

Applied Genetic Evaluation Of Livestock

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Program

Week	Date	Topic
1	12.04	Introduction to Genetic Evaluation of Livestock
2	19.04	Model Selection
3	26.04	Variance Components
4	03.05	Genetic Groups and Longitudinal Data
5	10.05	Genomic Selection
6	17.05	Questions, Test Exam
7	24.05	Pfingstmontag
8	31.05	Exams

Course Objectives

The students

- ▶ understand the theoretical background and the practical application of the prediction of breeding values in Swiss cattle breeding, in pigs, sheeps and goats.
- ▶ know how to interpret predicted breeding values.

→ What is the meaning of a predicted breeding value of -900 kg for milk yield

→ What is the difference between production and breeding

Further Reading

- ▶ Willam und Simianer: Tierzucht - Grundwissen Bachelor (Ulmer, UTB 3526 2011). This book gives an introduction into evolution, livestock production and breeding programs.
- ▶ Falconer and Mackay: Introduction to Quantitative Genetics (Longman). The de-facto standard in the area of quantitative genetics uses many examples from experimental research to illustrate the concepts of quantitative genetics.
- ▶ Mrode: Linear Models for the Prediction of Animal Breeding Values (CABI Publishing, 2005). The main focus is on prediction of breeding values using different models.

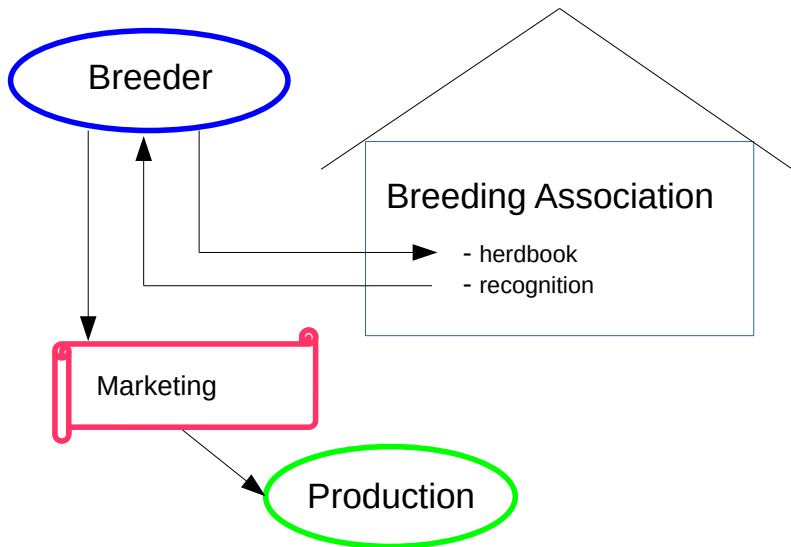
Terminology

- ▶ Livestock breeding versus animal husbandry: no difference made
- ▶ Breeding (in German: *Zucht*) used in different contexts with different meanings
- ▶ Science:
“Selection and Mating of parents are used such that offspring generations are closer to a defined goal.”
- ▶ Distinction between
 - ▶ livestock breeding and production
 - ▶ cattle breeding and milk or beef production
 - ▶ pig breeding and pork production and
 - ▶ chicken breeding and egg producers

