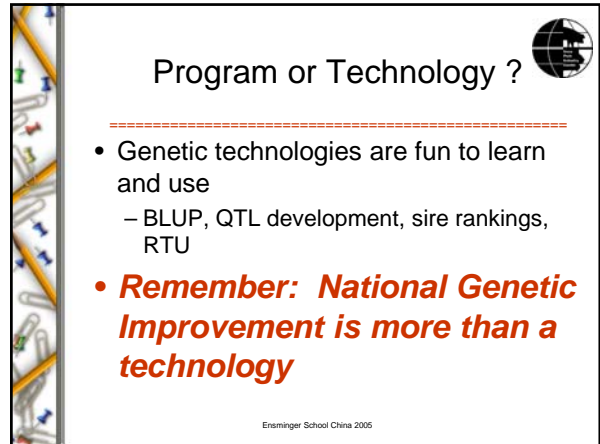


National Swine Genetic Improvement:
An Overview of Essential Program Components and Organizational Structure Needed For Success

Dr. John Mabry
 Director, Iowa Pork Industry Center
 Iowa State University

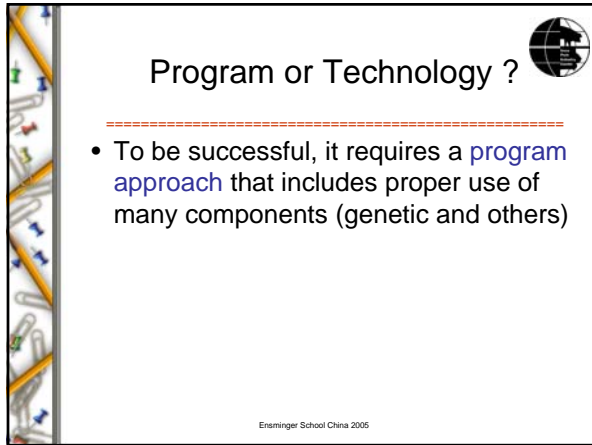
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Program or Technology ?

- Genetic technologies are fun to learn and use
 - BLUP, QTL development, sire rankings, RTU
- Remember: National Genetic Improvement is more than a technology**

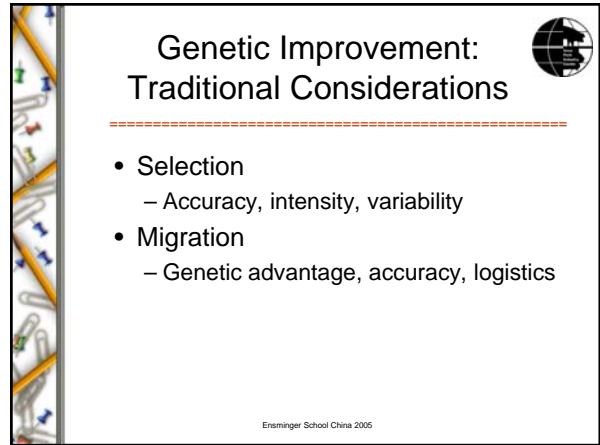
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Program or Technology ?

- To be successful, it requires a **program approach** that includes proper use of many components (genetic and others)

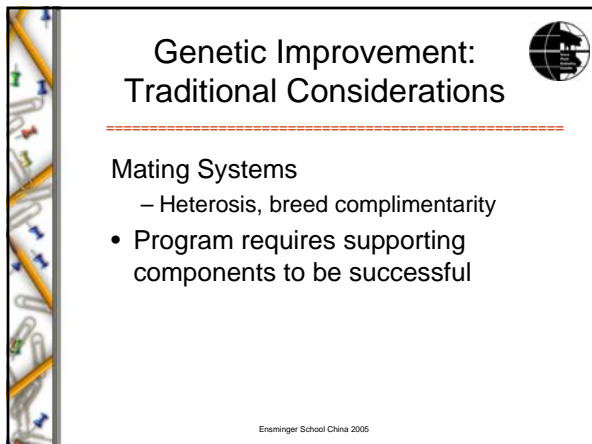
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Genetic Improvement: Traditional Considerations

