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Increasing genetic *E. coli* F18 resistance in Swiss pigs

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Oedema disease and post-weaning diarrhoea are mainly caused by enterotoxigenic and enterotoxaemic *E. coli* expressing F18 fimbriae. A mutation in the *FUT1* gene was shown to be causative for these diseases. *A/A* pigs are resistant and *A/G and G/G* pigs are susceptible to infection with *E. coli* F18. So, it is possible to increase the number of resistant pigs by genotyping and selection of breeding candidates.

SUISAG, the Swiss herd book and AI organisation, genotypes about 800 Large White dam line sows and young boars for *E. coli* F18 resistance annually. SUISAG administrates all genotypes in a combined database with the traditional pedigree and performance data. A majority of pigs in the herd book is still not genotyped, but the Swiss database system allocates them one allele in case of a known homozygous parent or progeny and thereby uses the genotyping information in an optimum way.

Since 2006, SUISAG runs an elite mating program and a subsequent station test for dam line boars to improve the selection of the AI boars in general. Known homozygous susceptible (*G/G*) or heterozygous (*A/G*) Large White dam line sows are not considered for elite matings. Boars out of the elite matings enter the test station at 25kg. They are genotyped promptly afterwards if their genotype is not known from their homozygous parents. Less than 10% of the boars are *G/G*. They are slaughtered at the end of the test. Homozygous resistant boars (*A/A*) are preferred for AI.

E. coli F18 resistance of the Large White dam line AI boars improved considerably. On 1.1.2009, there were 25 (15) homozygous resistant, 10 (12) heterozygous and 0 (12) homozygous susceptible boars at the AI station (in brackets: AI boars on 1.1.2006). So, the frequency of the resistance allele increased from 54% to 86% within the Large White dam line AI boars.

SUISAG will continue the selection to eliminate the *E. coli* F18 susceptible allele from the Large White AI boars and thus increase the number of resistant piglets in the herd book and piglet producer farms.

AG für Dienstleistungen in der Schweineproduktion
Société de prestations de services en production porcine

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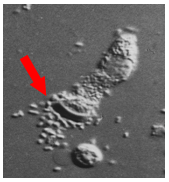
Oedema disease and post-weaning diarrhoea

- extreme rapid course of disease
- mostly, caused by *E.coli* bacteria expressing fimbriae type 18
- often mortal

- Frequent disease on farms
- Often caused by *E.coli* bacteria expressing fimbriae type 18
- affected piglets grow slower

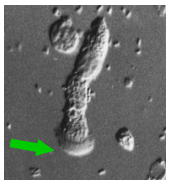
Genetic *E. coli* F18 resistance
⇒ Causal mutation on SSC6 in the *FUT1* gene

The pig is:
Homozygous susceptible ≙ G/G
or
Heterozygous susceptible≙ A/G



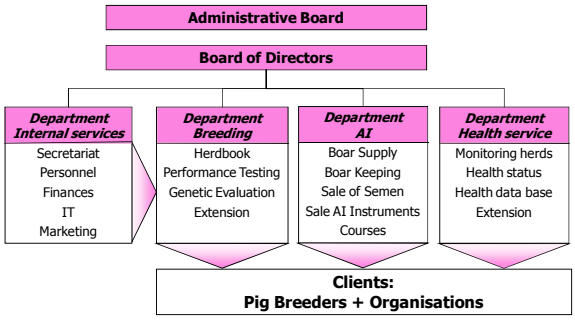
F18 bacteria adhere to the brush border of an enterocyte
⇒ Pigs could become ill

The pig is:
Homozygous resistant ≙ A/A



F18 bacteria can not adhere to the brush border of an enterocyte
⇒ Pigs are resistant

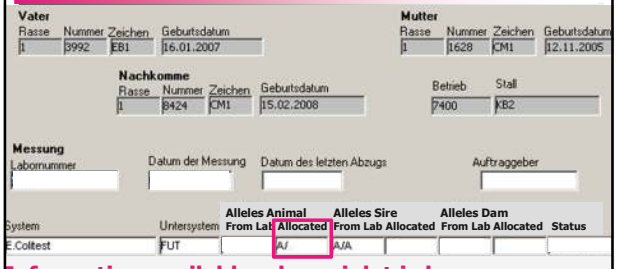
SUISAG ⇒ Services in pig production



SUISAG ⇒ Services in pig production

- **Breeding Department**
  - **Swiss pig herdbook ⇒ ≈12.000 sows**
  - **Performance test**
    - **Central test-station at Sempach**
    - **On-farm tests**
    - **Field test of terminal AI-Boars**
  - **Database**
    - **Pedigree**
    - **Performance data**
    - **Genotypes**
    - **SUISAG performs the genetic evaluation for pigs in Switzerland**
    - **Breeding values**

SUISAG database system
⇒ Administration of genotyping results



Information available when piglet is born
⇒ One "A" allele is allocated to the offspring from the homozygous sire

