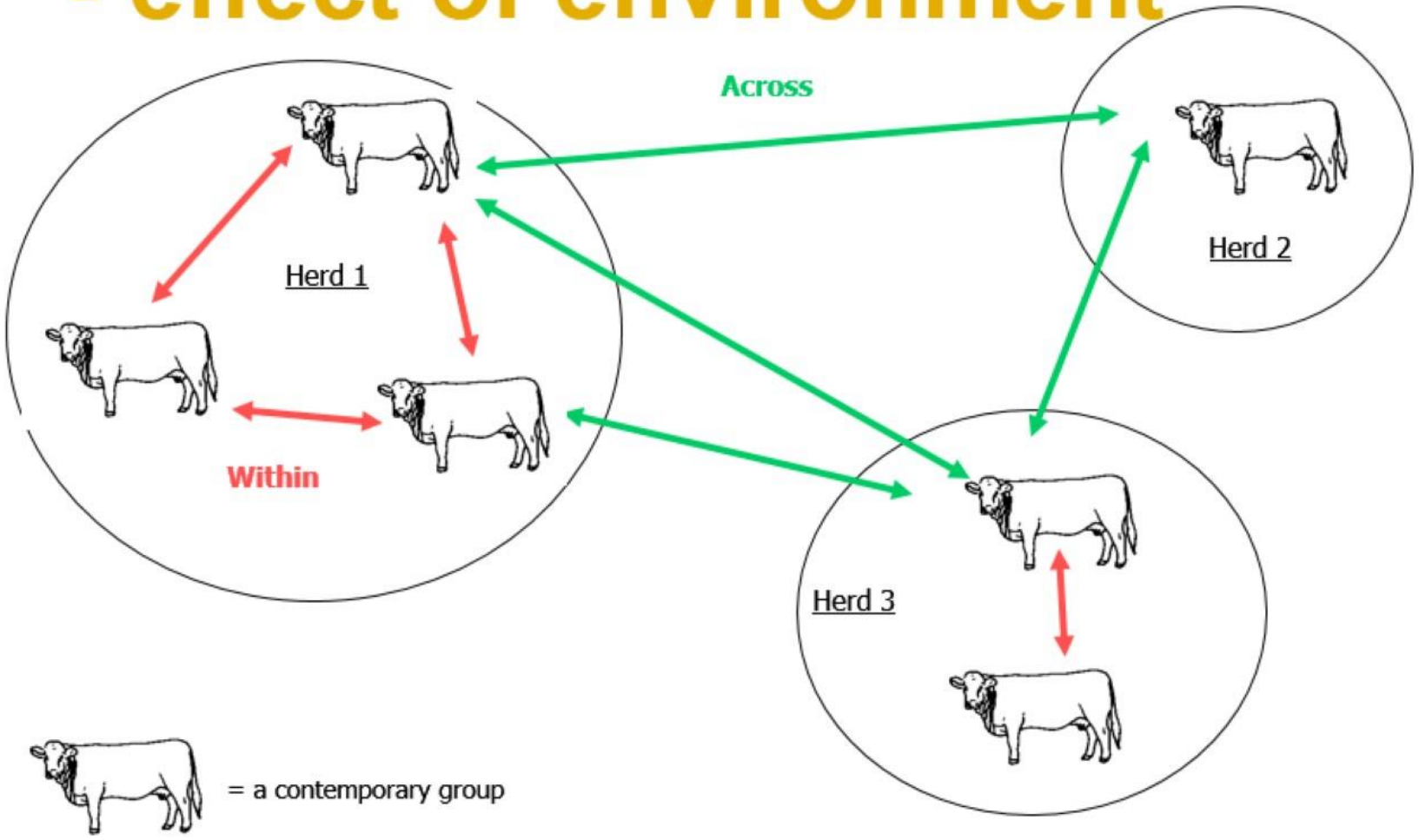


Pedigree

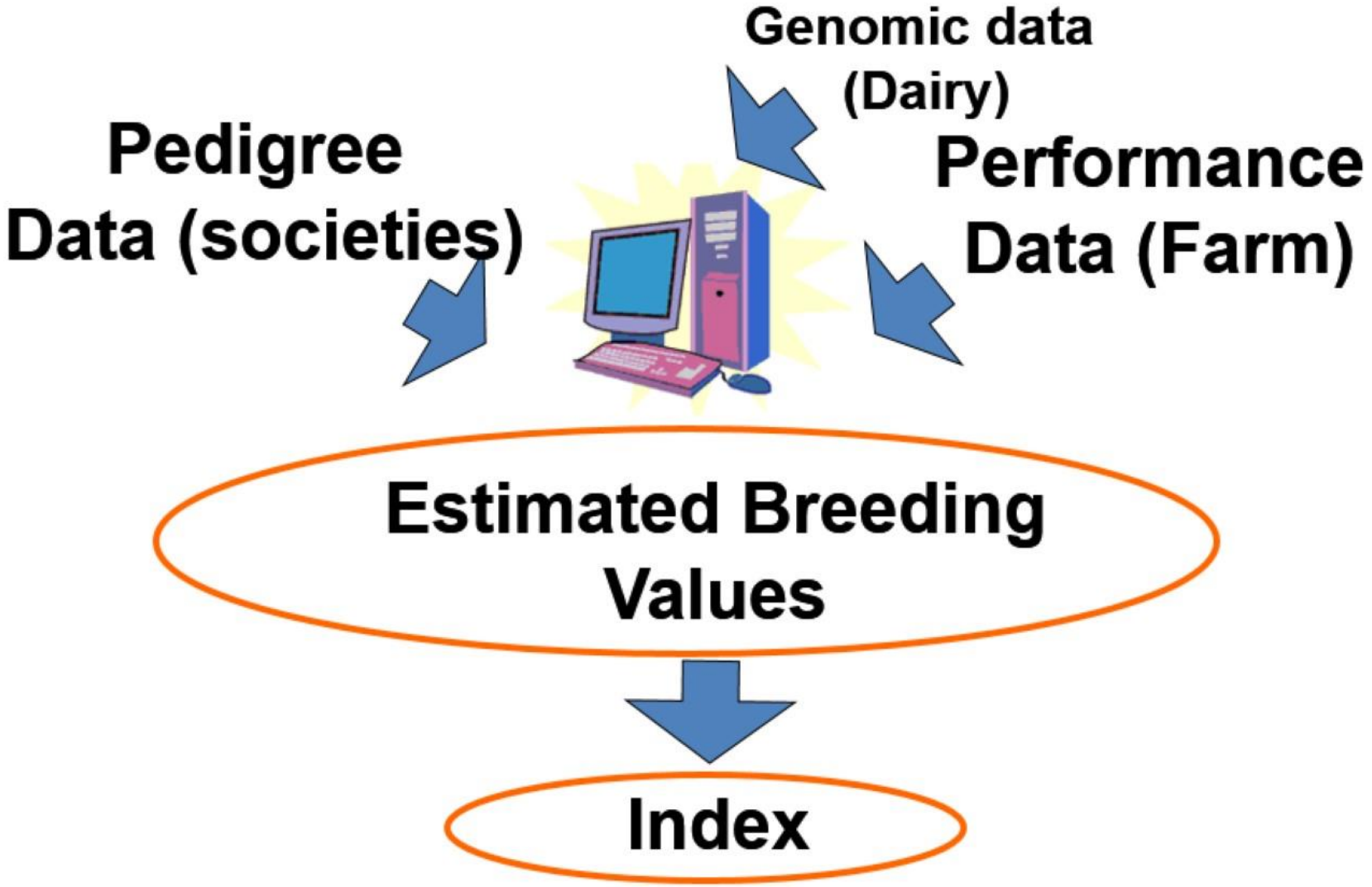



Name: NORSEMAN N219
Prefix: GIVENDALE
HBN:
Eartag: UK 142911/602425
DoB: 12/03/2012