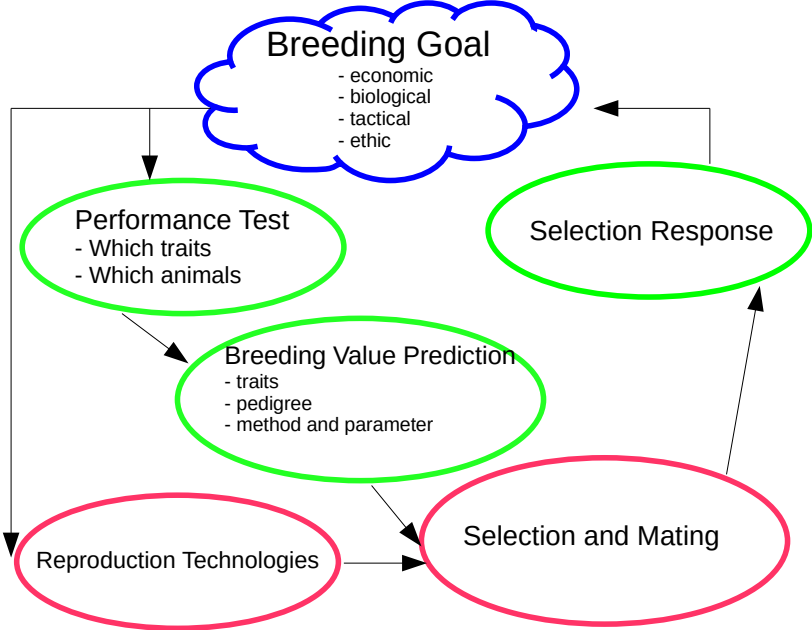
History

- ▶ Formations of breeding organisation (BO)
- ▶ Tasks of BO: herdbooks and certification
- ▶ Crisis at beginning of 20th century lead to federal regulations
- ▶ Developments of technologies
 - ▶ Reproduction
 - ▶ Molecular biology
 - ▶ Computer science

Breeding Organisations



Breeding Programs



Parts of Breeding Program

- ▶ Applied prediction of breeding values is a part of the breeding program
- ▶ Design and planning of a breeding program requires to answer the questions
 - ▶ What goal do we want to achieve
 - ▶ What measures do we want to use to achieve the goal

Types of Breeding Programs

Two types of breeding programs

1. Focus on **selection response**
 - ▶ countries with limited resources
 - ▶ big farms or big companies
2. Focus on clients and services
 - ▶ cattle and pig breeding of developed countries
 - ▶ economic interest of companies and farms

Breeding Goals

Types of breeding goals

- ▶ economic
- ▶ biological
- ▶ tactical
- ▶ ethical

Breeding goals might be formulated in different ways

- ▶ **political**: description of idealized image of future animal. Often conflicting and not verifiable
- ▶ **scientific**: mathematical description of direction of desired change. Measurable via selection response

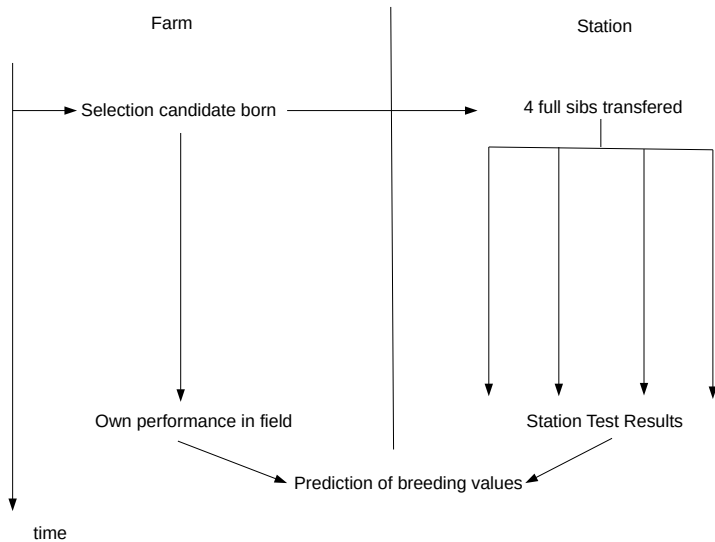
Performance Testing

- ▶ Basic question: What trait is measured when for which animals
- ▶ Breeding should be based on data
- ▶ Quality of derived parameters (heritability, predicted breeding values) depend on accuracy of collected data
- ▶ Data collection used for performance testing often started for different reasons
 - ▶ milk sample testing: quality of product
 - ▶ station testing in pigs: correction of environment

