THE NEXT STEP

Sustainable breeding in small re-established populations in Austria

The Example of Murboden Cattle

B. Berger, S. Eaglen, J. Sölkner, B. Fürst-Waltl
The case of Murboden cattle

- Famous for draught power and willingness
- Beef mainly from oxen
- Milk less important

- 1900 > 50,000 animals
- 1950 draught power not needed any more
- 1970 Crossbreeding with German Frankenvieh for more milk
- 1972 herdbook discontinued
Genetic bottleneck

- Herdbook re-established in 1978
  - About 200 supposedly purebred females
- 1982 – founding of ÖNGENE
  - < 500 animals including crossbreds
  - nucleus herd established on state farm at Piber
  - national conservation programme - maximal heterocygosity
- 1995 second conservation programme
  - collect all breeding animals „phenotypically Murboden“
  - Collect as much pedigree information as possible
The long way back...

First program 1982 to 1995

- Heterocygosity program, involve private breeders
- nucleus herd owned by state

Second conservation program 1995

- collecting and registering
- Gene banking

Herdbook closed in 2000, recording of fertility data started

Third program 2002

- minimize inbreeding by planned mating based on pedigree information
- start re-building population
- ancestry control
Re-entering the market

2006 marketing project

Murbodner association together with marketing organisation and biggest Austrian food retailer

- Oxen from pedigree herds only
- Raising and fattening on different farms
- Premium beef label „Murbodner Qualitätsochse“

Fourth program 2007

- Recording of production traits

2011 Heifer and cow program – Product development
  - Sausage „The Murbodner“

Products well established but......
Problems identified

- Genetic
  - Narrow genetic basis
- „Classic animal breeding“
  - Calving ease not satisfying
  - Daily gain of calves too low
- Economic
  - Not competitive without extra income from breeding program (contributions from government)
The project

- Initiated and funded by ÖNGENE
- realized at University of Life Sciences, Vienna

„From the selection against inbreeding to the selection against inbreeding and for performance“

- Goals:
  - Develop a sustainable breeding program for small populations
  - Develop ready to use software to imply the breeding program
Material

- 2 model populations
  - Murboden cattle
  - Carinthian sheep

- Population data and pedigree information from national database RDV

- Recording data from Zuchtdata Austria
  - 25,000 calvings, 20% first calvings, up to 10 calvings per cow
  - 16,000 weighing data (200d), 2950 slaughterhouse data sets
  - Approx. 500 herds, > 450 bulls

- Interviews with breed organisations and farmers – which traits to include in selection

B.Berger
Institute of Organic Farming and Biodiversity of Farm Animals
Method

- Optimum contributions selection (Meuwissen/Wooliams)
  - Complex method
  - Only strictly controlled breeding (nucleus herd)
  - Not applicable in the field!

➔ Look for a method applicable in practical breeding!
  - Combination of classic breeding value and inbreeding control
  - Estimation of breeding values for easy calving, daily gain & carcass traits

➔ Develop easy to use breeding value index
Parts of Project

1) Analyse situation of inbreeding
2) Develop estimation of breeding values
3) Combine breeding value and inbreeding control = index
Inbreeding rate and effective population size

![Graph showing inbreeding rate and effective population size over years.](image-url)
Estimation of genetic parameters

- Easy calving

\[
\begin{align*}
\text{direct} & : 0.17 \pm 0.04^* \\
\text{maternal} & : -0.44 \pm 0.10^* \\
\end{align*}
\]

- Heritabilities high but not unusual

- Recommend estimation of breeding value according to normal Austrian model

\[
\begin{align*}
\text{direct} & : 0.07 \pm 0.02^* \\
\text{maternal} & : 0.07 \pm 0.02^* \\
\end{align*}
\]

\* p < 0.05
Inbreeding depression

- Calving ease: Maternal Inbreeding
Inbreeding depression

- Live weight 365 days
Influence of Inbreeding

- No influence of inbreeding on carcass traits
- **Maternal inbreeding influences calving ease!**
- Weak connection between inbreeding of animal and growth (LW 200d; 365d)
Estimation of breeding value

Heifer index

- Calving ease
  - Direct
  - Maternal

Cow index

- Calving ease
- LW 200d
  - Direct
  - Maternal
- Slaughter weight
- Daily gain
- EUROP class
## Possible combinations of breeding value and inbreeding information

- All information separated
- Inbreeding, heifer index, cow index
- Weighted index

### Index values based on weighted contribution (%) of inbreeding vs. genetic merit

<table>
<thead>
<tr>
<th>Sire</th>
<th>Inbreeding coeff. (Inzuchtgrad (%))</th>
<th>Breeding Value (EBV)</th>
<th>Cow Index</th>
<th>Heifer Index</th>
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<tbody>
<tr>
<td></td>
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<td>0% 10% 25% 50% 75% 90% 100%</td>
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</table>
Conclusions

- involve farmers, official breeding authorities & genebank
- involve breed association & retailers
- establish sustainable breeding program (e.g. production & inbreeding) – involve farmers, research & development & official breeding authorities
- involve government
- look for dedicated people!
- How to make it fly? – just start small, take one step at a time and work together!
Heading into the future...