Breeding values
- effect of environment



Breeding values



Create an index

Index = EBV1 x £value + EBV2 x value + EBV3 etc

BEEF - Beef Value, Maternal Value, Calving Index, Maternal Production Value

SHEEP – Terminal Sire Index, Hill Index

DAIRY = PLI, Spring Calving Index

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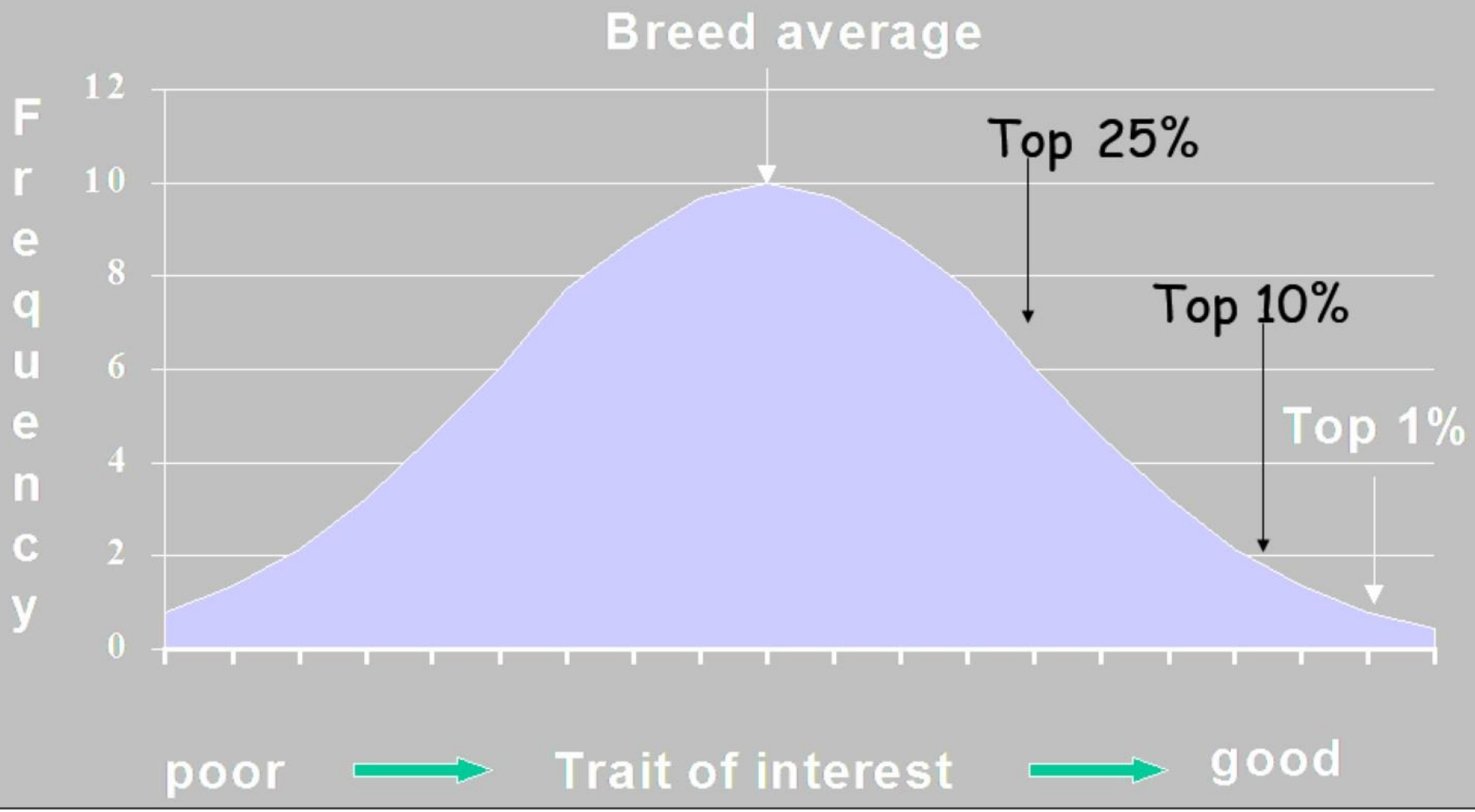
Population


Breed average
Top 25%
Top 10%
Top 1%
Frequency
12
10
8
6
4
2
0
poor
Trait of interest
good

Which is the best sire for growth rate?

	Bull	Average Progeny Weight
Farm A	Mark	350kg
	Simon	330kg
Farm B	David	310kg
	Mark	280kg

Relative to Mark

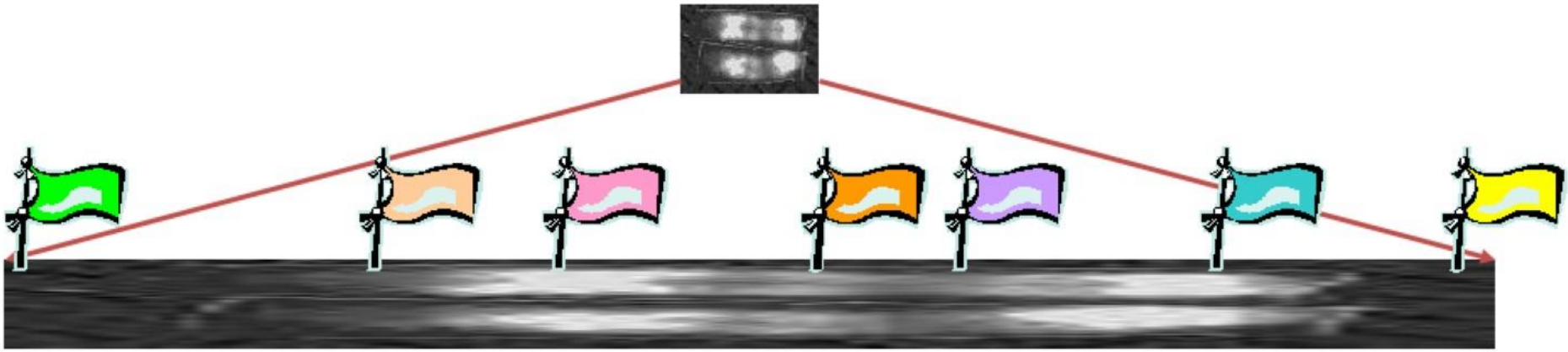
David + 30kg
Mark 0
Simon – 20kg

Givendale Black Oswald

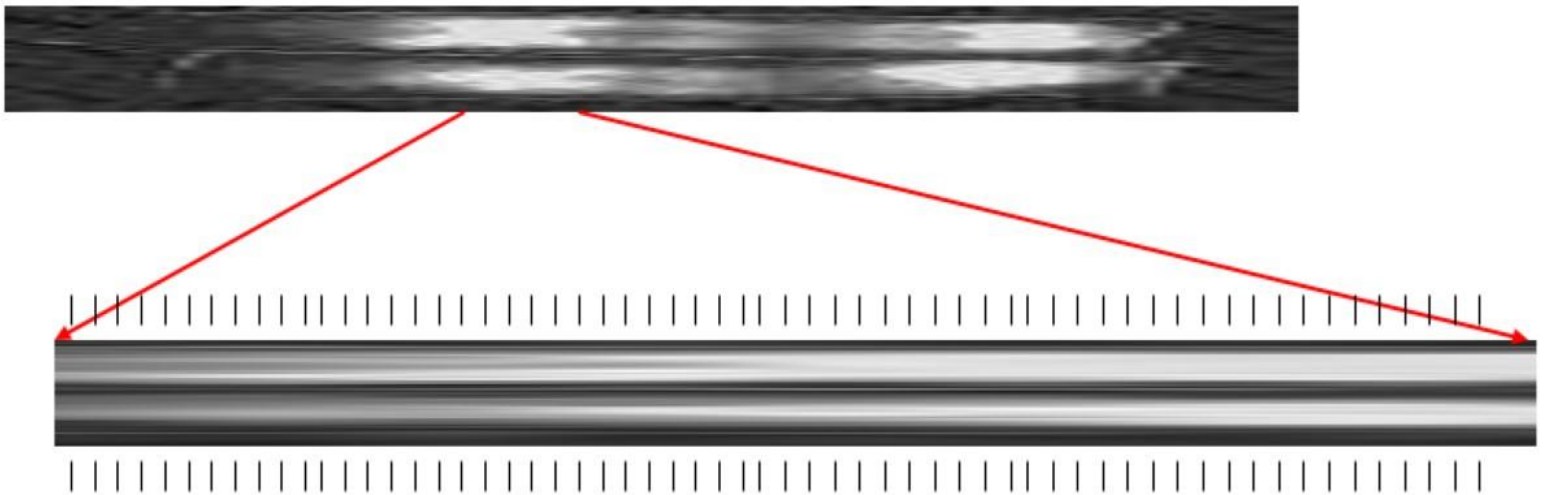
CV 5: BV 40: MPV 45: Homo Polled & Black

Genomics
Gene Markers

Marker Assisted Selection (MAS)



Genome Wide Selection – An alternative approach?



