Breeding strategies for long term benefits (for society and farmers)

AN INTRODUCTION

Side event

1st Int. Technical Conference on Animal Genetic Resources for Food and Agriculture

Interlaken, Switzerland

September 3rd 2007

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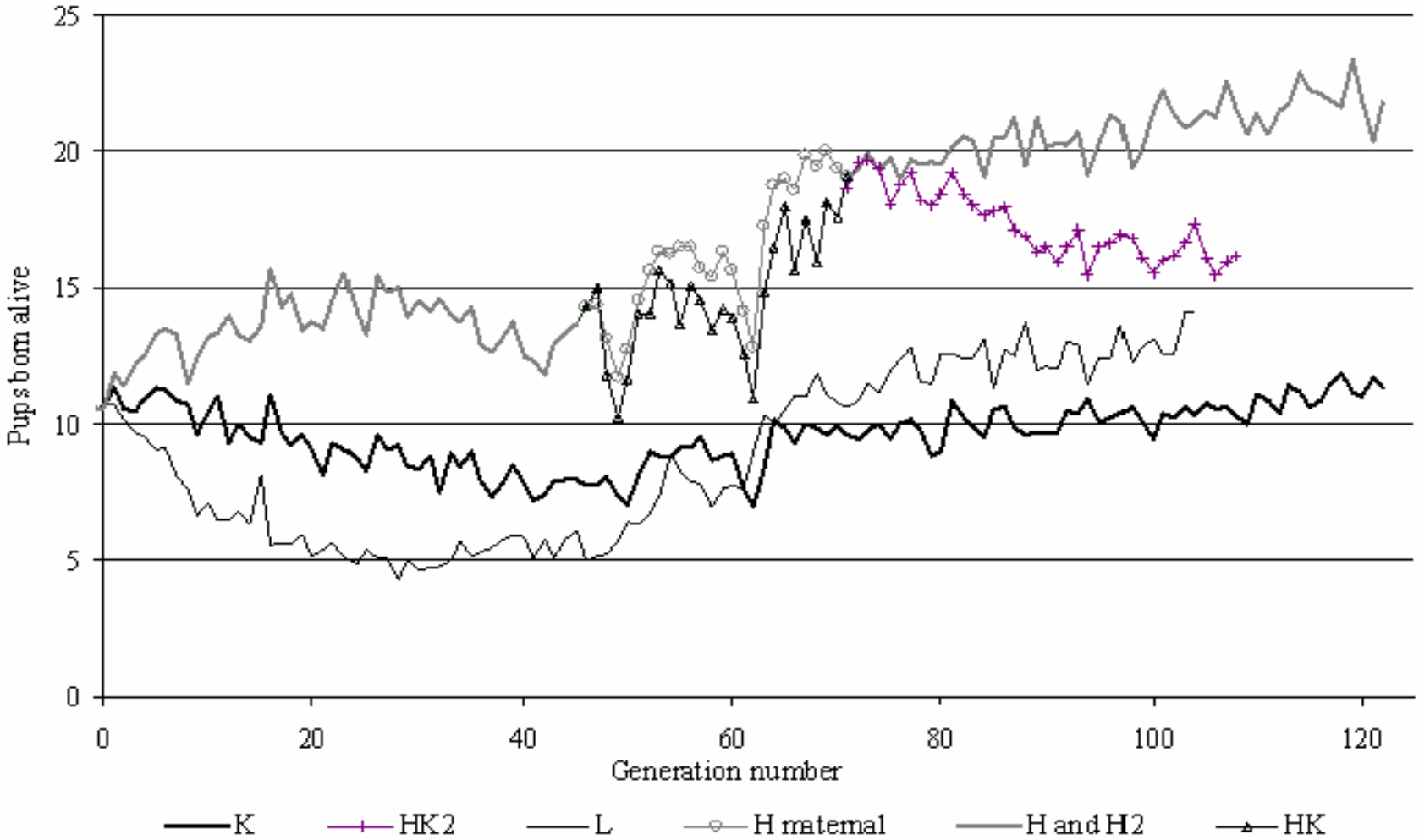
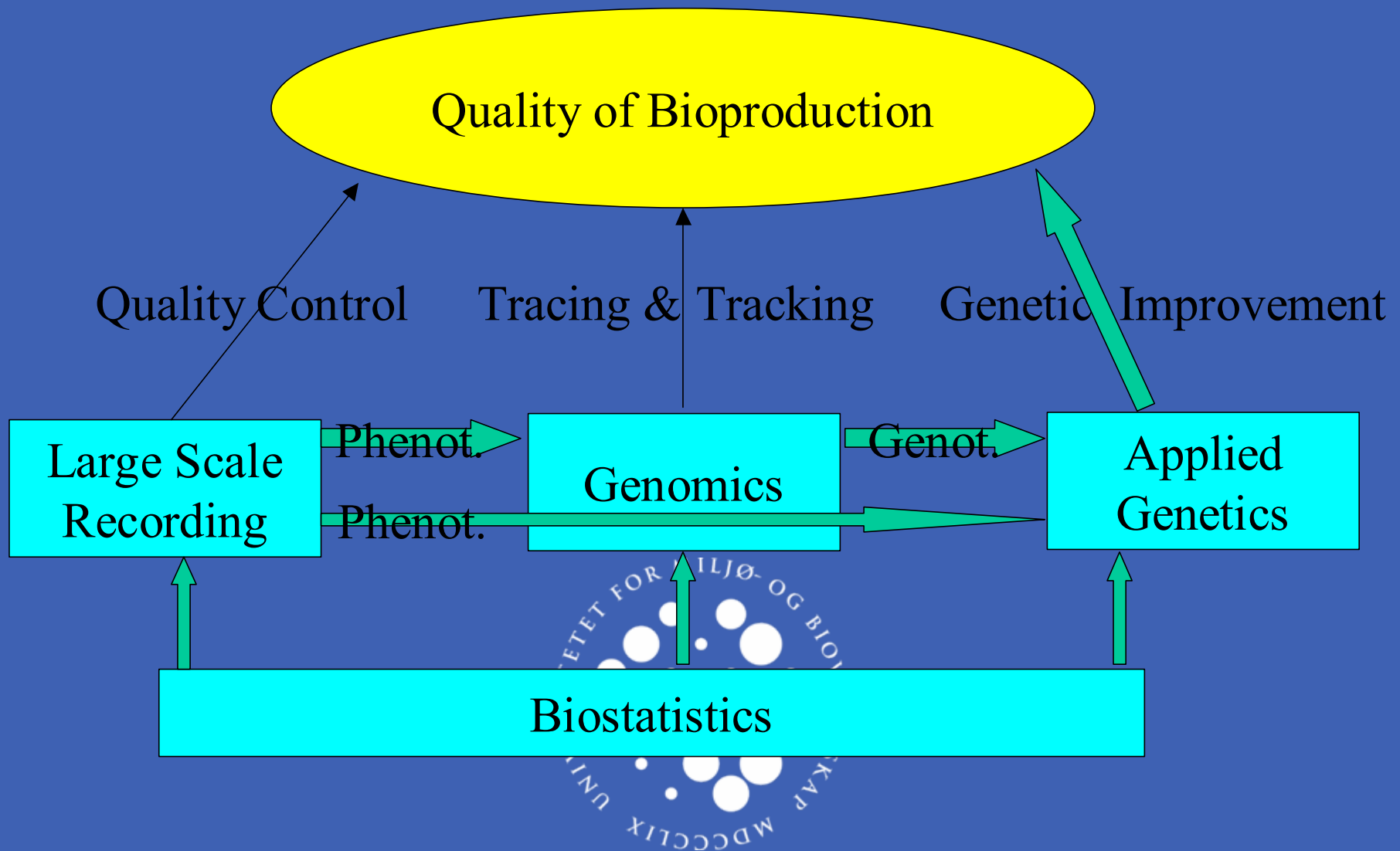
Computer tomography in pigs- a new way of improving selection for optimal body composition

