

Optimizing design of small-sized nucleus dairy cattle breeding programs with minimal recording

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Introduction

- Current genetic improvement in developing countries is through semen importation



Temperate



Tropical

- GxE between regions estimated to be 0.49 (Ojango and Pollot, 2002)

Environment specific breeding programs

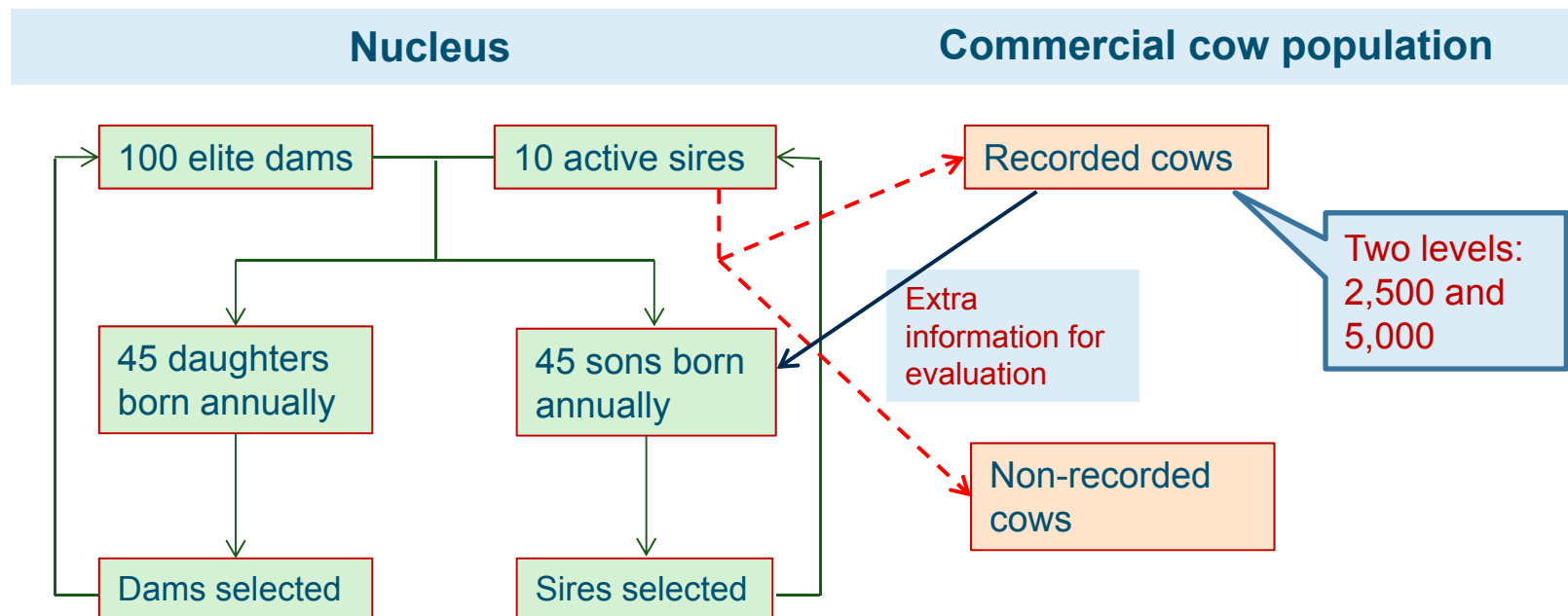
- Alternative approach: environment-specific breeding programs
- Limitation – minimal and erratic pedigree and performance recording at farm level (Wasike et al., 2011)
- Negatively impacts genetic evaluation of selection candidates

Objective

- Small-sized nucleus dairy cattle breeding program?
- What selection strategy to adopt?
 - Response to selection
 - Accuracy
- We ignored inbreeding for this study

Materials and Methods

- Deterministically simulated a nucleus program



SelAction (Rutten et al., 2004)

Materials and Methods

- Selection strategies

Abbreviation	Description
DP	Phenotypes of nucleus dams
PT	Progeny testing
GS	Genomic selection
GS+DP	Genomic + nucleus dams
GS+PT	Genomic + progeny testing

Materials and Methods

- GS was implemented by mimicking a correlated trait with $h^2 = 1$ and genetic and phenotypic correlations were calculated following Dekkers (2007)
- Selected for a single trait – total merit trait
- Truncation selection with 8 age-classes

Results – response to selection (ΔR)

- Response for the basic DP scheme in genetic standard deviation (σ_g)

Scheme	Number of CRC		L (years)
	2,500	5,000	
DP	0.042	0.047	4.2

- For comparison alternative selection strategies were benchmarked against basic DP scheme and presented as a percentage

Results – response to selection (ΔR)

	ΔR		
	Number of CRC		
Scheme	2,500	5,000	L (years)
PT	13.5	27.0	6.2
GS	24.3	70.3	3.0
GS+DP	24.3	43.2	4.2
GS+PT	16.2	29.7	6.2

Extra response as percentage of the response in DP schemes

- For these results the pedigree is assumed to be known accurately

Results – accuracy (r_I)

	r_I	
	Number of CRC	
Scheme	2,500	5,000
PT	0.62	0.73
GS	0.21	0.30
GS+DP	0.33	0.39
GS+PT	0.64	0.74

Conclusions

- Feasibility exists for creating genetic gains through nucleus programs with minimal performance recording
- GS will have the highest responses
- Lower accuracies in GS will be offset by the higher annual responses

Thank you for your attention!



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