SUISAG database system
⇒ Administration of genotyping results

Information available after genotyping of the boar

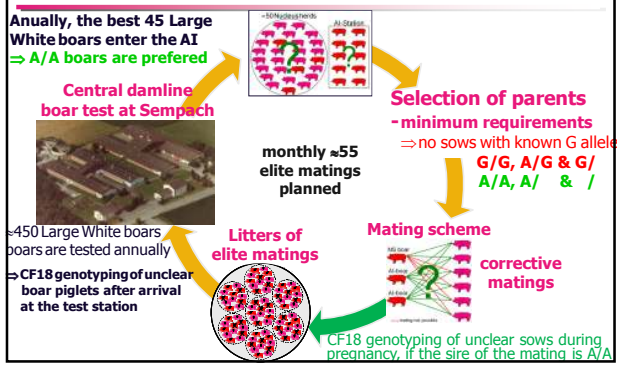
⇒ Genotyping result of the lab is plausible

⇒ One A allele is allocated to the dam from her homozygous progeny

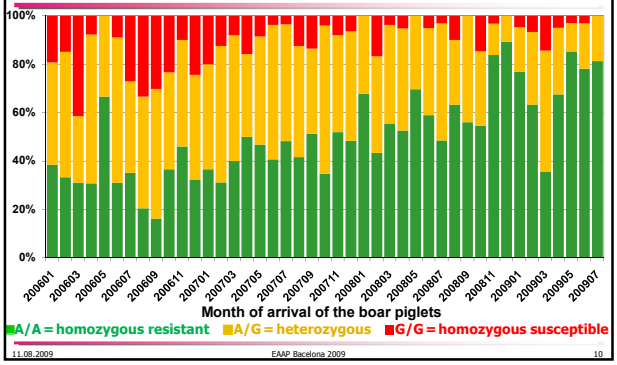
Since 2006: Elite mating program and central damline boar test

- Systematic production, testing and selection of new AI-Boars by SUISAG together with herdbook breeders
- **Improve the genetic quality of AI-Boars in general**
  - Increasing *E.coli* F18 resistance is only a „by-product"
- Control of genetic diversity of AI-Boars more systematically

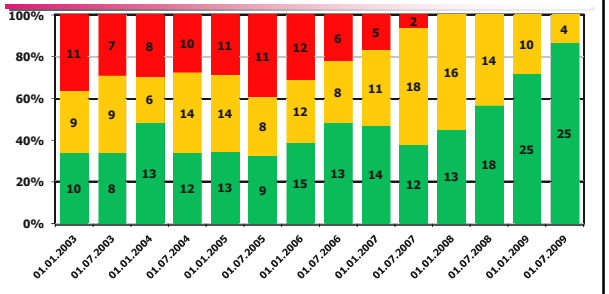
Large White elite mating program and central damline boar test



Increasing *E.coli* F18 resistance in Large White boars tested at Sempach



Increasing *E.coli* F18 resistance in active Large White AI-Boars since 2006



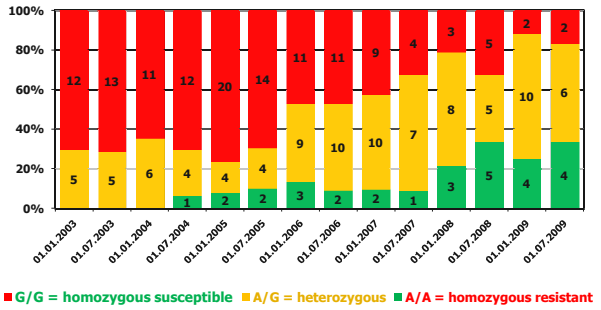
Number of CF18 genotyped Large White pigs in total

2003	2004	2005	2006	2007	2008	2009
230	384	369	636	575	717	442

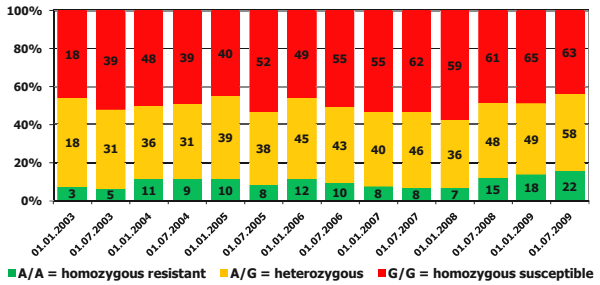
Conclusion and next steps

- The genetic *E.coli* F18 resistance was notable increased in the Swiss Large White breed by a systematic genotyping and selection program in the last three years
- Finish selection on *E.coli* F18 resistance in Swiss Large White
  - ≈1 year ⇒ only homozygous resistant Large White boars in AI-Station
  - Continuously increase the resistance allele in Large White nucleus sows by use of the homozygous AI-Boars
- Start a systematic selection program on *E.coli* F18 resistance in the Swiss terminal sire line **PREMO**

Increased *E.coli* F18 resistance in active Landrace AI-Boars



Minor progress in *E.coli* F18 resistance in active PREMO AI-Boars



⇒ No systematic genotyping & selection of all AI candidates before purchase for AI at the moment