Imagine not a few hundred
but tens of thousands of markers

Genomic Evaluations

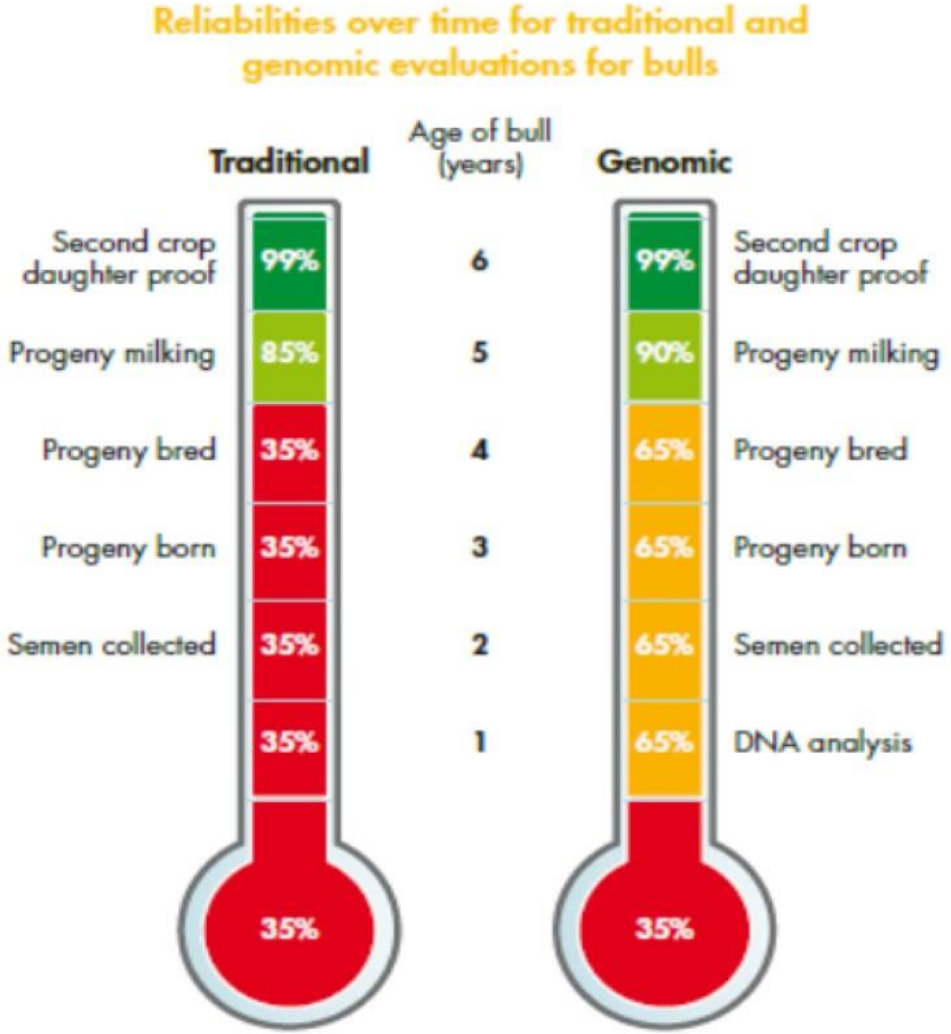
- Genomic evaluations based on:
  - Pedigree information
  - Genomic information
  - Performance recording
  - Progeny performance

- Builds on current proven methodology

Genomics

- Able to make predictions of genetic merit early
  - without Progeny or Performance info
- Improve accuracy for difficult to measure traits
  - e.g. Lifespan, Fertility, (TB, Feed efficiency, GHG ?)
- However, reliability still lower than progeny test
  - 35% Pedigree index
  - 65% Genomic enhanced evaluation
  - 75+ First crop progeny test
  - 95+ High reliability progeny proven

Genomic evaluations;
a tool for genetic improvement

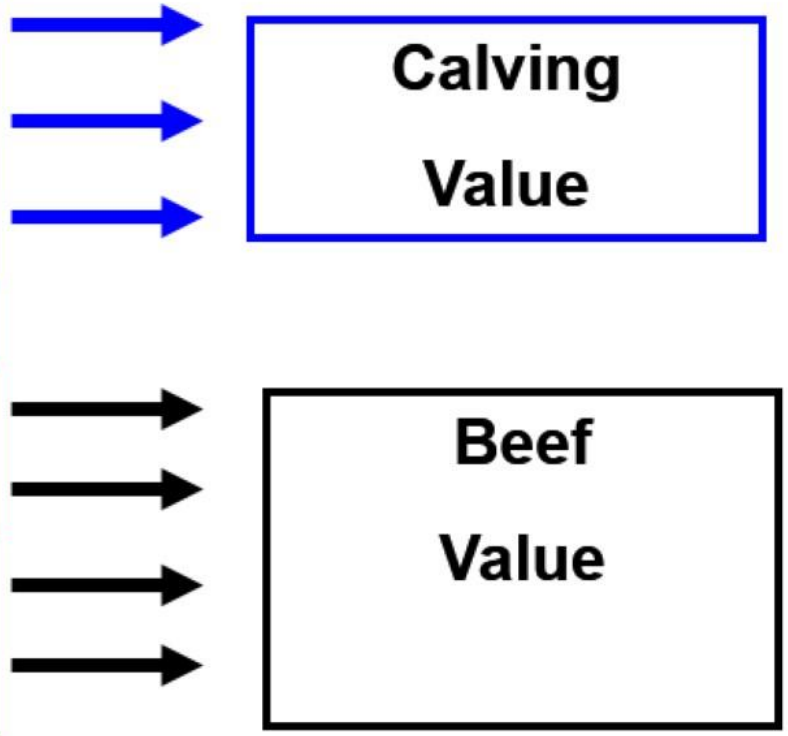


EBVs and Breeding Indexes

EBV	Characteristic
Gestation length Calving ease Birth weight	Easier calving
200 day growth 400 day growth	Efficient growth
Muscle depth / area Fat depth	Saleable meat Lean meat yield

Traits of Economic Importance

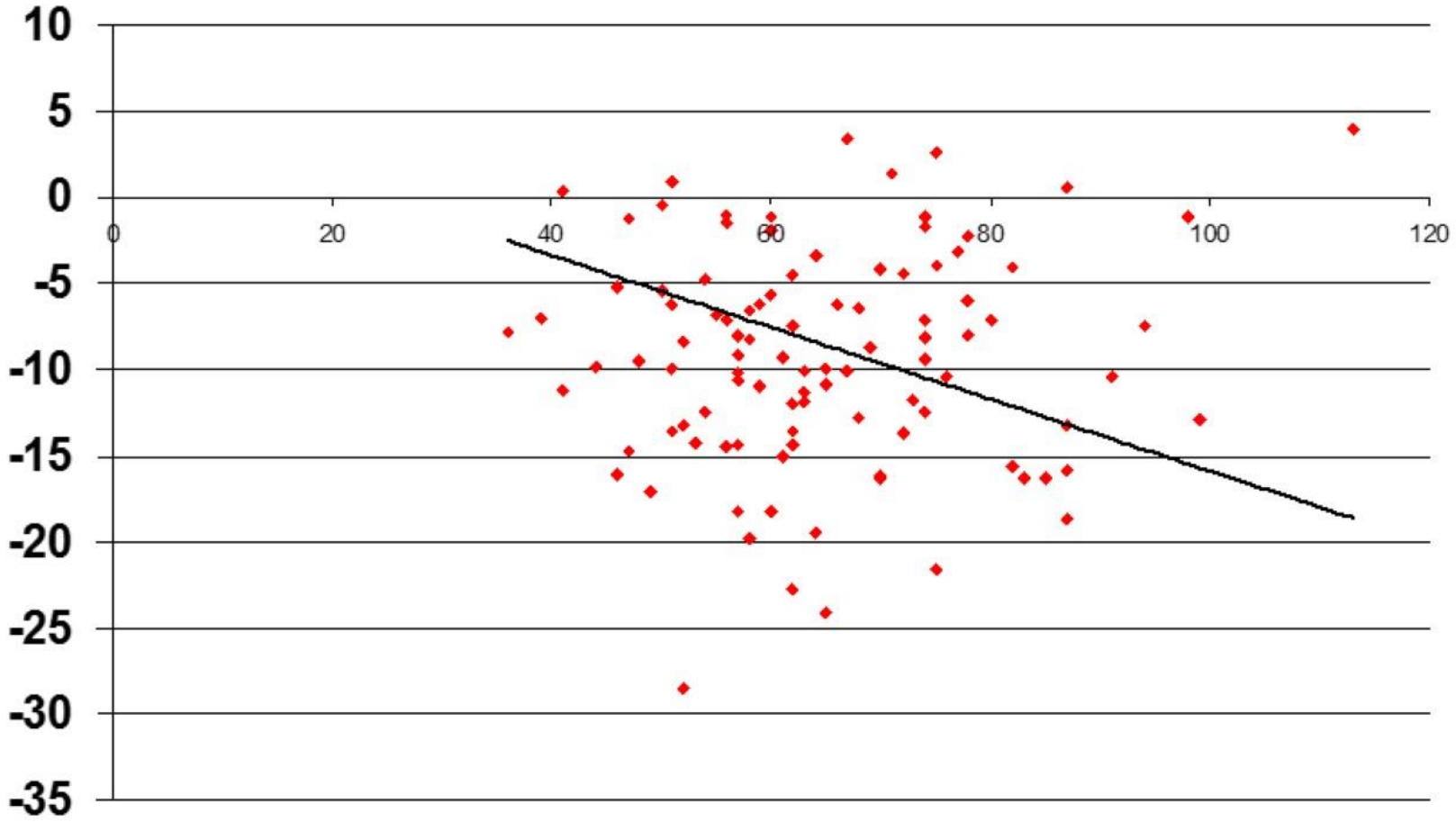
Characteristic	BEEF EBV
Easy birth	Gestation length Calving ease Birth weight
Maternal ability	200 day milk
Efficient growth	200 day growth 400 day growth
Saleable meat **Lean meat yield**	Muscle depth / area Fat depth



