The elimination of the allele Rendement Napole (RN) in the Hampshire Pig has reduced genetic gain and increased inbreeding

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Negative influences of RN⁻

- 70% increase in glycogen content in skeletal muscle
- 10% lower concentration of protein
- Low ultimate pH (acid meat)
- Increased slaughter loss
- Increased drip loss
- Decreased technological yield
- Reduced water holding capacity
Positive influences of RN- 

- More tender meat
- Increased lean meat content
- Better taste
- Increased daily gain (in some studies)
Selection strategy in 3 steps

- Pre-selection and index selection
  1. 1999 Boars: Heterozygote or homozygote rn
  2. 2001 Boars: Homozygote rn
  3. 2002 Sows: Homozygote rn

- The total number of animals in population increases
  - 2001: From 4900 to 6400 animals
  - 2002: To 7300 animals
Successful elimination of unwanted genotype

- The frequency of genotypes in the Danish Hampshire Pig in 1999
  - Homozygote RN⁻: 74%
  - Heterozygote: 24%
  - Homozygote rn⁺: 2%

Graph showing allele frequency of rn⁺ in new born (%) from August 1999 to February 2003.
Theory

- Reduced genetic improvement
  - Increased population size
  - Reduction of gene pool
    - Potential breeding animals have been left out with pre-selection for r<sup>n</sup>+ animals

- Possibility of using animals with same ancestors when pre-selection for a single allele
Hypotheses

- The genetic improvement is reduced as a consequence of the elimination of the RN- allele through the pre-selection

- The average coancestry increased faster during the elimination of RN-
Data materiel

- Phenotypic observation from Hampshire pigs
- Three traits
  - Daily Gain\textsubscript{30-100kg}
  - Lean Meat Percentage
  - Feed Conversion Rate
- RN genotype on animals (not all animals have been genotyped)
- Full pedigree from 1974 to 2005
Production data analysis

- Three single trait models (DMU-software)

Daily gain_{30-100kg} = 
Intercept(f) + gender(f) + HYS(f) + genotype(f) + litter(r) + pen(r) + animal(r) + start weight(fr) + residual(r)

Lean Meat Percentage = 
Intercept(f) + gender(f) + HYS(f) + genotype(f) + litter(r) + pen(r) + animal(r) + residual(r)

Feed Conversion Rate = 
Intercept(f) + HYS(f) + genotype(f) + litter(r) + animal(r) + start weight(fr) + residual(r)
Expected genetic progress

- Before elimination
- Expected breeding progress
- During elimination
Annual polygenetic progress

<table>
<thead>
<tr>
<th>Traits</th>
<th>Before elimination</th>
<th>During elimination</th>
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<tbody>
<tr>
<td>Daily gain&lt;sub&gt;30-100kg&lt;/sub&gt; (gram per day)</td>
<td>18.4</td>
<td>9.5</td>
</tr>
<tr>
<td>Lean Meat percentage (%)</td>
<td>0.091</td>
<td>0.166</td>
</tr>
<tr>
<td>Feed Conversion rate (Feed unit/kg gain)</td>
<td>-0.014</td>
<td>-0.005</td>
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</tbody>
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Calculation of average coancestry

- Use of full pedigree

- Degree of average coancestry
  - 15 generations
  - Calculated with EVA_inbred-software
Average coancestry increases less than feared during elimination

- Annual change in coancestry 1996–2005:
  - 1997: 0.82%
  - 1998: 1.01%
  - 1999: 0.94%
  - 2000: 0.53%
  - 2001: 0.63%
  - 2002: 0.47%
  - 2003: 0.51%
  - 2004: 0.52%
  - 2005: 0.64%
Summary

- Gradually change in elimination program
  - Sufficient genetic variance
- Increased population size
  - Use of less good animals for breeding
  - Decreased risk of using related animals
- Less relationship between rn\(^+\) pigs
  - The mutant RN\(^-\) might come of one or few ancestors
Perceptive

- The elimination of RN⁻ is complete
- Elimination of RN⁻ had a harmful effect on the breeding progress
  - Loss of genetic improvement was less than expected
- Average coancestry increased more slowly during the elimination period than prior to elimination