



# SimHerd Crossbred for estimating the economic effects of crossbreeding

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# What is SimHerd? - and why is it useful?

- SimHerd is a **dynamic, stochastic and mechanistic** simulation model of a dairy herd including young stock
- SimHerd can quantify the **herd level technical and economic effects** of a change in management

# What is SimHerd? - and why is it useful?

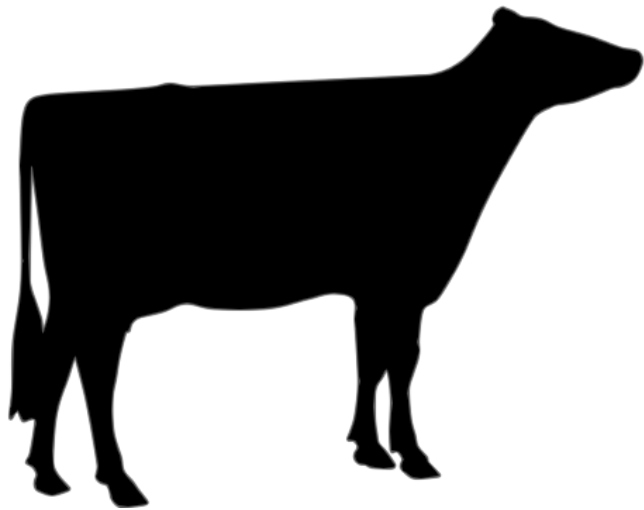
- SimHerd has been continuously **developed since 1992**
- Commercially used by **farmers, farm advisors and veterinarians** since 2005 (SimHerd Inc.)
- Used for **science and teaching**
- Used primarily by Danish farmers, but also **Dutch, Swedish, Finnish and other countries**



# SimHerd

vs.

# SimHerd Crossbred



I don't care  
what breed  
I am..

We do!



# SimHerd Crossbred

- Herd specific assumptions are used
- Each animal in the herd is:
  - **Simulated individually**
  - given a **genetic level and heterosis effects** dependent on breed composition
- Different systematic crossbreeding programs can be evaluated
- **Output: Annual net return**

Can also be used for estimating the effect of a change of breed

# How is it done?

- Every single animal is given a genetic (breed effect and heterosis) level at birth
- Breed and heterosis effects established for many traits
  - Yield
  - Fertility
  - Health
  - Mortality
  - Calving ease
  - And more

# Additive/relative breed estimates (Danish example, relative to Holstein)

	Trait	Unit	Breed A	Breed B	Breed C	
Production	Milk yield, kg ECM, 1. parity	Relative ratio	0.87	0.97	0.88	
	Milk yield, kg ECM, 2. parity	Relative ratio	0.87	0.95	0.88	
	Milk yield, kg ECM, 3. parity	Relative ratio	0.87	0.94	0.88	
Feed efficiency	Feed Conversion Efficiency (FCE)	Additive	0.02	0.00	0.00	
	Milk fever	Odds ratio	1.92	0.87	0.87	
Diseases	Dystocia	Odds ratio	0.19	0.85	0.85	
	Retained placenta	Odds ratio	0.38	0.88	0.88	
	Metritis	Odds ratio	0.38	0.87	0.87	
	Displaced abomasum	Odds ratio	0.50	0.90	0.90	
	Ketosis	Odds ratio	0.49	0.87	0.87	
	Digital Dermatitis	Odds ratio	0.64	0.67	0.67	
	Interdigital Hyperplasia	Odds ratio	0.80	0.79	0.79	
	Hoof horn diseases	Odds ratio	0.74	0.74	0.79	
	Mastitis	Odds ratio	1.20	0.75	0.75	
	Somatic cell count, cells per ml. (x 1000)	Additive	-7	-9	-9	
	Reproduction	Start breeding, heifers, months	Additive	-1.5	0.5	0.5
		Start breeding, cows, days	Additive	-7	0	-5
Insemination rate, heifers		Odds ratio	1.00	1.13	1.00	
Conception rate, heifers		Odds ratio	1.00	1.13	1.00	
Insemination rate, cows		Odds ratio	1.23	1.04	1.00	
Conception rate, cows		Odds ratio	1.38	1.28	1.23	
Mortality	Stillbirth	Odds ratio	0.82	0.82	0.82	
	Calf mortality (1-180 days after birth)	Odds ratio	1.28	1.13	0.93	
	Cow mortality	Odds ratio	1.06	0.69	0.69	