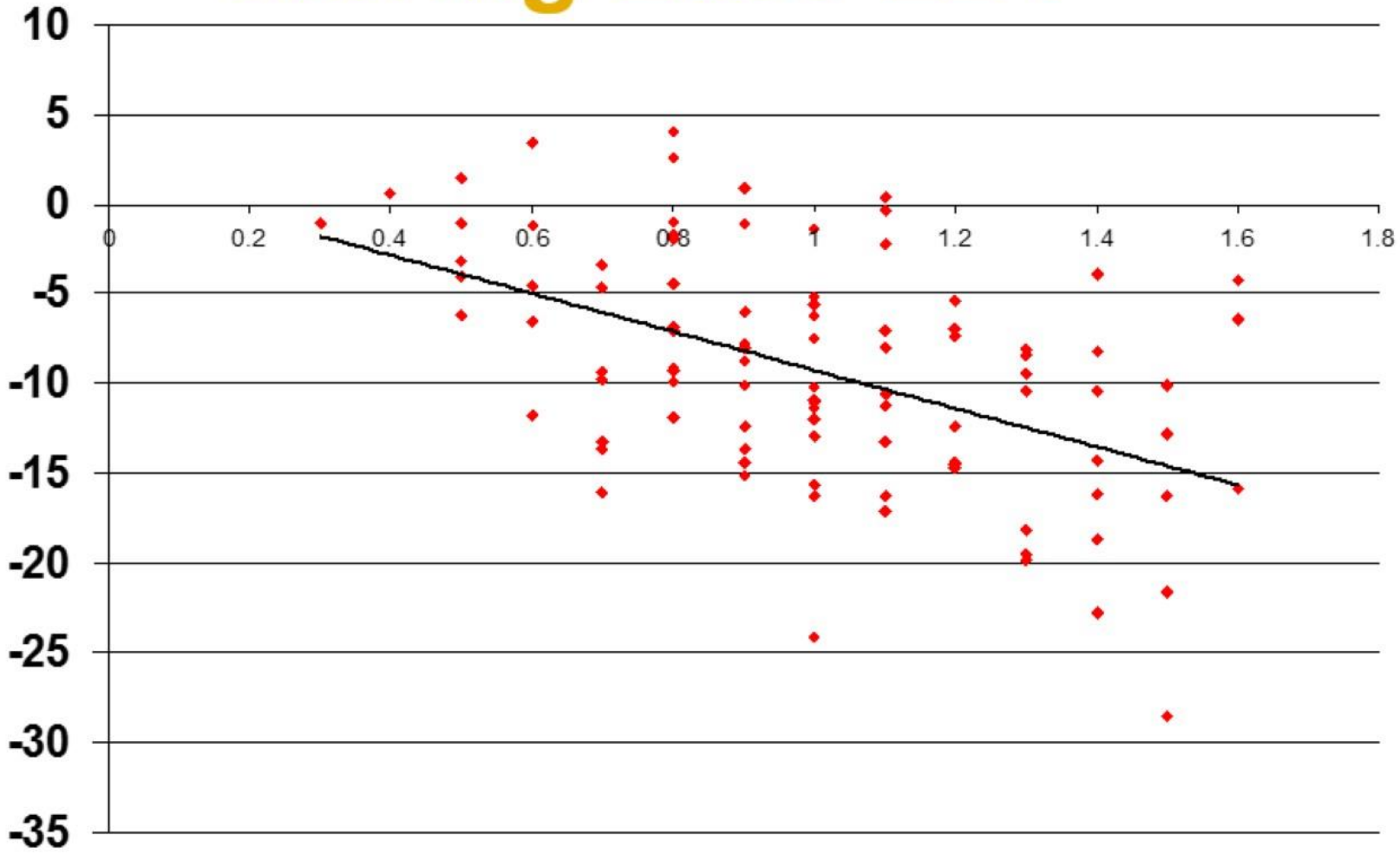
EBVs and Breeding Indexes

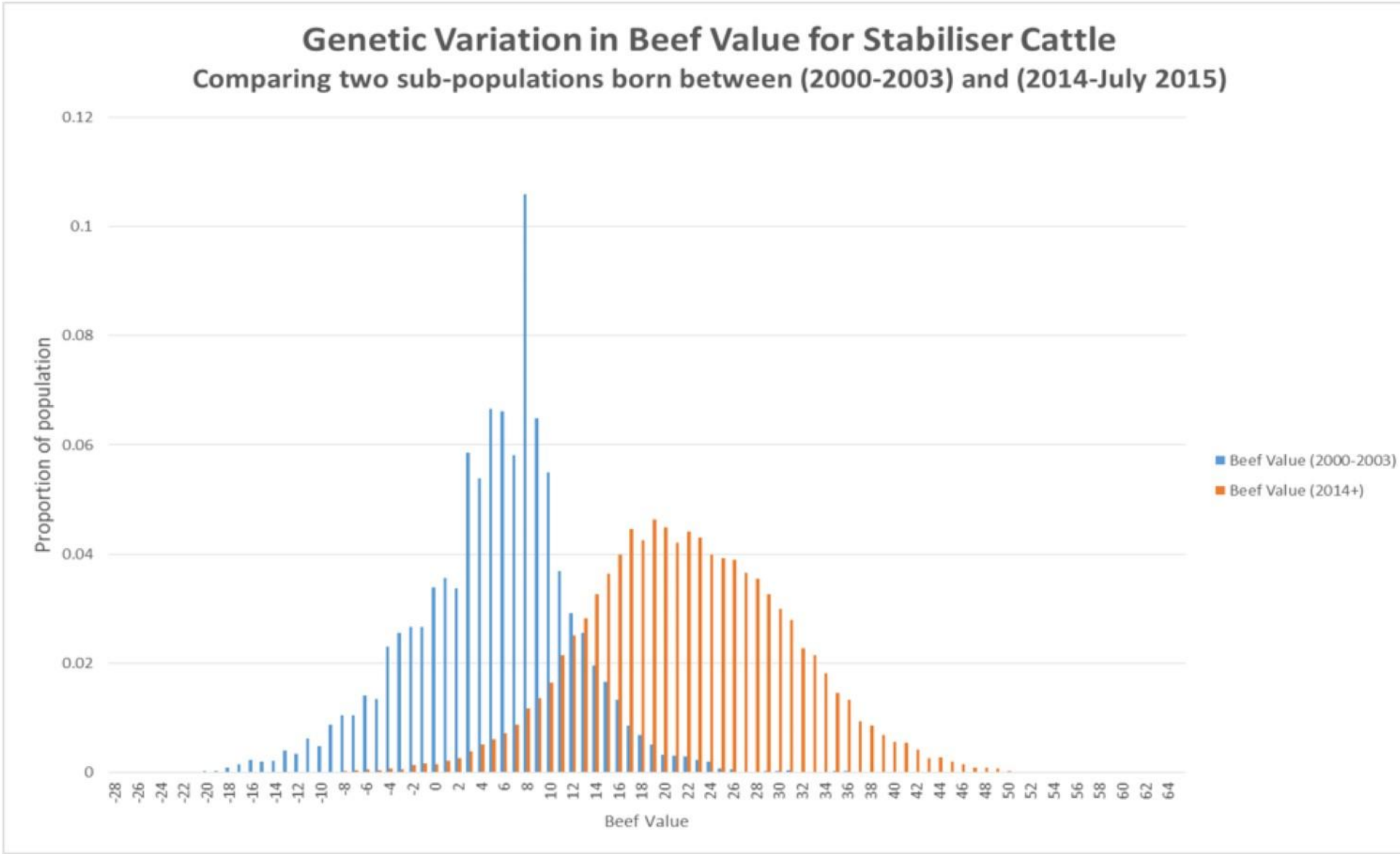
EBV	Characteristic
200 Day Milk Maternal Calving Ease Age at first calving Calving Interval Longevity	Maternal Traits
Scrotal Circumference Docility Cow Mature Size	New Traits

Calving ease EBV vs 400 day weight EBV



Muscle Score EBV vs Calving Ease EBV




Genetic Variation in Beef Value for Stabiliser Cattle
Comparing two sub-populations born between (2000-2003) and (2014-July 2015)
Proportion of population
0.12
0.1
0.08
0.06
0.04
0.02
0
-28 -26 -24 -22 -20 -18 -16 -14 -12 -10 -8 -6 -4 -2 0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60 62 64
Beef Value
Beef Value (2000-2003)
Beef Value (2014+)

What's the value?