120 generations of selection for litter size in mice- a story of changing litter size from 10 to 23, and still maintain genetic variation.




Quality of Bioproduction
Quality Control
Tracing & Tracking
Genetic Improvement
Large Scale Recording
Phenot.
Phenot.
Genomics
Genot.
Applied Genetics
Biostatistics

The “leading stars” for Norwegian Breeding Organizations were formulated around 1960 and were expressed as such:

- **Genetic progress for the many** (***the farmers, heavily involved in recordings for the breeding organisation, have the right to shear a part of the outcome of genetic progress)***
- **The farmers’ ownership to their genetics**

  (involvement, ownership)
- **Utilizing the scientific improvements**

  (utilizing new knowledge, bridge between theory and practice)

The success of a breeding organisation is dependant on the genetic improvement created, and this genetic improvement is dependant on scientific inputs.

- Norwegian breeding organizations have some success on the export market. WHY:
- Strongly organised
- High AI percentage (high selection intensities and efficient use of males)
- High health status
- Short distance theory-practice
- Interested and motivated breeders
- Openness of breeding system
- Documentation of genetic level

Key elements

- **The present success of Norwegian farm animal breeding nationally and internationally is a result of these leading stars and the investments in animal breeding and genetics from then to present.**
- **Some of the key elements of this development have been the close links between breeding industry and genetic / breeding research and education. The success of a breeding organisation is dependant on the genetic improvement created, and this genetic improvement is dependant on scientific inputs.**
- **The success of Norwegian fish farming (especially salmon) was as well developed from the same breeding philosophy and from the same scientific groups linked to our department and to the scientists within the breeding organisations.**

How to maintain these advantages for farmers and society?

- Breed for future traits
- Maintain production efficiency
- Maintain strong alliances with the breeders
- Beware of importance of field recording systems and health status
- Strengthen breeding for health, longevity and fertility –

  in both purebreeding and crossbreeding

Present and future traits- important for future improvements

• Growth	Production economy
• Feed eff iency	”
• Fertility, male and female	”
• Body composition	Product quality
• Quality parameters	
• Health traits	Animal welfare / prod. economy
• Other traits	Labour etc

LONG TERM BREEDING GOALS THAT WILL SURVIVE SHORT TERM PROFIT TRAITS

- Healty animals with high longevity, with low labour input
- Less resource demanding animals (food, labour etc)
- Increased focus on quality traits in the breeding goals

NB!! Too high emphasis on production efficiency traits (milk production, growth, etc) can be negative,

however, international competition is often based on production efficiency traits alone.

BREEDING GOAL:

Breeding goal 2006

Norsvin Landrace

TOTAL EBV – 100 %

Production 12 %	Carcass quality 28 %	Meat quality 7 %	Litter size 24 %	Reproduction 5 %	Maternal traits 17 %	Health 6 %
· Feed consumption, 25–100 kg (kg)	· Yield	· pH_u	· Live born:	· Age, first service (d)	· Teats (number)	· Conformation (score)
· Age at 100 kg (d)	· Lean meat (%)		- first litter	· Interval, weaning – service (d)	· Litter weight:	· OCD, front leg (score)
	· Bacon quality (score)		- second litter		- first litter (kg)	· OCD, hind leg (score)
			- third litter		- second litter (kg)	
					- third litter (kg)	

2007: + 3-weeks wt, IMF, + health disorders

Criteria for sustainable breeding

- The main breeding organisations in Norway have all documentet- in their yearly reports- that their breeding is sustainablee according to the following factors;
- Documentation of inbreeding development
- Genetic progress for other traits than production efficiency (health, fertility etc)

Criteria for sustainable animal breeding (Vangen 2006)

At the breed level:

Breeding for more traits than production efficiency- crucial for a balanced biology of the animals

Breeding in a long term perspective is important for a balanced biology of the animal

Recording of traits in the natural production environments (="field", "on-farm") ensures adaptation to the production environments

Be aware of the biological limitations and non- linear relationships between traits

Maintain a large enough effective population size

Balance breeding values with the animal's genetic uniqueness value.

Gene Technology Legislation in Norway (when evaluating gene modified organisms):

Only in Norway:

- **Sustainable development**
- **Value of the product for the society**

In whole Europe (Norway included):

- **Ethical considerations**
- **Environment and health effects**

Main challenge for sustainable breeding in Norwegian Red (NRF)

- Minimum inbreeding
- Maintaining genetic variance
- Genetic gain

(Sehested, 2006)

Other dairy cattle populations

	Population	Effective size	ΔF
Weigel 2001	US Holstein	39	1,28
	US Ayrshire	161	0,31
	US Brown Swiss	61	0,82
	US Guernsey	65	0,77
	US Jersey	30	1,67
Sørensen et al 2004	Danish Holstein	70	0,71
	Danish Jersey	98	0,51
	RDM	274	0,18
Sehested 2005	NRF	167	0,30

Solutions

- Optimal selection of elite bulls
- Optimal use of elite bulls

Optimal: Taking both total merit and bulls relationship with population into account

- Tool: ”Optimal contribution”
  - GENCONT
  - EVA
  - ”??”

Conclusions on Breeding strategies for long term benefits

- A long term perspective is important for long term profit
- Breeding for low heritable trait is dependant on field recordings of health, fertility and longevity. These traits are crucial for sustainable breeding in future
- Close inks between farmers, breeding organisations and science is important for equal sharing of benefits
- Norwegian animal breeding has obtained its reputation through these guide lines and they are now in demand on the international market due to these long term investments!

THANK YOU