EXAMPLE

# SimHerd Crossbred

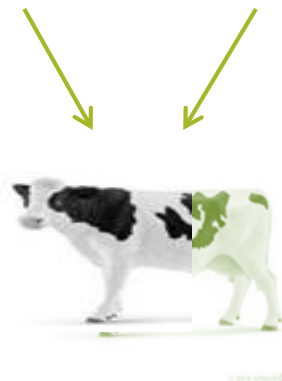
- A cow is characterised by its own as well as the parents breed composition

Parents



heterozygoti = degree of expressed heterosis

The cow

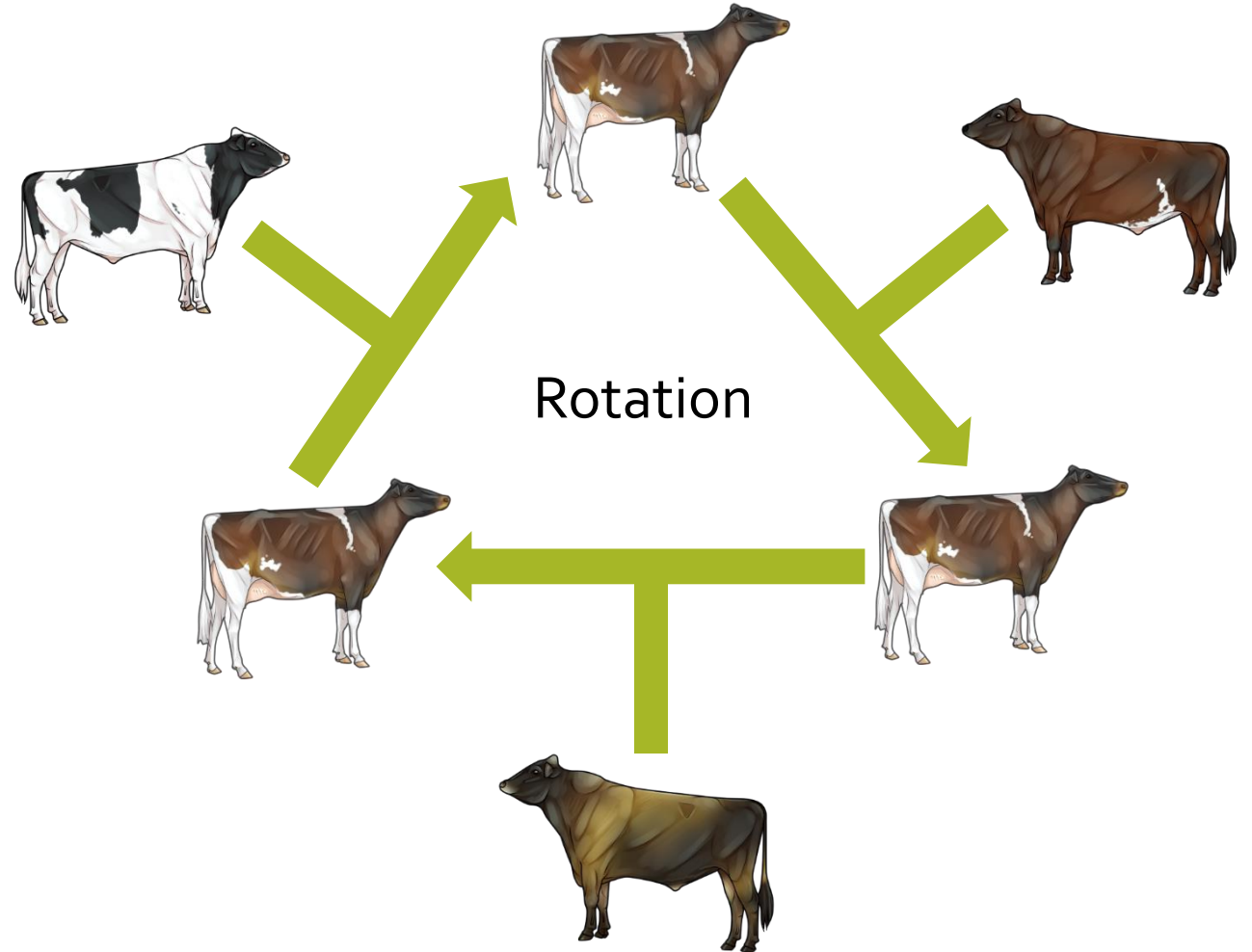
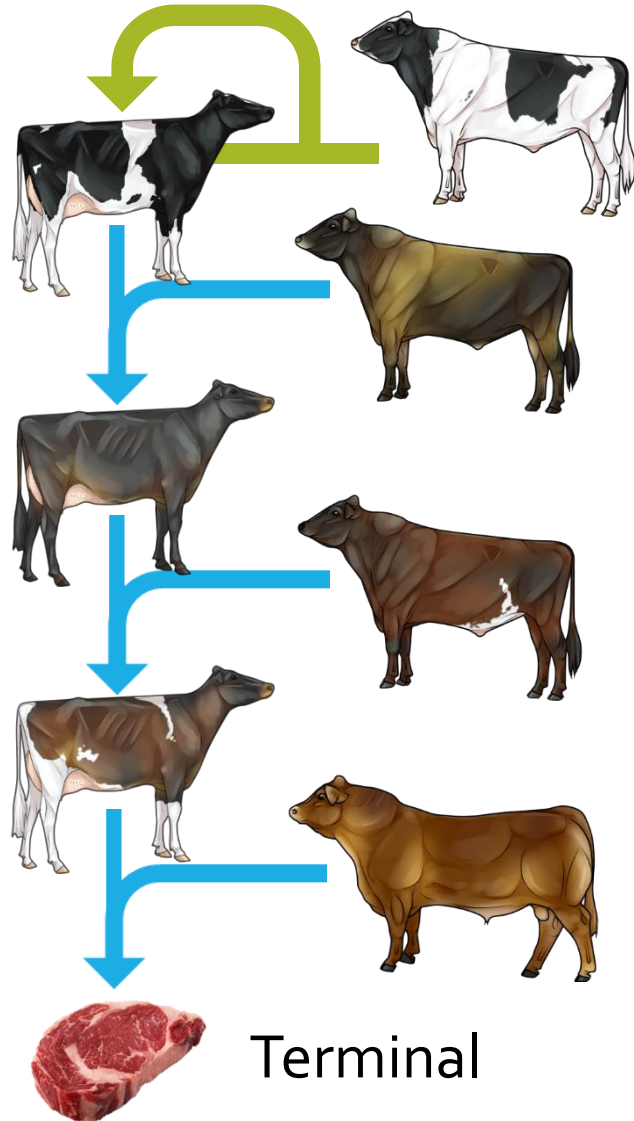


