Strategies for use of OPU and MOET in Holstein, RDC and Jersey

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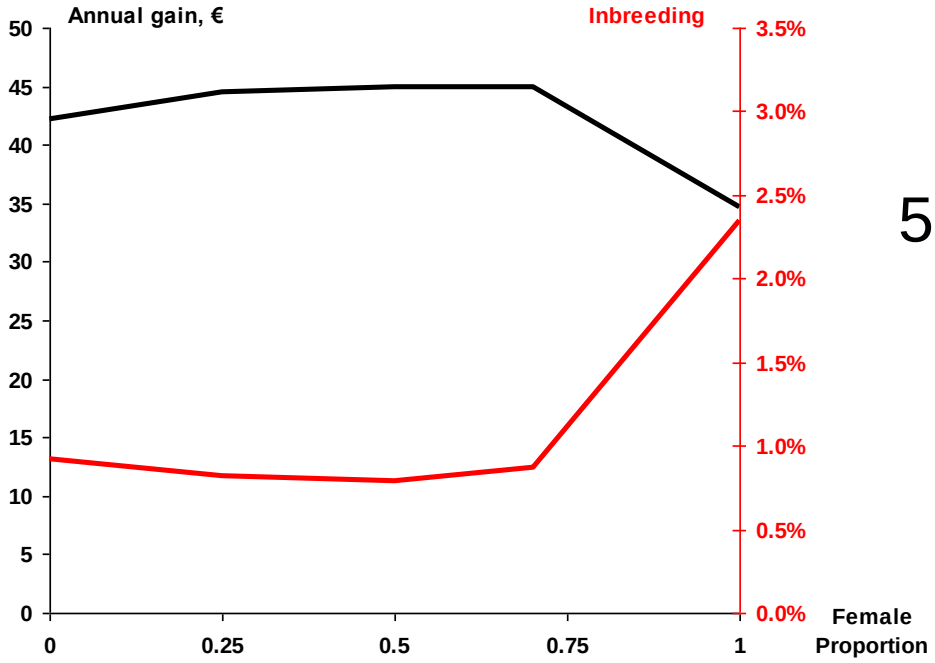
State of Art – Genomic Selection

- More focus on within-family selection to select animals with positive mendelian sampling
- The greatest benefits are obtained when families are large and a large number of animals are genotyped
- Positive interaction between GS and MOET in dairy cattle (Sørensen and Sørensen, 2010; Pedersen et al., 2012)
- Larger benefits are obtained when GS and MOET are used on the youngest heifers (Pryce et al., 2010)

Benefits from using GS on females when MOET is used



400 donors
5 progeny/donor

(Sørensen and Sørensen, 2010)

Status of OPU simulations

- Pilot studies
- Pseudo genomic simulations
  - Genomic information modelled as correlated traits
- Detailed analysis of selected scenarios
- Economic evaluation

Optimal utilization of OPU in a genomic selection scheme

- Evaluation criteria:
  - Genetic Gain
    - Monetary yearly gain in Euro
  - Inbreeding
    - Pedigree based per generation
- Evaluation period
  - Average year 21 to 30

General design

- Breeding goal
  - Protein
  - Mastitis

- Young bull schemes
  - Holstein
    - Large breed
    - High reliability of DGV = 0.5
  - RDC
    - Large breed
    - Low reliability of DGV = 0.36
  - Jersey
    - Small breed
    - Low reliability of DGV = 0.36

Simulation design for Holstein and RDC

- 2000 genotyped bull calves
- 2000, 4000 or 8000 genotyped females pr year
- Age at OPU: 2 or 14 month
- Donors : 50, 100, 200
- Sires: 50, 100, 200

} 6 combinations

- Sires pr donor: 5
- Full sibs: 2 or 4

} 10 or 20 progeny per donor

Simulation design for Jersey

- 2000 genotyped bull calves
- 500, 1000, 2000, 4000 genotyped females pr year
- Age at OPU: 2 or 14 month