Improve fertility	*4% improvement = £12.80 / cow*
Increase liveweight	*20kg improvement = £20.70 / cow*
Improve carcase quality	*Premium £15/calf = £13.50 / cow*

Store calves at £320/head
90% calving rate

Interpreting EBVs

	Calving ease EBV (%)	Birth weight EBV (kg)	Milk EBV (kg)	200 Day Growth EBV (kg)	400 Day Growth EBV (kg)	Muscle Area EBV (sq.cm)	Fat Depth EBV (mm)	Terminal Sire Index
Nautical	+ 8.2	+ 1.5	+ 9	+ 26	+ 50	+3.0	-0.7	+26
Breed Average	-1.2	+1.9	+ 3	+ 27	+ 46	+ 2.6	+ 0.2	+19
	↑	↓	↑	↑	↑	↑	↓	↑

Exercise: Bull Selection

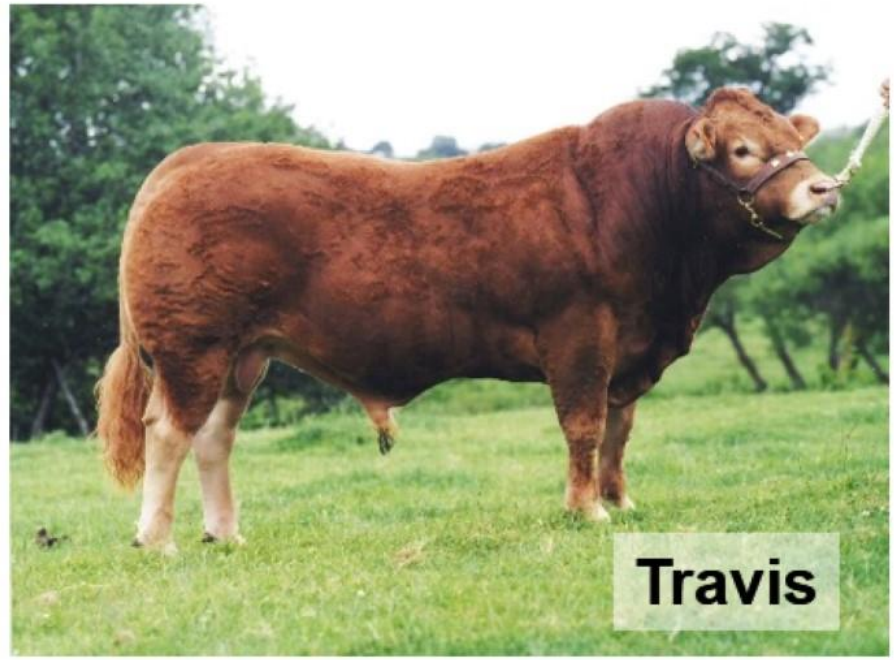
Which bull would you select, where the breeding objectives are :-

- calving ease direct
  - as a result of the genes of the sire
- growth
- muscling

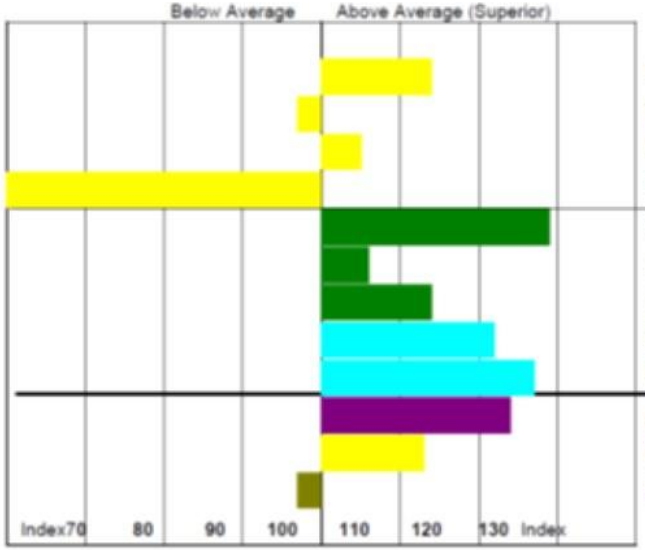

Hawk


Sundance


Supersonic


Travis

LOT: 5 **HAWK** — BROADMEADOWS CANNON — RONICK ESTHER — 22-Apr-1992



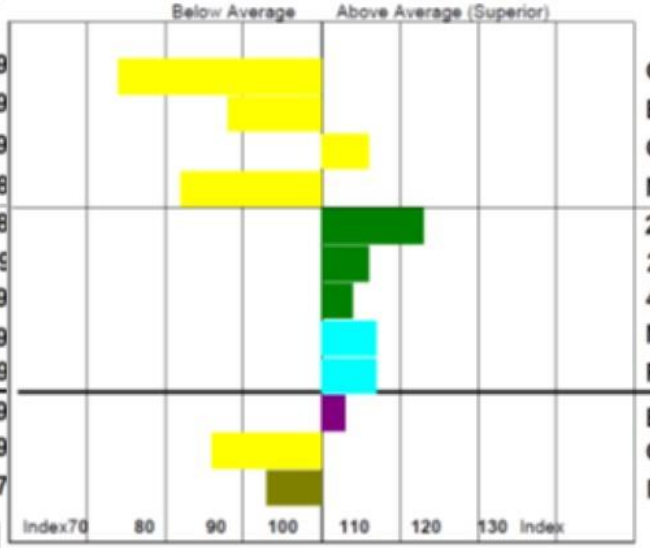
Analysis date: 01/11/2010 (

		EBV	Acc %
Gest. Length (days)		-0.8	99
Birth Weight (kg)		1.5	99
Calving Ease (%)		-1.6	99
Mat.Calv. Ease (%)		-1.1	98
200 Day Milk (kg)		5	98
200 Day Growth (kg)		22	99
400 Day Growth (kg)		49	99
Muscle Depth (mm)		4.5	99
Fat Depth (mm)		-0.5	99
Beef Value	LIM	35	99
Calving Value	LIM	2C	99
Maternal Value	LIM	1V	97

Adjusted Weights	100	200	300	400	500	Scanned

Sale Wt(kg) | Withers / Rump Ht (cm) | Scrotal Circ. (cm)

LOT: 6 **SUNDANCE** — UK 105112/700020 — REDPATHS JAGUAR — CASTLEDEN NAN — 11-Feb-2001



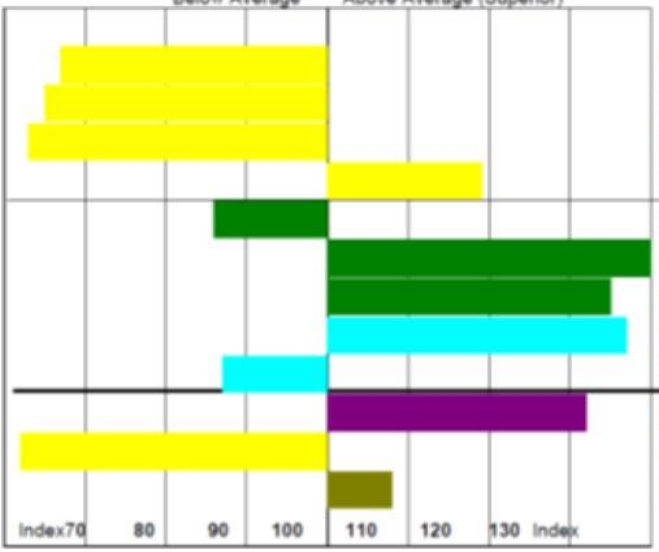
Analysis date: 01/11/2010 (

		EBV	Acc %
Gest. Length (days)		3.2	91
Birth Weight (kg)		2.1	89
Calving Ease (%)		-1.5	82
Mat.Calv. Ease (%)		0.0	62
200 Day Milk (kg)		2	67
200 Day Growth (kg)		22	90
400 Day Growth (kg)		35	89
Muscle Depth (mm)		2.8	85
Fat Depth (mm)		-0.2	67
Beef Value	LIM	22	90
Calving Value	LIM	-2C	89
Maternal Value	LIM	-3V	61

Adjusted Weights (kg)	100	200	300	400	500	Scanned
	194	353	482	638	808	N

Sale Wt(kg) | Withers / Rump Ht (cm) | Scrotal Circ. (cm)

