


بسم تعالی

ژنتیک کمی در اصلاح دام

منابع اصلی:

> "ژنتیک کمی و آنالیز ژنوم" : تألیف: دکتر سعید انصاری و مهندس مهرانوش فروتن - انتشارات دانش بروهان
 Introduction to Quantitative Genetics - by : DS Falconer and TFC Mackay
 Genetics and Analysis of Quantitative Traits - by: Michael Lynch
 Quantitative Trait Loci Analysis in Animals - by: J I Weller



Quantitative Genetics with Integration of Molecular Genetics for Animal Breeding

Basic Goal of Animal Breeding
 Create genetic improvement in a population

Select and mate animals to breed the next generation
 such that the next generation has better average
 performance than the current generation

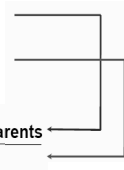
While maintaining genetic diversity

Basic Principle of
making genetic progress in a population

Mate the "best" to the "best"
and do that as quickly as possible.

Genetic Gain/Yr = $\frac{\text{genetic superiority selected parents}}{\text{generation interval}}$

= $\frac{\text{intensity} \times \text{accuracy} \times \text{genetic st. dev.}}{\text{generation interval}}$

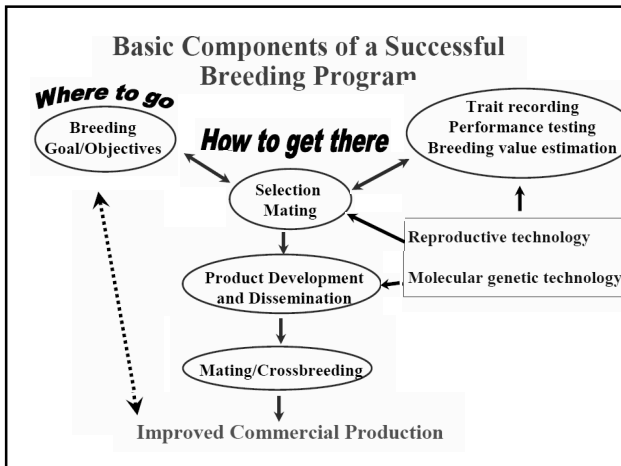


Mate the “Best” to the “Best”
and Do That As Quickly As Possible

Some Questions

- How to find/identify the “best”?
- “Best” for what?
- What are the limits to use of only the “best”?
- How can we shorten the generation interval?
- What are the limits?
- How can a breeding company make a profit from this?
 - “Breeding is a business” Lush, 1945
- How do technologies enter into this?

Basic Components of a Successful Breeding Program



Basic Components of a Successful Breeding Program

- **Breeding Goal or Objectives - where should we go?**
 - ◆ Which traits must be improved? - Economic traits
 - ◆ How important is each trait? - Economic values
 - ◆ Focus on improvement of Economic efficiency/profit
 - ◆ Consider (future) consumer demands
 - **Trait recording, Performance testing, Br. value estimation**

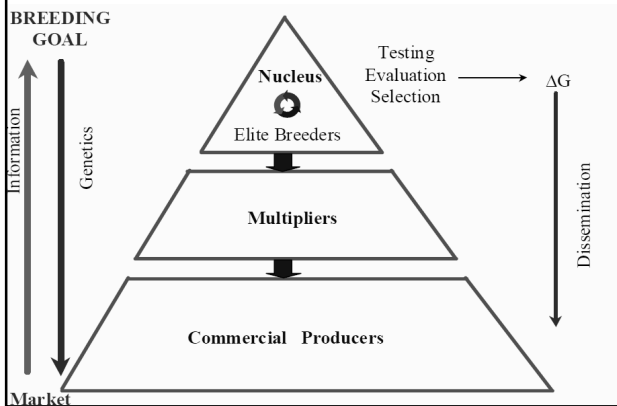
Identify animals with “best” genetics - relative to breeding goal

 - ◆ performance recording and testing programs
 - ◆ which traits should be recorded and on which animals?
 - field recording
 - performance test stations/ nucleus herds
 - progeny testing
 - ◆ pedigree registration
- Genetic Evaluation → Selection Index (Total merit index)

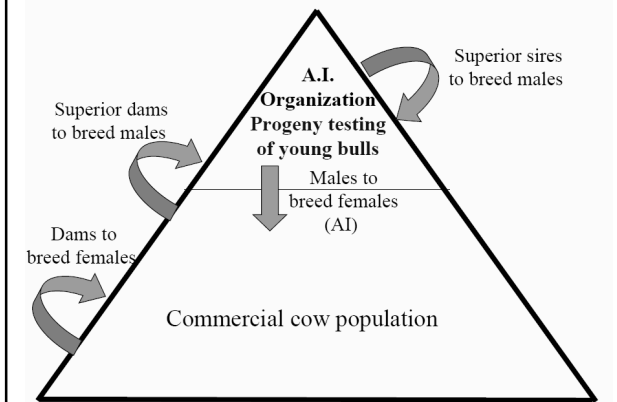
Components of a Successful Breeding Strategy

- **Selection and mating**
 - ◆ use best animals to breed next generation → genetic improvement
 - ◆ How many and which animals should we select?
 - ◆ How should we mate them?
 - ◆ Should reproductive technology be used to increase # progeny/parent?
 - ◆ balancing rate of genetic gain and inbreeding (and cost)
- **Product Development and Dissemination**
 - ◆ program for marketing and distribution of superior genes into the commercial sector
 - progeny testing, AI
 - multipliers
- **Mating/Crossbreeding**
 - ◆ optimize combinations of genetic material in commercial animals

Typical Structure of Animal Breeding Programs



Dairy Cattle Progeny Testing Program



Required Knowledge and Tools for Animal Breeders

- Quantitative genetics theory
- Statistical genetics
 - ◆ Genetic parameter estimation
 - ◆ Estimation of breeding values
 - ◆ QTL detection
 - ◆ Market-assisted breeding value estimation
- Systems analysis
 - ◆ Models to predict response to selection
 - ◆ Models to predict rates of inbreeding
 - ◆ Models to evaluate the impact of including markers in breeding programs