- Selection
 - Accuracy, intensity, variability
- Migration
 - Genetic advantage, accuracy, logistics

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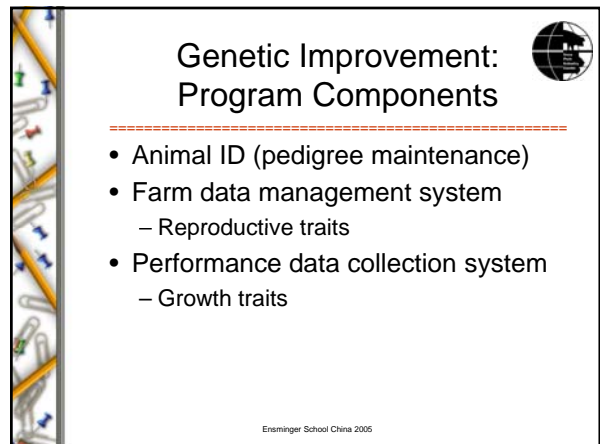


Genetic Improvement: Traditional Considerations

Mating Systems

- Heterosis, breed complementarity
- Program requires supporting components to be successful


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Genetic Improvement: Program Components

- Animal ID (pedigree maintenance)
- Farm data management system
 - Reproductive traits
- Performance data collection system
 - Growth traits


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Genetic Improvement: Program Components

- Meat quality data collection system
- Role of phenotypic selection
- Molecular genetics program


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Genetic Improvement: Program Components

- Data collection, processing and editing system
- Breeding value estimation
- Selection Index formulation from BV's


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Genetic Improvement: Program Components

- Combining molecular genetic information with Breeding Values
- Report System
- Quality control system


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Genetic Improvement: Program Components

- Central test station role
- AI station role
- Genetic sampling


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Genetic Improvement: Program Components

- Within farm genetic improvement program implementation
- National Swine Genetic Evaluation program (across herd)

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Genetic Improvement: Other Components

- Considerations based on the structure of the pig industry
- How to get participation in the program
- Role of government in the program

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Animal ID System

- Components
 - Breed, birth date, farm, litter number, pig number
- Unique for each pig
- Common system would be best
- Compatible with farm ID system
- Include pedigree information at some location

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Animal ID System

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Farm Data Management System

- Most data will be measured at the farm by farm personnel
- Farms need computerized data systems for their usage to improve productivity
- Not all farms will use the same system
- Each system should be able to extract data easily for genetic program usage

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Performance Data Collection System

- Must be accurate
- Must be consistent
- Must be flexible
- Must relate to profitability
- Must be comprehensive
 - Reproduction, growth traits, composition traits, meat quality traits

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Reproductive Traits

- Fertility
 - Litter size born alive
- Milking ability
 - Litter weaning weight
- Non-productive sow days
 - Wean to first service interval
- Age at puberty, appetite, longevity
- Other traits as they evolve

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Growth Traits

- Growth rate
 - Days to market
- Composition
 - Backfat, loin depth, loin muscle area, percent lean, use Real Time Ultrasound
- Feed conversion
 - Improvement through correlated response or direct measurement?

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Meat Quality Data Collection System

- Which traits influence eating quality and have economic importance ?
- Which traits can be measured on the live animal ?
- How to measure the other traits ?
- How to determine economic importance ?

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Role of Phenotypic Selection

- There is a need to include phenotypic selection
- Selection for structural soundness
 - Feet and legs, hip structure, conformation
- Selection for reproductive soundness
 - Teat number and quality, vulva structure
- Selection against abnormalities
- Extend longevity and reduce mortality

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Molecular Genetics Improvement Program

- Which have economic importance ?
- Which can be measured on the live animal ?
- Which are repeatable across populations ?
- How to measure economic importance ?
- Who does this ?

