CROSSBREEDING IN THE BREEDING SCHEME

NEW TOOLS FOR EVALUATING AND MANAGING SYSTEMATIC CROSSBREEDING AT HERD LEVEL AND RESULTS FROM CROSSBREEDING IN DENMARK

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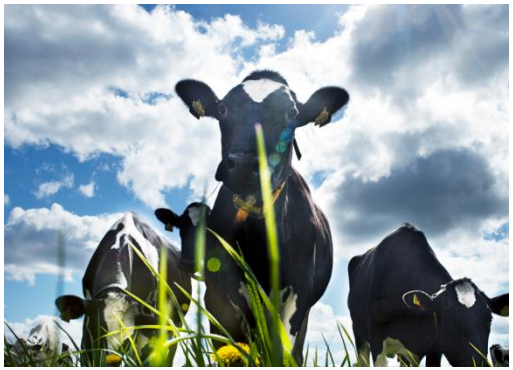
Den Europæiske Landbrugsfond for Udvikling af Landdistrikterne:
Danmark og Europa investerer i landdistrikterne

LDP 2020

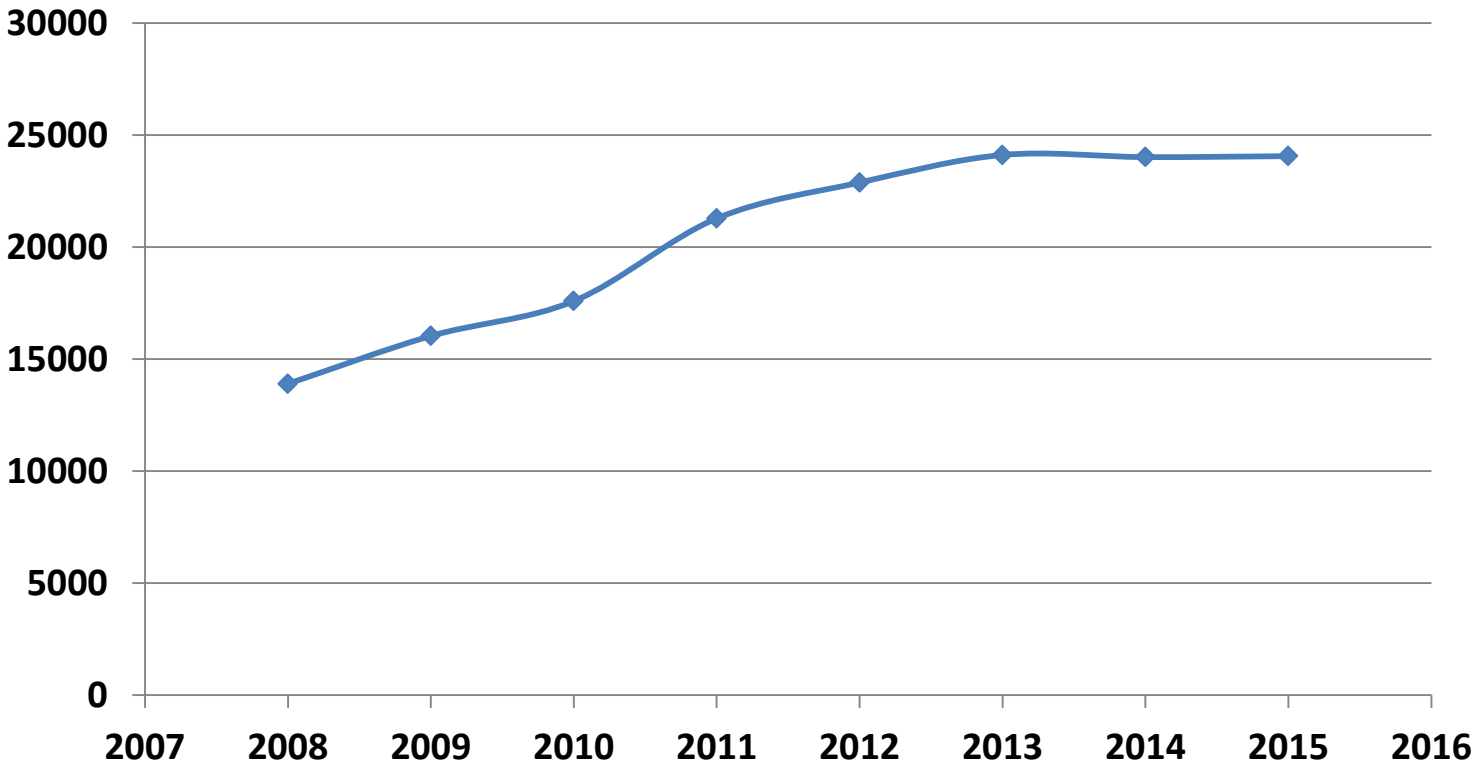
Miljø- og Fødevareministeriet
NaturErhvervstyrelsen

