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Application of breeding programmes, basic and applied research in livestock breeding, genetic resources

Modul no. 2: Conservation and Sustainable Use of Animal Genetic Resources

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Breeding programmes

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Breeding programmes

- Long-term goals and breeding means.
- Synthesis of theoretical knowledge and practical experience – performance animal production.
    - Selection methods and mating programs.

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Breeding adaptation to local conditions

The necessity of adapting farm animals to the production environment

Genetic adaptation – adaptation:

- natural environmental conditions
- sales conditions

Adaptation factors:

- ekological
- ekonomic
- tradition

The genetic potential of individual populations is not maximized, but optimized.
=> It is not often possible to improve the production environment.

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Optimization of breeding programs

The task of breeding:

- increasing production efficiency,
- improvement of product quality.

Planning area:

- definition of the breeding goal,
- selection of suitable populations,
- estimates of population parameters,
- determination of economic weights,
- creation of mating plans.

An important part of planning breeding progress is transferring breeding progress from breeding to production area - the time delay should be as short as possible.

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Basic types of breeding programs

Selection program (uses additive component of population genetic variability)

- Works with:
  - selection, breeding value, heritability coefficient and genetic gain,
  - breeding methods using an additive component of genetic variability:
    - Purebred breeding,
    - Inbreeding,
    - Line breeding,
    - Gradian up crossing,

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Basic types of breeding programs

Hybridization program (uses the non-additive component of population genetic variability)

- Works with:
  - complementarity and individual effects of hybridization: heterozygous effects, positional effects and non-linear effects.

- Breeding methods using the additive component of genetic variability
  - Methods of utility crossing without selection for special combinational succession:
    - simple utility crossing without further use of hybrids in breeding,
    - rotary crossover,
    - interspecies crossing.
- Breeding methods using the effects of the heterosisis with selection for special combinational continuity :
  - interline breeding,
  - crossing inbred lines,
  - repeated selection for combinatorial continuity

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Factors of breeding progress

Genetic factors

- knowledge and size of the relevant population;
- knowledge of genetic parameters,
- choice of breeding measures, breeding program of performance control, heredity control, testing, etc.,
- choice of selection criteria and intensity of selection,
- gene flow, breeding methods.

Non-genetic factors

- integration of genotype and environment
  - Location of animals - climatic conditions, housing method, technology...
- animal nutrition,
- level of breeders (knowledge, experience),
- service level.

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Perspectives of livestock breeding

- Economics of production of agricultural products.
- Creating active health (revealing genetic diseases, increasing genetically determined resistance to diseases, etc.).
- Secondary traits such as longevity, exterior, etc.
- Genetic determination and genetically determined differences in feed utilization.
- Animal assessment - refinement of BW estimation and population testing.

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Basic and applied research in breeding

Basic research

is the study of physiological processes and their influence on gene manipulation, chromosome mapping, chromosome cloning.

Applied research

is the study and characteristics of a specific production environment (production conditions - sales) characteristics of individual populations (in specific environmental conditions).

it is in specific conditions a suitable (creative) way to apply genetic factors of breeding progress.

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Genetic resources

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Genetic resources – genetic reserves

- Currently, 250 local livestock breeds are threatened in Europe.

- In the Czech Republic, for example:
  - Czech Red Cattle, Czech Spotted Cattle,
  - Prestice Black-Pied pig,
  - Sumava Sheep, Wallachian Sheep,
  - Old Kladruber Horse, Silesian Norik, Hucul.

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Preservation of genetic resources - importance

- cultural and historical wealth of the nation,
- reserve of specific genes (not yet appreciated),

  a.) overcoming selection limits

  - significant genetic variability,
  - not predicting future breeding goals,
  - new (so far unknown) diseases; endurancenové.

  b.) production under unfavorable conditions (local conditions).

  c.) better understanding of the processes of domestication, evolution, natural and artificial selection.

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Conservation possibilities of genetic resources

- In situ
    - breeding of live animals in small populations (at the place of origin).
- Ex situ
    - frozen semen storage (transfer crossing),
    - preservation of frozen embryos,
    - conservation of populations far from their place of origin,
    - a combination of the previous options.

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Selection methods for genetic resources

- Individual selection
  - based on an appropriately chosen method of BV prediction (and other aspects),
- Selection of families
  - selection of the entire family based on the average value of the chosen selection criterion,
- Combined selection
  - the best individuals from the best families based on the chosen criterion,
- Family selection
  - the best individuals from each family, based on a pre-selected criterion.

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Breeding in small populations

- determination of the breeding goal,
- choice of selection criteria,
- optimization of the selection program,
- performance and health check,
- property evaluation,
- selection and breeding,
- monitoring the development of populations,
- propagation of genetic material.

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