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Data Processing and Editing System

- Data entry at the farm
- Data editing and accuracy checks
- Data transfer to program staff
- Edits for outlier records
- Edits for errors (typos, mis-reads, etc)
- Errors can occur at all information points

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Breeding Value Estimation

- Where is this done ?
 - At farm, at central location
- Data adjustment
- Genetic analysis models
- Variance components
- BLUP software
- Frequency

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Selection Indexes from the Breeding Values

- Indexes to be used in a terminal crossbreeding system for commercial swine production
- Maternal index for use in Landrace and Large White (Yorkshire) pigs
 - Include reproductive traits, growth traits, composition traits, and meat quality traits if available

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Selection Indexes from the Breeding Values

- Terminal index for use in Duroc pigs
 - Include growth traits, composition traits and meat quality traits if available
- Based on accurate economic values
- Include threshold adjustments

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Breeding Value Report System

- For use at points in the production cycle that selection can be exercised
- Weaned sow report
 - Identify superior sows for purebred mating decisions, identify poor sows for culling
- Replacement gilt selection
- AI boar selection

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Quality Control Program

- Programming to detect pedigree errors
 - Inconsistent pedigree, inconsistent sex
- Programming to evaluate selection differentials realized in the farms
- Genetic trend analysis (by farm and across farm)
- Percentile breakdowns and benchmarking

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Central Test Station Role

- To measure performance of diverse genetics under same environment
- To measure traits that cannot be measured at the farm
- To provide genetic evaluation ties between farms
- To demonstrate new technology
- Who owns and manages them ?

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Role of Artificial Insemination Boar Studs

- Essential for dissemination of superior genetics to farms
- Provide genetic ties between farms
- High health procedure for genetic transfer
- Who owns the AI studs ?
- Who uses the semen from the boars?
- Where do they get their boars ?

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Genetic Sampling (Migration)

- Swine genetics is a worldwide industry
- Other countries offer promising lines and animals to sample and to see if they can improve the genetic merit of pigs
- If selection goals change, migration is very efficient in speeding up the response to the new genetic needs

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Genetic Sampling (Migration)

- Must have a way to accurately identify the genetically superior animals to import
- Must import the animals in a manner that does not create health concerns
- Must have an accurate program to measure success of imported animals compared to existing animals

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Within Farm Genetic Improvement Program

- BLUP technology can be used at commercial farms for reproductive traits
- BLUP technology can be used at genetic farms for all traits
- Phenotypic selection can be used at all farms

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National Across Herd Genetic Evaluation

- Accurately identifying genetically superior animals across farms can add to genetic improvement
- Must have different farms participate in the program
- Must have genetic ties between the farms
- Must use proper technologies and methodologies

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Structure of Pig Industry in China

- Evolving from local pig breeds to more efficient pig breeds and programs
- New farms are larger, use technology, and are more business oriented
- New farms are in separate systems and like to work independently
- Would they participate in a 'National Genetic Improvement Program' ?

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Potential Roles for the Government in a National Genetic Improvement Program



- Support of the university system
 - Education and outreach (students, faculty, producers, consumers)
 - Research (including technology transfer)
- Central Test Stations
- Artificial Insemination Stations
- Pedigree maintenance system
- Importation of new genetics

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What to Do Next ?

- This discussion is designed to lay the groundwork for leaders to gain information that might assist them in making decisions about how to structure a 'National Genetic Improvement Program' for swine and the components that are needed and could be utilized.



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What to Do Next ?

- It is up to domestic leaders to decide:
 - What needs to be done
 - What can be done
 - What are the best approaches
 - What are the roles and responsibilities for the people that make a program successful
 - What is the role of government



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What to Do Next ?

- The people involved in this conference offer support for you and others in accomplishing the goal of a successful 'National Genetic Improvement Program' for swine and look forward to working with you in the future.



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Summary

- We have tried to encapsulate the scope and depth of the challenge that comes with the development and implementation of a 'National Genetic Improvement Program' for swine

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Summary

- We will offer information, suggestions and advice based on our experiences in developing and implementing programs such as this.
- We offer assistance, technology that we have developed, and encouragement for your success in improving swine genetics.

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