- Donors : 25, 50, 100
- Sires: 25, 50, 100

} 6 combinations

- Sires pr donor: 5
- Full sibs: 2 or 4

} 10 or 20 progeny per donor

Reference scenarios without OPU

Breed	# Dams genotyped	# Sires	ΔG Euro	ΔF %	
Jer	**0**	**25**	32.6	0.77	Reference
	500	**25**	32.7	0.80	
RDC	**0**	**50**	31.1	0.44	Reference
	2000	**50**	31.2	0.40	
Hol	**0**	**50**	34.4	0.36	Reference
	2000	**50**	35.1	0.34	

Relative genetic trend Holstein

		Donors 14 month		Donors 2 month	
# Donors	# Sires	10 calves	20 calves	10 calves	20 calves
50	**50**	116	129	136	160
100	**50**	122	137	149	174
200	**50**	129	144	162	184
100	**100**	114	129	136	163
200	**100**	120	138	150	175
200	**200**	111	128	137	163

$LSD_{0.05}$=1.0

2000 females genotyped

Relative increase in inbreeding Holstein

		Donor 14 month		Donor 2 month	
# Donors	# Sires	10 calves	20 calves	10 calves	20 calves
50	**50**	128	164	158	186
100	**50**	122	144	139	150
200	**50**	119	142	122	128
100	**100**	69	89	83	97
200	**100**	67	83	72	78
200	**200**	39	47	44	50

$LSD_{0.05}$=3.8

2000 females genotyped

Relative genetic trend
RDC

		Donors 14 month	
# Donors	# Sires	10 calves	20 calves
50	**50**	114	125
100	**50**	120	134
200	**50**	125	141
100	**100**	112	126
200	**100**	118	133
200	**200**	109	125

$LSD_{0.05}$=1.1

2000 females genotyped

Relative increase in inbreeding RDC

		Donors 14 month	
# Donors	# Sires	10 calves	20 calves
50	**50**	125	175
100	**50**	130	168
200	**50**	125	157
100	**100**	75	100
200	**100**	70	91
200	**200**	39	52

$LSD_{0.05}=6.1$

2000 females genotyped

Relative genetic trend Jersey

		Donors 14 month	
# Donors	# Sires	10 calves	20 calves
25	**25**	110	118
50	**25**	114	124
100	**25**	117	129
50	**50**	107	120
100	**50**	112	124
100	**100**	105	118

$LSD_{0.05}=1.5$

500 females genotyped

Relative increase in inbreeding Jersey

		Donor 14 month	
# Donors	# Sires	10 calves	20 calves
25	**25**	135	179
50	**25**	140	184
100	**25**	143	174
50	**50**	73	101
100	**50**	78	99
100	**100**	40	57

$LSD_{0.05}=8.6$

500 females genotyped

Summary of results

- 200 donors and 50 sires provides the highest genetic gain
- Increasing number of sires has the most significant positive influence on inbreeding
- No significant genetic gain by increasing number of genotyped females with same number of doners and sires
- Increasing the donor program increases the genetic gain, but has in general no significant effect on inbreeding
- Lower reliability (from 0.5 to 0.35) costs 5 Euro in yearly genetic gain

Action points

- More realistic Jersey and RDC plans involving use of progeny tested bulls
- Full genomic simulations of most relevant scenarios
- Evaluate profit of different OPU-strategies in ZPLAN

Genetic trend with increasing number of genotypings

Fixed selection intensity in genotyped/donors

# Genotyped females	Breed	# Donors	# Sires	# calves	
				10	**20**
2000	Hol	50	50	40.0	44.3
	RDC	50	50	35.4	39.0
4000	Hol	100	50	+2.2	+2.9
	RDC	100	50	+1.7	+2.7
8000	Hol	200	50	+2.6	+2.6
	RDC	200	50	+2.1	+2.3