Den Europæiske Landbrugsfond for Udvikling af Landdistrikterne

Se EU-Kommissionen, Den Europæiske Landbrugsfond for Udvikling af Landdistrikterne



Number of born crossbred dairy heifers from systematic crossbreeding programs in Denmark



Approximately 9 % of all born heifers calves

Systematic crossbreeding in Denmark

- Approximately 59.000 crossbred cows in yield control
  - Increasing
    - Fewer random
    - More systematic
  - 12 % genetic contribution from beef breeds
    - Therefore this group is bad for comparisons
  - Nearly 9 % genetic contribution from Jersey

Crossbred animals have production like Holsteins and are more robust (2017)

Fleckvieh X Holstein

Jersey X Holstein

Montbeliarde X Holstein

RDC X Holstein

305-day yield – compared to Holstein				
Fat + Protein, 1st lactation	- 9	8	20	7
Fat + Protein, 2nd lactation	- 27	- 1	-1	-3
Survival (% point) – compared to Holstein				
Survival to 2nd lactation	3	3	3	2
Survival to 3rd lactation	10	8	12	5

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Fertility- compared to Holstein				
1. to last e ins, 1. parity	- 7	- 11	- 7	- 6
1. to last ins. 2. parity	- 20	- 14	- 14	- 9
Mastitis treatments (% point) - compared to Holstein				
1. parity	- 0,2	+ 1,7	+ 1,1	- 1,9
2. parity	- 2,8	- 1,5	- 3,6	- 2,0

Genetic analyses from Denmark

(first lactation)

Breed level compared to Holstein

	Protein (kg)	SCC (#/ml)*	DCFI**
Nordic Red	- 4	- 9.000	-8
Jersey	- 40	+ 16.000	-5

Heterosis

	Protein (Kg)	SCC (#/ml)	DCFI**	Days empty
HF*Nordic Red	6	- 2.000	- 2	- 5
HF*Jersey	12	- 7.000	-2	-12

* Average 71.000

** Days from calving to first insemination

Heterosis for longevity

Survival until end of fifth lactation

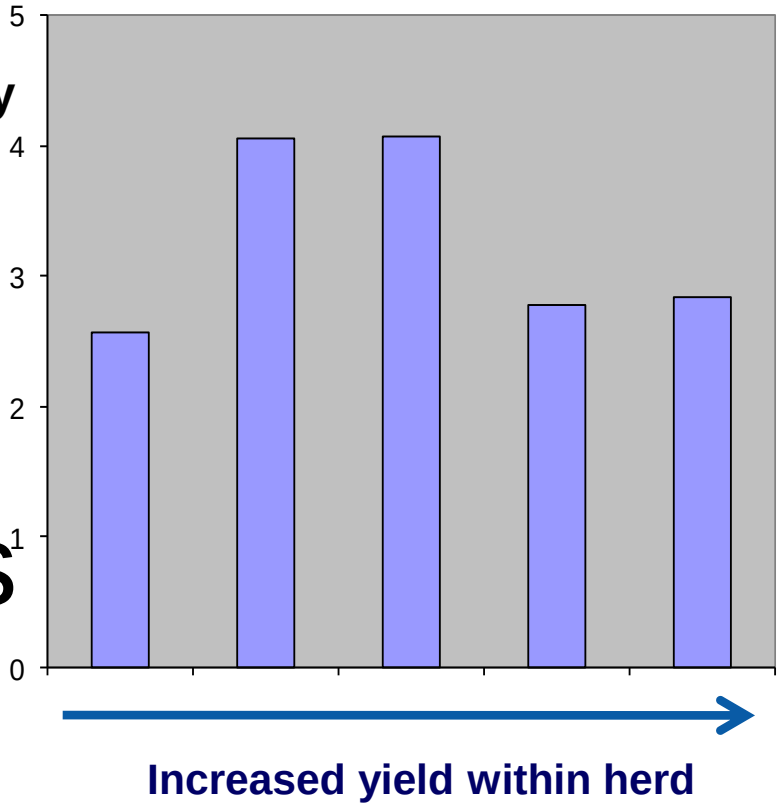
	HF x Nordic Red		HF x Jersey		Nordic Red x Jersey	
	%	days	%	days	%	days
5th lact	+ 8.5	+ 65.2 (15.1)	+ 6.2	+ 48.5 (23.6)	+ 7.2	+ 56.2 (42.1)

J. B. Clasen, E. Norberg, P. Madsen, J. Pedersen & M. Kargo

Is heterosis existing under good management levels?

