

# Implementation Of A Breeding Programs

Peter von Rohr

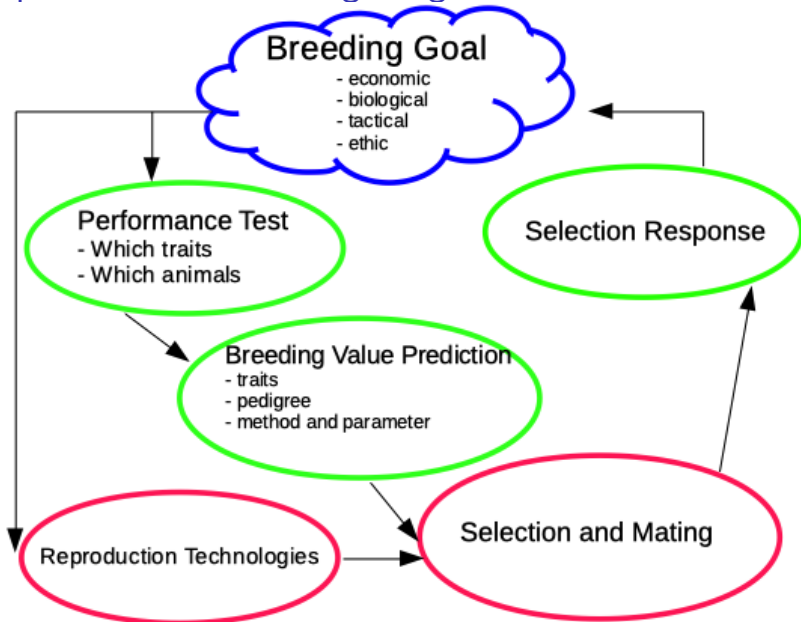
06.04.2020

# Recall

Types of breeding programs:

- ▶ focus on selection response (scientific)
- ▶ focus on customers and services (political)

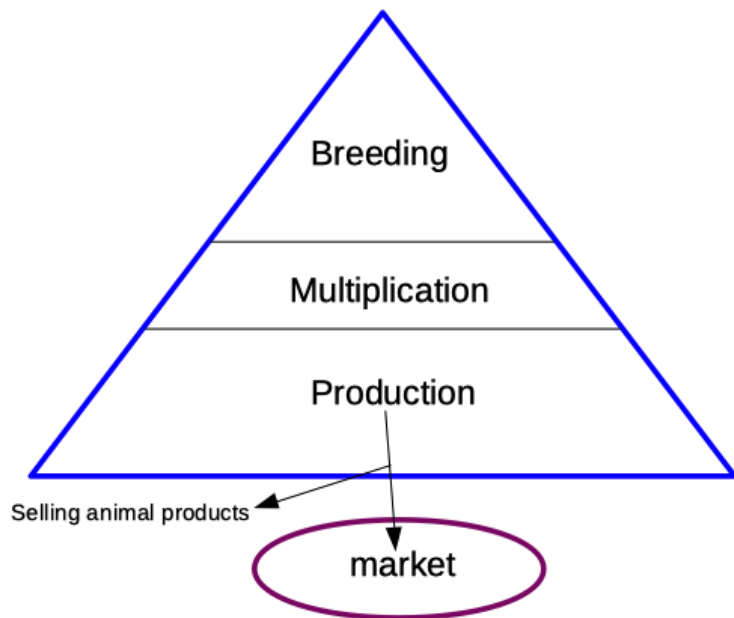
# Components of a Breeding Program



## Example of Implementation

- ▶ Assume: beef breeding organisation
- ▶ Improvement of animal at production level with respect to economic profitability
- ▶ Implementation of scientific breeding program
- ▶ Start to design and to develop economic breeding goal
- ▶ Combine economically important traits into an aggregate genotype ( $H$ )
- ▶ Use hierarchical structure

# Hierarchical Breeding Program

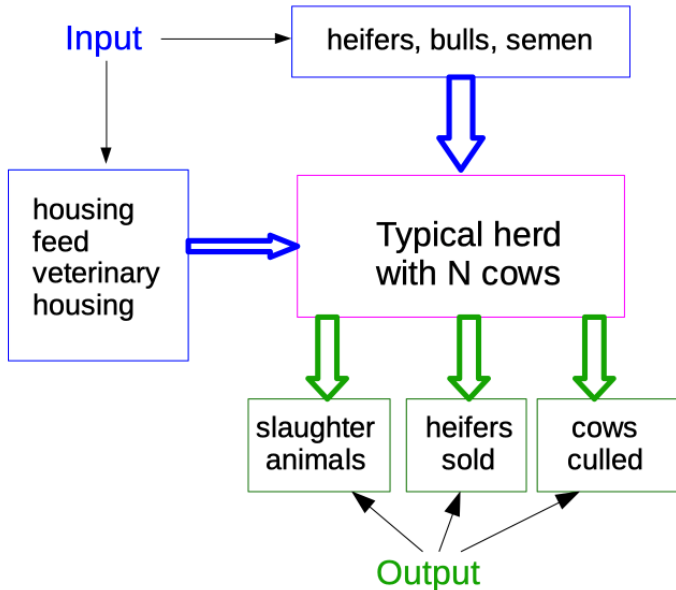


# Three Steps To Design Economic Breeding Goal

The following steps are needed to implement a breeding program

1. description of production system
2. modelling profit of a typical herd
3. derive economic values