breed composition = degree of breed effect



# Crossbreeding systems (3 breeds)

Combi - Cross



## Simherd Crossbred results - Breed differences compared to HF Given average Danish production circumstances

	Jersey	Nordic Red
ECM per year cow (kg)	- 1168	- 370
Calving interval (days)	- 14	- 8
Replacement rate %	- 4,7	- 3,7
Number of treatments (per 100 cows)	- 29	- 34
Annual net return per cow (Euro)	- 54	+ 49
Net return per kg ECM (Eurocent)	+ 1.1	+ 0.9

Economically equal breeds



# Simherd Crossbred results

## – Crossbreeding compared to HF



	HF	Rotation HF*R*MON	Combi- Cross
ECM per year cow (kg)	10,554	- 131	- 94
Conception rate cows (%)	41	+ 7	+ 4
Replacement rate %	40.8	- 7.5	- 6.1
# of treatments per cow per year	1.36	- 0.27	- 0.16
Annual net return per cow (Euro)	2179	+ 136	+ 92
Net return per kg ECM (Eurocent)	20.7	+ 1.2	+ 0.7

# Simherd Crossbred results

## – Crossbreeding compared to HF



	HF	Rotation HF*R*J	Combi- Cross
ECM per year cow (kg)	10,554	- 324	- 171
Conception rate cows (%)	41	+ 8	+ 6
Replacement rate %	40.8	- 8.6	- 6.4
# of treatments per cow per year	1.36	- 0.26	- 0.15
Annual net return per cow (Euro)	2179	+ 77	+ 65
Net return per kg ECM (Eurocent)	20.7	+ 1.1	+ 0.6

# Conclusion

- SimHerd Crossbred can **estimate the biological and economic consequences** of different crossbreeding programs
- Introduction of a systematic crossbreeding program will **increase herd profitability**
- Profitability varies and depends on management levels, breeds but also payments for solids