Heterosis (%) between Danish Jersey and US Jersey for protein yield in Different management levels
(Kargo et al., 2012. JDS)

The answer is yes



Is heterosis existing under good management levels?

- A Danish investigation

- RDM * Holstein crosses compared to Holstein
  - Appr. 100.000 Holstein og 15.000 crosses
  - At least 5 crosses per herd*year
  - Three management levels

Management level	Mean – first parity, Kg F+P
High	675
Average	611
Low	532

Crossbred performance compared to Holstein under different management levels

Management level	High	Average	Low
Kg fat + protein, 1. parity	+ 7	+ 7	+ 3
Kg fat + protein, 2. parity	- 4	-12	- 7
Still birth at first calving	- 30 %	- 38 %	- 35 %
Mastitis treatments , 1. parity	- 15 %	- 15 %	0
Mastitis treatments , 2. parity	- 14 %	- 11 %	- 6 %

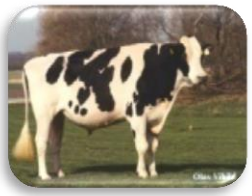
Performance of crossbreds

- Yield – a little better than Holstein level
- Functionality and robustness – a little better than the level of colored breeds

THE SEGES PLAN 2020

- 40 % of the dairy herds use systematic crossbreeding programs
- 150.000 slaughtered beef*dairy crosses
- A replacement rate of 32 %.
  - This can only be achieved with a systematic use of beef semen in combination with improved management

Combi-Cross



Step 1
Pure Breeding

Step 2
Two- breed cross

Step 3
Three-breed cross

Step 4
Beef Cross

The idea behind Combi-Cross

- The advantages of pure breeding and cross breeding are combined
- The level of the purebred nucleus is increased due to use of Sexed Semen
- The functional ”F1-animals” express their full heterosis
- The three-cross cows give birth to beef crosses

Assessing the economically consequences through SimHerd Crossbred

- A supplementary tool to SimHerd
- The program can judge different crossbreeding strategies within a herd
  - Systems
    - Rotational
    - Combi - Cross
  - Breeds

What is the SimHerd model - and why 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 and/or
  - in cow level relationships

SimHerd as to day

- A cow is a cow independent of breed

SimHerd Crossbred

- A cow is characterised through own and parents breed composition

Parents

heterozygoti= degree of expressed heterosis

The animal

breed composition = degree of expressed breed affect

How

- Every single animal is given a genetic potential (additive and heterosis) at birth
- Breed- and heterosis effects for many traits defined based on a large review
  - Yield
  - Fertility
  - Health
  - Mortality
  - Calving ease
  - And more