LOT: 7 **SUPERSONIC** — UK 324456/400043 — GRANGE LINARIA — BAPTON JEWEL — 19-Feb-2001



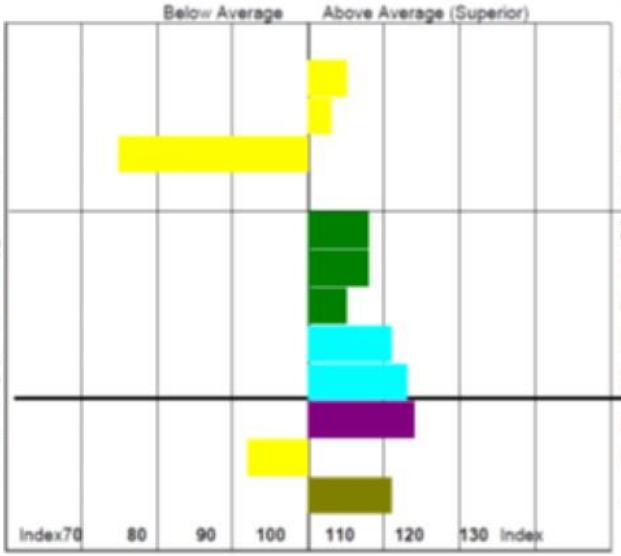
Analysis date: 01/11/2010 (

		EBV	Acc %
Gest. Length (days)		3.9	88
Birth Weight (kg)		3.6	84
Calving Ease (%)		-8.4	76
Mat.Calv. Ease (%)		1.8	55
200 Day Milk (kg)		-3	62
200 Day Growth (kg)		56	82
400 Day Growth (kg)		78	81
Muscle Depth (mm)		6.2	77
Fat Depth (mm)		0.1	65
Beef Value	LIM	40	83
Calving Value	LIM	-5C	86
Maternal Value	LIM	10V	53

Adjusted Weights (kg)	100	200	300	400	500	Scanned
	218	391	539	697	0	N

Sale Wt(kg) | Withers / Rump Ht (cm) | Scrotal Circ. (cm)

LOT: 8 **TRAVIS** — UK 366351/300280 — KILLERTON PADDY — KILLERTON NARNIA — 12-Mar-2002



Analysis date: 01/11/2010 (

		EBV	Acc %
Gest. Length (days)		0.1	98
Birth Weight (kg)		1.1	96
Calving Ease (%)		-6.5	94
Mat.Calv. Ease (%)		0.9	44
200 Day Milk (kg)		1	65
200 Day Growth (kg)		24	94
400 Day Growth (kg)		37	92
Muscle Depth (mm)		3.3	91
Fat Depth (mm)		-0.3	90
Beef Value	LIM	29	95
Calving Value	LIM	-1C	98
Maternal Value	LIM	13V	56

Adjusted Weights (kg)	100	200	300	400	500	Scanned
	182	338	498	656	0	N

Sale Wt(kg) | Withers / Rump Ht (cm) | Scrotal Circ. (cm)

	Calving Ease EBV	Birth Weight EBV	400 Day Growth EBV	Muscle Depth EBV
Hawk	-1.6	1.5	49	4.5
Sundance	-1.5	2.1	35	2.8
Supersonic	-8.4	3.6	78	6.2
Travis	-6.5	1.1	37	3.3
Breed Average	**-2.2**	**1.3**	**30**	**2.0**

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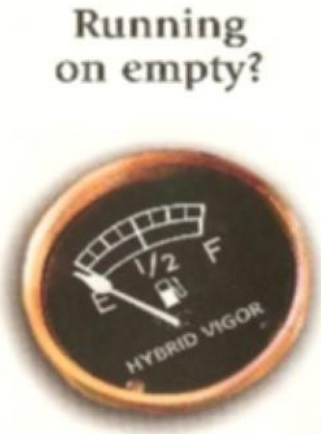
Traits affected by hybrid vigour

Trait	Impact of hybrid vigour
Carcass measurements Skeletal size Mature weight	Low 0-5%
Growth rate Early weights Milk production	Medium 5-10%
Reproduction Health Longevity	High 10-30%