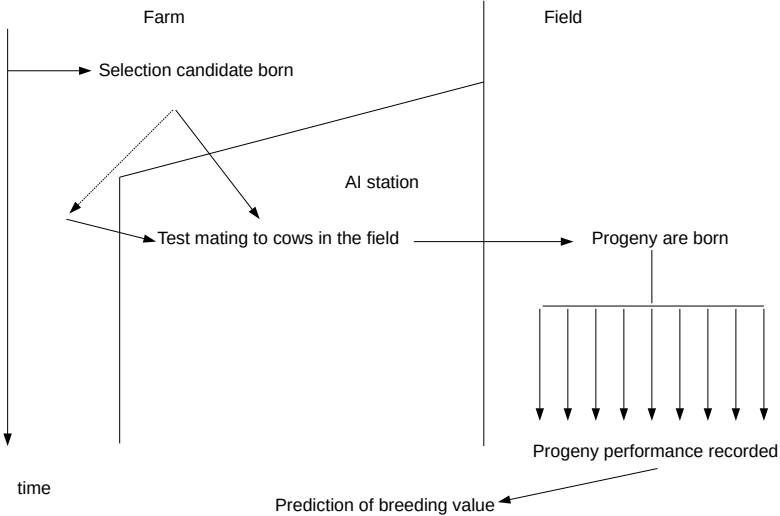
Classification of Performance Tests

- ▶ Place
 - ▶ Station
 - ▶ Field
- ▶ Relationship between selection candidate and tested animal
 - ▶ own performance record
 - ▶ full-sib
 - ▶ progeny
- ▶ Traits
 - ▶ should have genetic variation
 - ▶ economic importance
 - ▶ measurable better than subjectively observed

Examples: Pigs



Examples: Cattle



Prediction Of Breeding Values

- ▶ Done in most breeding programs
- ▶ Federal regulation
- ▶ Performance tests much more expensive
- ▶ Different intervals
 - ▶ cattle: three times per year
 - ▶ pigs: nightly or weekly

Progress In Technologies

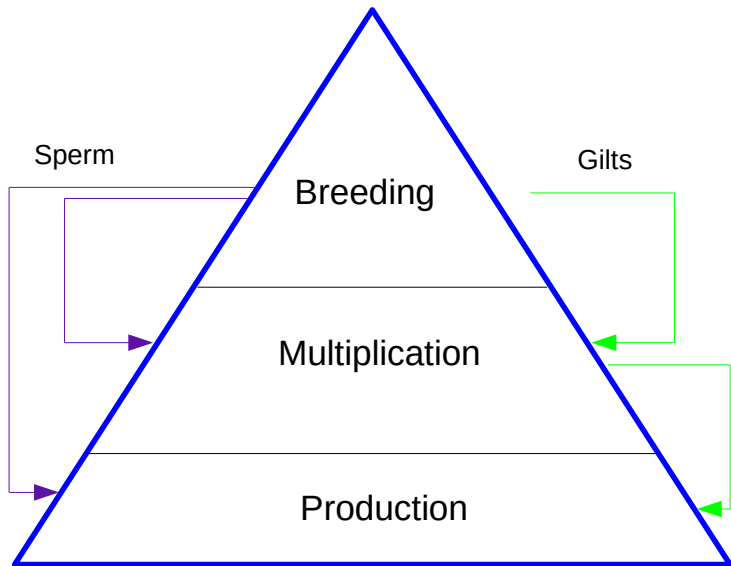
- ▶ Reproduction - AI
 - ▶ disease prevention
 - ▶ number of progeny per sire increased
 - ▶ better comparisons between herds
 - ▶ Future: more development on female side
- ▶ Molecular Biology
 - ▶ cheap and efficient large-scale genotyping
 - ▶ sequencing with more accuracy
- ▶ Computer Science
 - ▶ efficient evaluation of large amounts of data
 - ▶ big data technologies - continuous monitoring

Differences Of BP Between Species

Breeding programs (BP) for different species have different structure

- ▶ **hierarchical**: pigs and chicken
- ▶ **flat**: cattle and horse

Hierarchical Structure



Monolithic Structure