		Værdier for racer og racekombinationer til input					Mellemregning: forældregns * heterosis			Heterosis% bestemt fra litteratur			Mellemregning: ½race1 + ½race2			Værdier for rene racer bestemt fra litteratur		
Egenskab	Enhed*	Jersey	RDM	HF x JER	HF x RDM	RDM x JER	HF x JER	HF x RDM	RDM x JER	HF x JER	HF x RDM	RDM x JER	HF x JER	HF x RDM	RDM x JER	Holstein	Jersey	RDM
Mælkefeber	OR	1,92	0,87	0,89	0,90	0,89	0,051	0,034	0,049	0,9	0,9	0,9	0,057	0,038	0,055	0,040	0,074	0,035
Dystocia	OR	0,19	0,85	0,93	0,93	0,93	0,028	0,043	0,025	0,93	0,93	0,93	0,030	0,047	0,027	0,050	0,010	0,043
Retained Placenta	OR	0,38	0,88	0,89	0,89	0,89	0,057	0,077	0,052	0,9	0,9	0,9	0,063	0,085	0,058	0,090	0,036	0,080
Metritis	OR	0,38	0,87	0,89	0,89	0,90	0,050	0,068	0,046	0,9	0,9	0,9	0,056	0,075	0,051	0,080	0,032	0,070
Displaced Abomasum	OR	0,50	0,90	0,90	0,90	0,90	0,007	0,009	0,006	0,9	0,9	0,9	0,008	0,010	0,007	0,010	0,005	0,009
Ketosis	OR	0,49	0,87	0,90	0,90	0,90	0,034	0,042	0,031	0,9	0,9	0,9	0,038	0,047	0,035	0,050	0,025	0,044
Digital Dermatitis	OR	0,64	0,67	0,83	0,83	0,84	0,401	0,405	0,356	0,9	0,9	0,9	0,445	0,450	0,395	0,500	0,390	0,400
Interdigital Hyperplasia	OR	0,80	0,79	0,90	0,90	0,90	0,041	0,041	0,036	0,9	0,9	0,9	0,045	0,045	0,040	0,050	0,041	0,040
Hoof horn diseases	OR	0,79	0,74	0,88	0,88	0,88	0,198	0,194	0,176	0,9	0,9	0,9	0,220	0,215	0,195	0,240	0,200	0,190
Mastitis	OR	1,20	0,75	1,00	1,00	1,00	0,340	0,290	0,310	1	1	1	0,340	0,290	0,310	0,320	0,360	0,260
Cow Mortality	OR	1,06	0,69	0,89	0,90	0,90	0,049	0,041	0,042	0,9	0,9	0,9	0,055	0,045	0,047	0,053	0,056	0,037
Cell count	Additiv celler pr ml	7	-9	0	0	0	248	240	243	1	1	1	248	240	243	244	251	235
Mælkeydelse, 1. laktation	Relativ, kg EKM 305 dage	0,87	0,97	1,03	1,03	1,03	7749	8141	7614	1,03	1,03	1,03	7523	7904	7392	8035	7010,8	7773
Mælkeydelse, 2. laktation	Relativ, kg EKM 305 dage	0,87	0,95	1,03	1,03	1,03	8850	9236	8597	1,03	1,03	1,03	8592	8967	8346	9213	7971,692	8721
Mælkeydelse, 3. laktation og ældre	Relativ, kg EKM 305 dage	0,87	0,94	1,03	1,03	1,03	9209	9595	8929	1,03	1,03	1,03	8941	9316	8669	9586	8294,395	9044
Feed Conversion Efficiency (FCE)	Additiv ændring	0,02	0,00	0	0	0	0,89	0,88	0,89	1	1	1	0,890	0,880	0,890	0,88	0,9	0,88
Start breeding, heifers	Additiv, mdr.	-1,5	0,5	0	0	0	14,3	15,3	14,5	1	1	1	14,3	15,3	14,5	15	13,5	15,5
Insemination rate, heifers	OR	1,00	1,13	1,25	1,26	1,26	0,605	0,622	0,622	1,1	1,1	1,1	0,550	0,565	0,565	0,55	0,55	0,58
Conception rate, heifers	OR	1,00	1,13	1,28	1,29	1,29	0,638	0,655	0,655	1,1	1,1	1,1	0,580	0,595	0,595	0,58	0,58	0,61
Start breeding, cows	Additiv, dage efter klv.	-7	0	0	0	0	45,5	49,0	45,5	1	1	1	45,5	49,0	45,5	49	42	49
Insemination rate, cows	OR	1,23	1,04	1,18	1,17	1,18	0,435	0,413	0,440	1,1	1,1	1,1	0,395	0,375	0,400	0,37	0,42	0,38
Conception rate, cows	OR	1,38	1,28	1,19	1,19	1,21	0,484	0,473	0,517	1,1	1,1	1,1	0,440	0,430	0,470	0,4	0,48	0,46
Stillbirth	OR	0,82	0,82	0,87	0,87	0,87	0,048	0,048	0,044	0,88	0,88	0,88	0,055	0,055	0,050	0,06	0,05	0,05
Calf mortality after birth	OR	1,28	1,13	0,87	0,87	0,87	0,065	0,061	0,068	0,88	0,88	0,88	0,074	0,069	0,078	0,065	0,082	0,073

SimHerd Crossbred results

Average Holstein management level (conventional)

	HF	Jersey	Red
ECM per cow year	10022	- 1168	- 370
Calving interval	401	- 14	- 8
Replacement rate, %	41,1	- 4.7	- 3.7
# Treatments	1.61	-0.29	-0.34
Net return per cow year	9503	- 403	+ 368
Kr./kg ECM	0.95	+ 0.08	+ 0.07