Individual and Maternal Hybrid Vigour



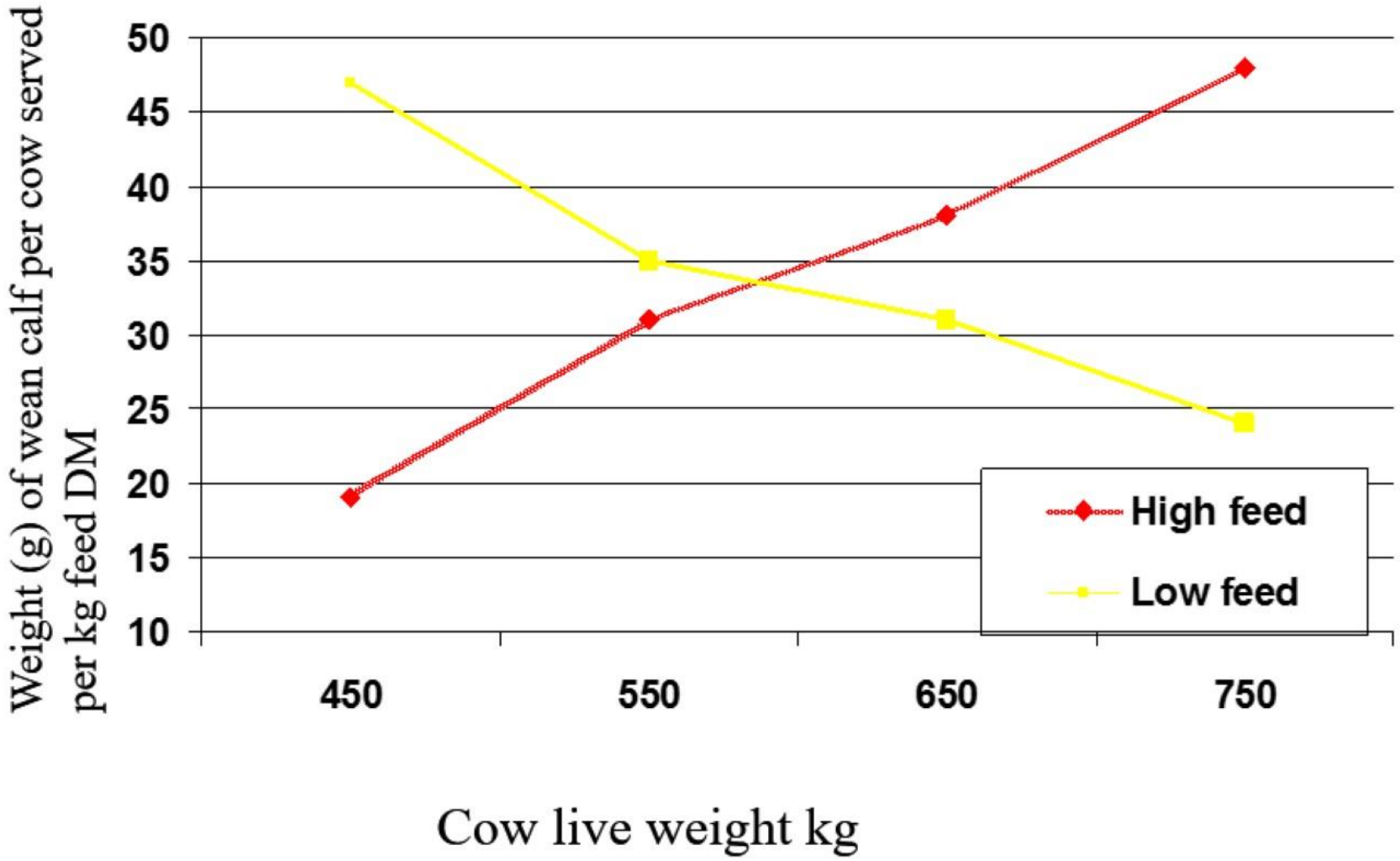
Maternal Hybrid Vigour

Fertility
Longevity
Milk production

Individual Hybrid Vigour

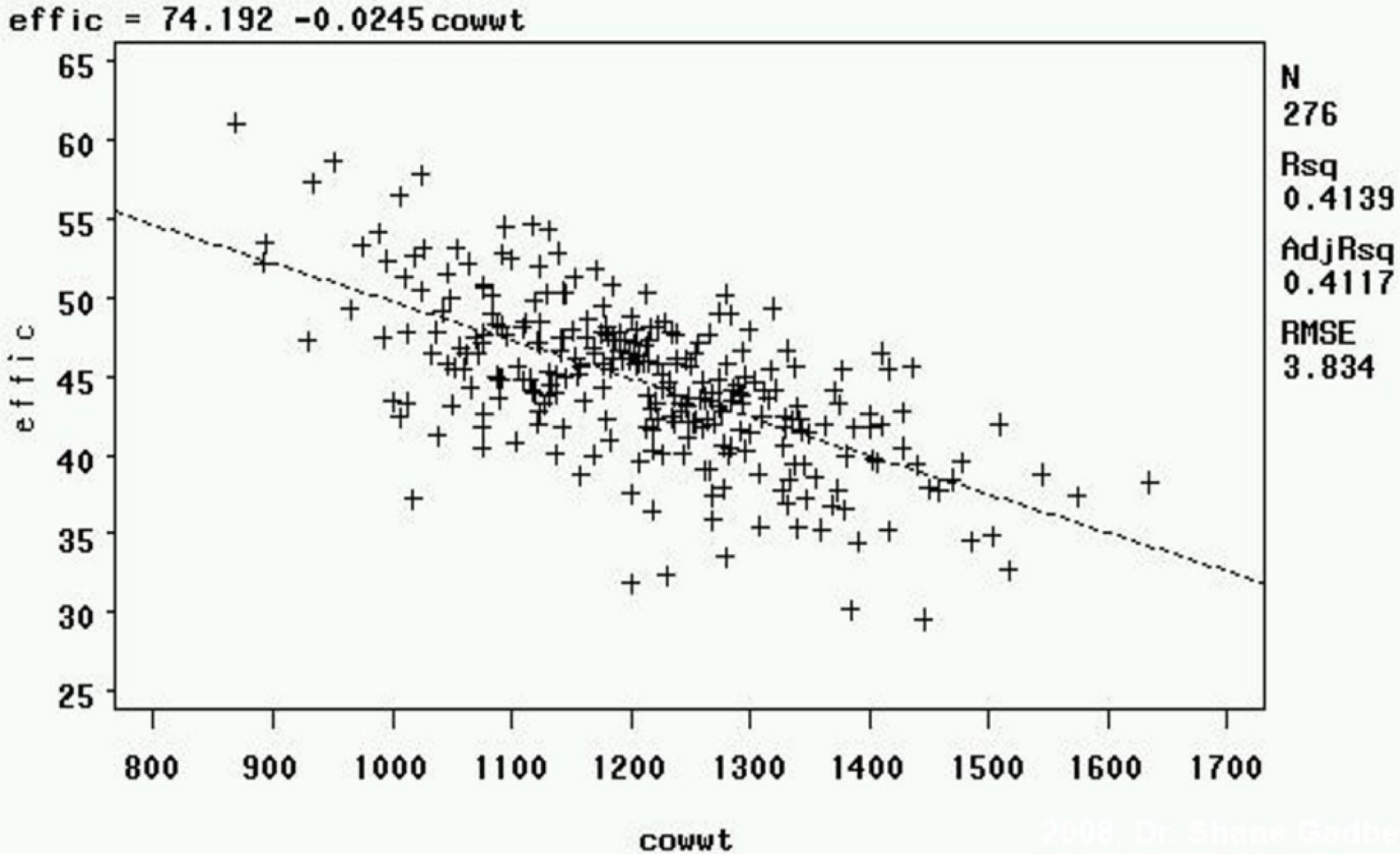
Calf / lamb Survival

Effect of feed quality/ availability on output



Profit Driver: Cow Size

% of Wt Weaned vs. Cow Wt



Traits affected by heterosis

Trait	Potential heterosis effect
Carcass measurements	Low 0-5%
Skeletal size	
Mature weight	
Growth rate	Medium 5-10%
Early weights	
Milk production	
Reproduction	High 10-30%
Health	
Longevity	

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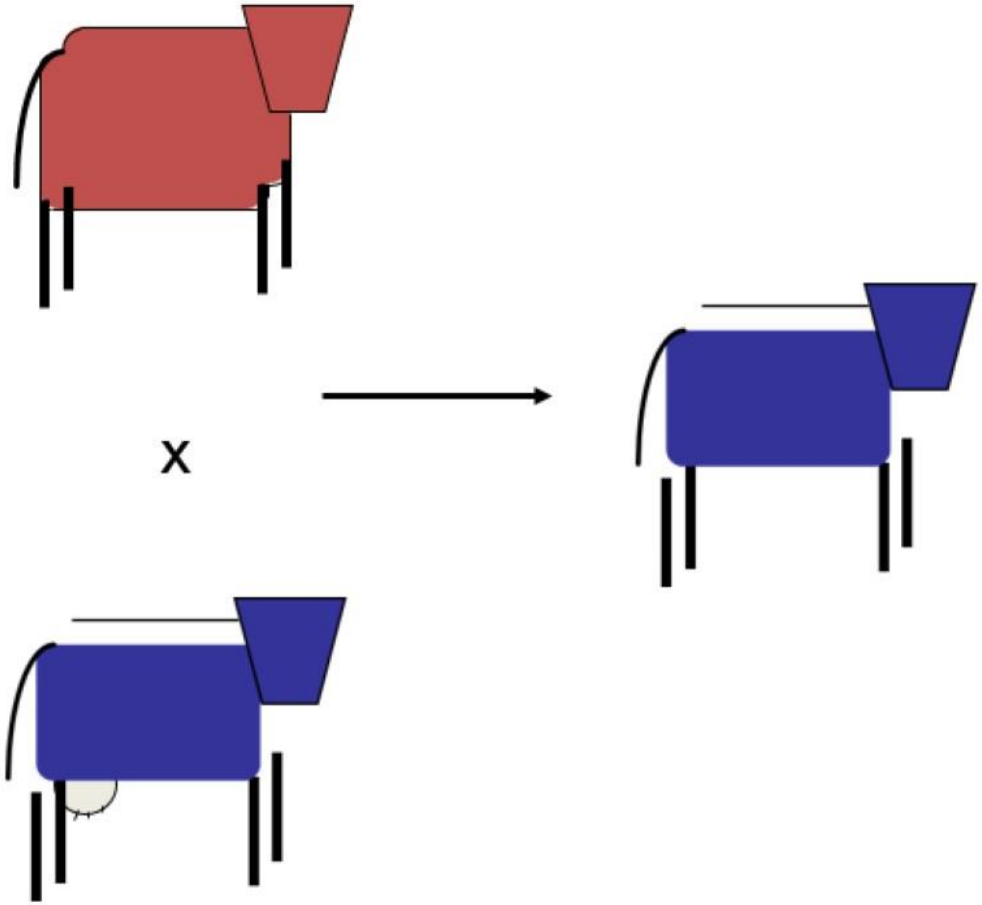
Predicted improvements in calf weaning weight for different crossbreeding systems

Mating system	Relative weight of weaned calf per cow exposed to the bull
Pure bred	100.0
Two breed rotation	115.5
Three breed rotation	120.0
Four breed composite	117.5
Half bred dam+terminal sire	123.3

Breeding plan

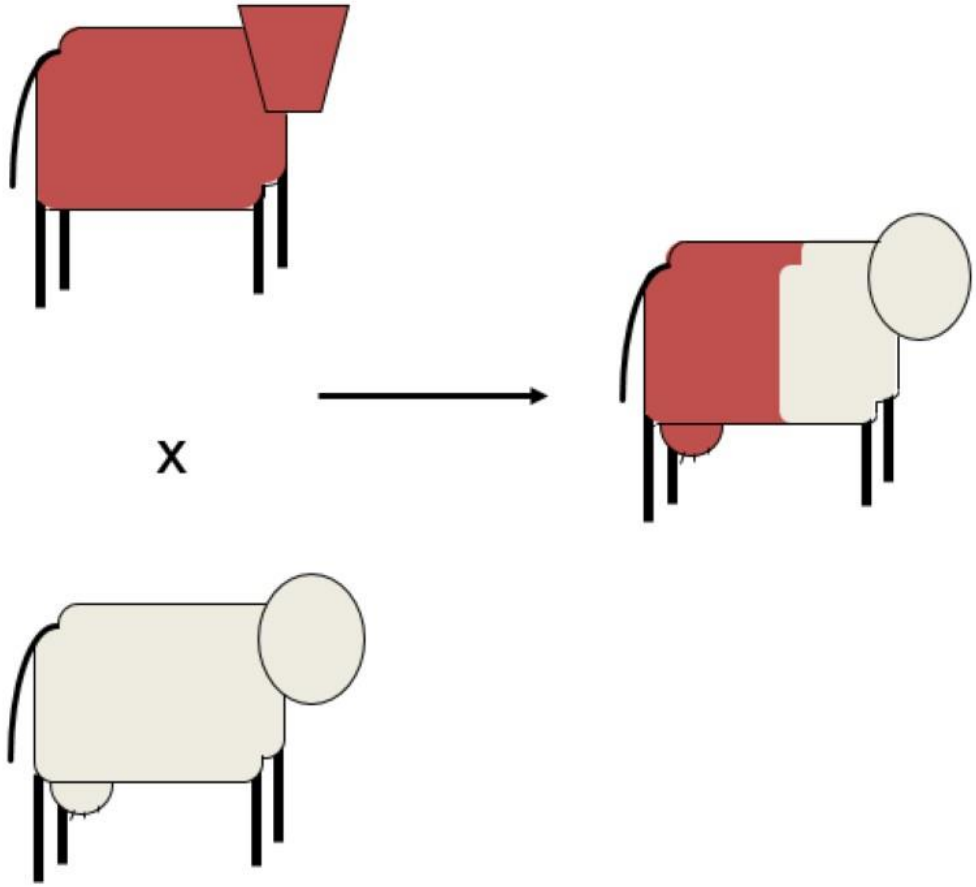
- Setting Breeding Objectives
  - What traits matter most
- Finding the right sires/ dams
  - Use indexes and EBVS
- Making sure the plan is sustainable
  - Avoid inbreeding
- Review plan annually