# Production System



# What is a Production System

- ▶ Simulation of production herd
- ▶ Collect input parameters (costs, biological parameters, labor, ...) from literature
- ▶ Use collected input parameters for simulation
- ▶ Run simulation
- ▶ Record output quantities (revenue, animals sold)



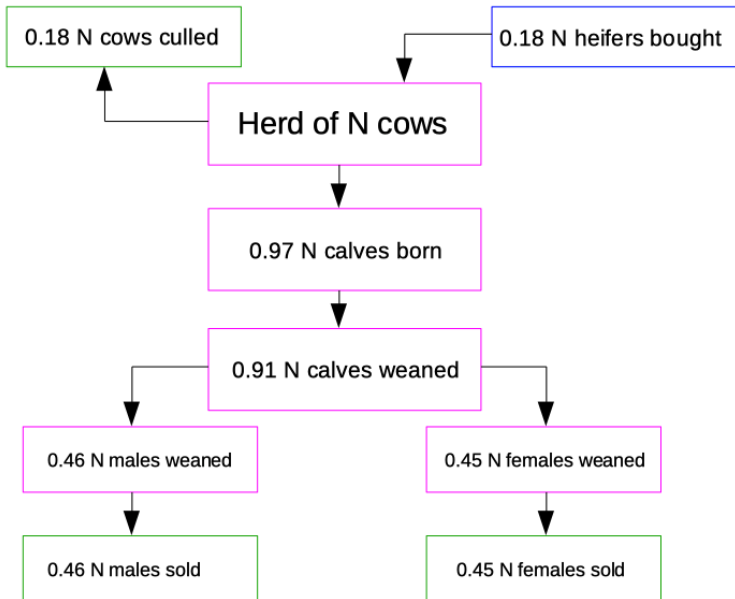
# Why Production System

- ▶ Profit is computed based on revenue and costs
- ▶ Characteristics and traits of animals with impact on profitability are found
- ▶ Impact of traits on profitability detected by changing input parameters
- ▶ Progeny must meet needs of production farms
- ▶ Breeders must select parents such that optimal progeny produced for production farms

# Structure of Production System

- ▶ Assume a hierarchical structure of the breeding program
- ▶ Alternatively: mixed farms in monolithic structure
- ▶ Breeding (and possibly multiplier) farms are selling their progeny to production farms

## Example Of Typical Production Farm



# Traits Of Interest

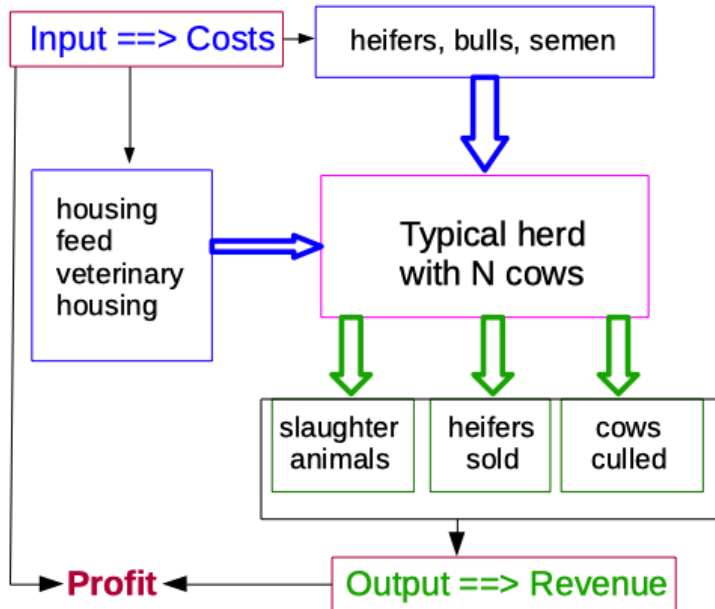
- ▶ Profit ( $P$ ) of production farm determined by revenues ( $R$ ) and costs ( $C$ )

$$P = R - C$$

- ▶ Traits of economic interest influence  $P$
- ▶ Restrict ourselves to output
  - ▶ age corrected carcass weight (CW)
  - ▶ carcass confirmation (CC)
  - ▶ carcass fat (CF)
- ▶ Above traits will be included in aggregate genotype ( $H$ )

$$H = a^T \cdot u$$

# Economic Evaluation



# Economic Values

- ▶ ... also known as economic weights
- ▶ Change of profit ( $P$ ) due to small change of trait mean ( $\mu_x$ )
- ▶ For trait  $x$  with mean  $\mu_x$ , the economic value  $a_x$  is defined as

$$a_x = \frac{\partial P}{\partial \mu_x}$$

# Genetic Evaluation

- ▶ Statistical modelling
- ▶ Stochastic relationship between genetic background and phenotypic expression
- ▶ Contrast: deterministic modelling in physics, e.g. law of gravity

# Statistical Modelling

- ▶ In most cases, two steps plus preparation
- ▶ Given: dataset on breeding animals containing traits of interest as response variables and predictor variables
- ▶ Preparation: do model selection to eliminate unimportant predictor variables
- ▶ Steps:
  1. variance components estimation
  2. prediction of breeding values