Economically equal breeds

SimHerd Crossbred results

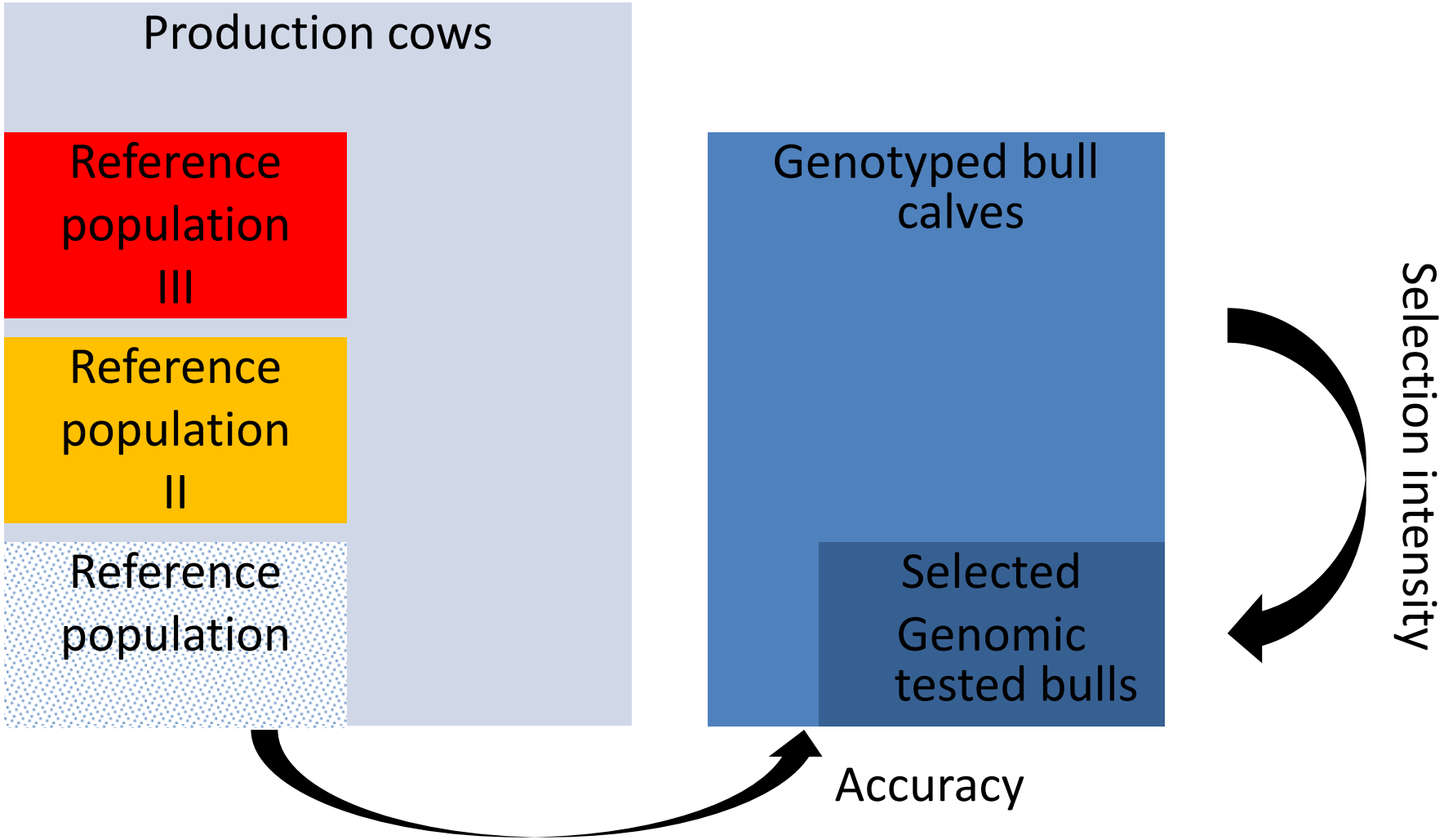
Average Holstein management level (conventional)

	HF	Zig-Zag HF*R	Rotationally HF*R*J	Combi - Cross
ECM per cow eyar	10022	+ 24	- 265	- 147
Calving interval	401	- 10	- 13	- 6
Replacement rate, %	41,1	- 3,6	- 5,7	- 3,6
# Treatments	1,61	- 0,24	- 0,32	- 0,22
NR per cow year	9503	+ 929	+ 712	+ 974
Kr./kg ECM	0,95	+ 0,09	+ 0,10	+ 0,11

Future breeding schemes at population level

- AI bulls selected for high performance of offspring in pure breeding
- AI bull selected for high performance in crossbred populations

The driving force behind genetic gain – using GS



More work will be done in

- SEGES crossbreeding projects
- Viking coordination – Hans Stålhammer
- GenTore
- Swedish/Danish Phd-project
  - Crossbreeding in dairy cattle
- New applications

Thank you for your attention ☺
Questions?