Pure breeding

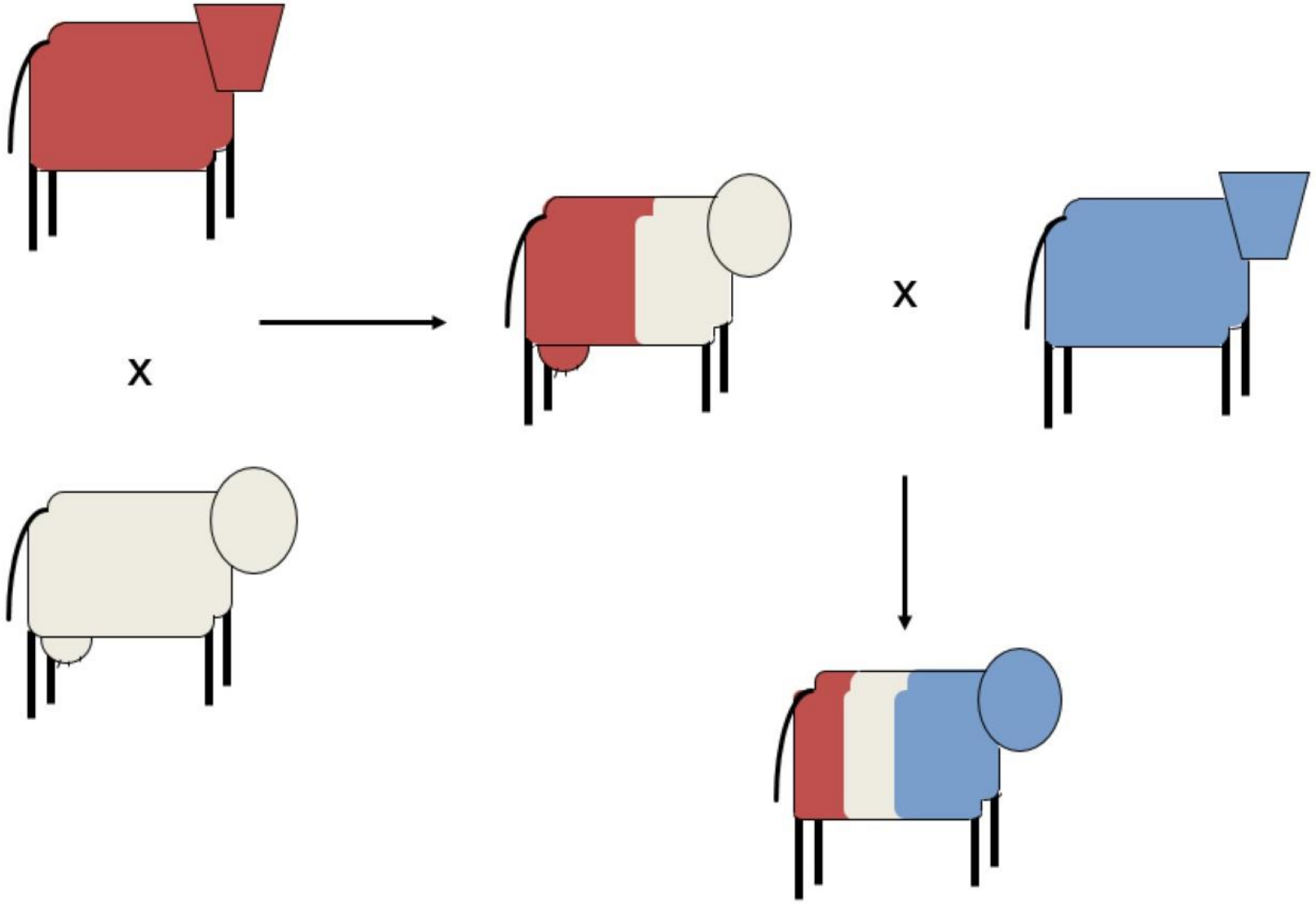



4
48

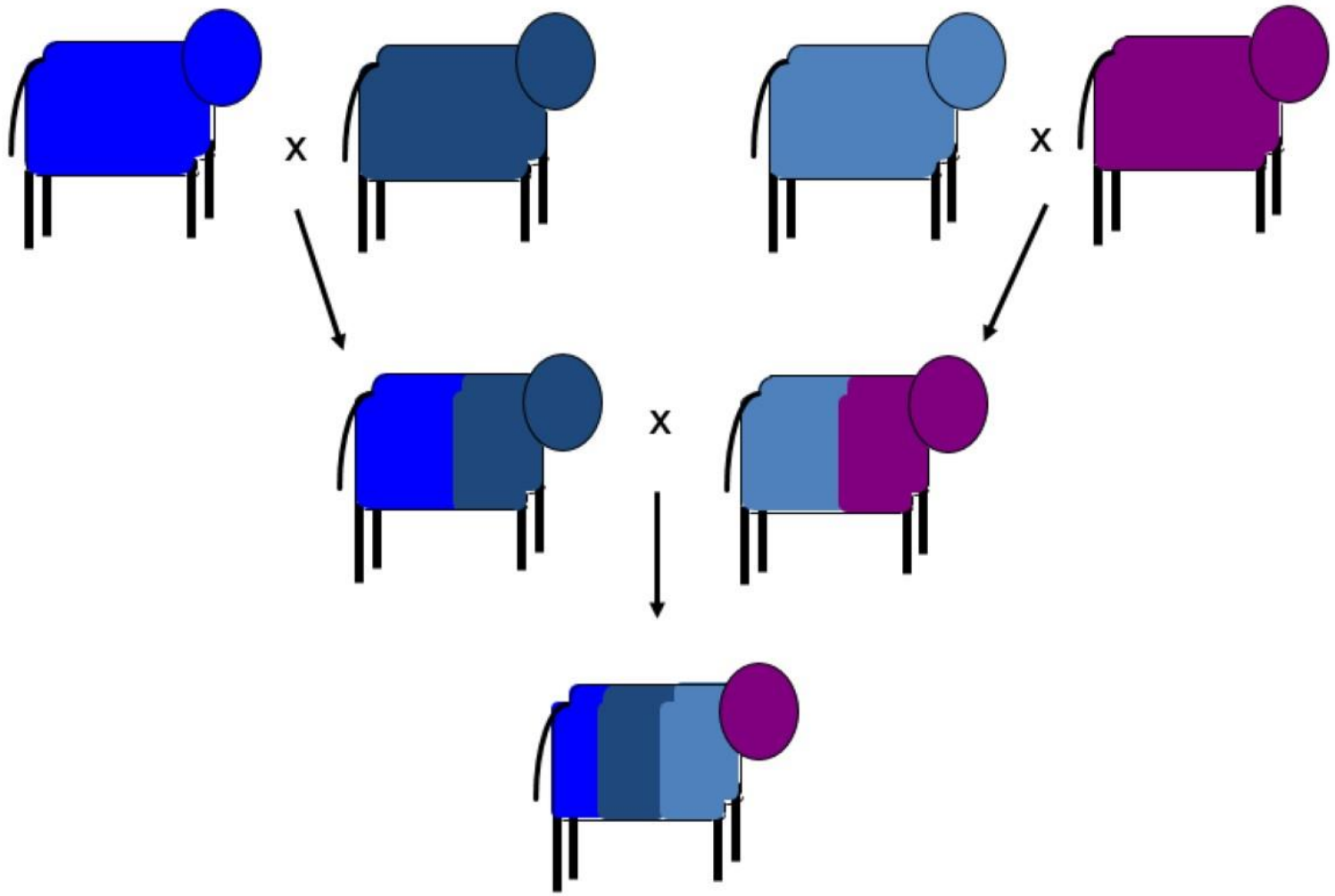
Two breed cross



static terminal sire



Four breed composite



In-calf Heifers

Key messages

1. Measurement of traits is vital to allow progress
2. EBVs provide the best guide to breeding potential
3. Focus on traits for profitability – indexes give a balanced approach
4. Match genetics to system, resources and market