Internal Multiplication: Breeding Strategies That Maximize Profit In Swine Production Systems

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Replacement Rates in Sow Herds

- It is a biological certainty that in a swine herd, females will go out of service on a regular basis
  - due to age, soundness, death, disease, etc
- Annual replacement rates of sows has increased dramatically in the past few years
  - PRRS, more reproductive and fragile genetics

Traditional Approaches to Replacement Gilt Procurement

- Purchase parent stock (PS) females from genetic supplier
- Purchase GP females and make PS females within herd
- Purchase GGP females and make GP and PS females within herd

Roles of Genetic Supplier and Pig Farm

- Genetic supplier provided the genetic progress in the form of healthy animals plus AI
- Pig farm simply multiplied the pigs
- Then came PRRS
- Many herds now want to be closed to all live animal introductions, will allow AI from PRRS negative studs

Breeding Strategies for Closed Herd Systems

- Breeding Strategy involves the genetic system being implemented
- Genetic System includes
  - Breeds utilized
  - Mating system utilized
  - Insemination program
  - Sources of germplasm
  - Genetic improvement program
  - Gilt production and development program

Closed Herd Genetic Systems

- Maintain purebred GGP females and make GP and PS females using maternal AI lines
- Problem is managing purebred females
Closed Herd Genetic Systems

- Rototerminal cross system using maternal AI lines
- Problem is *lost maternal heterosis* in herd (around 1 P/S/Y)

Relative Genetic Cost of Production ??

- Cash or out of pocket costs
  - purchase breeding stock or semen or supplies
  - produce breeding stock
- Salvage value of culled breeding stock
- Interest rate on capital spent on purchases
- Royalties or selection fees
- In-herd multiplication costs

In-Herd Multiplication Costs

- A parent female with 100% heterosis is replaced with a maternal line female mated to a maternal line boar
  - potentially less maternal heterosis (< P/S/Y)
  - maternal offspring grow slower, have a lower lean percentage and poorer feed conversion
- These are not out of pocket costs, but are hidden costs that must be accounted for

Genetic COP with Alternative Replacement Female Systems

<table>
<thead>
<tr>
<th>Genetic Costs</th>
<th>Purchased PS</th>
<th>Internal Rototerminal</th>
<th>Internal PB GGP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Per Pig Sold</td>
<td>$ 4.55</td>
<td>$ 3.32</td>
<td>$ 2.78</td>
</tr>
<tr>
<td>Annual Sold</td>
<td>$ 259,106</td>
<td>$ 173,269</td>
<td>$ 153,821</td>
</tr>
<tr>
<td>Cost Difference</td>
<td>$ 105,285</td>
<td>$ 19,988</td>
<td>Least Cost</td>
</tr>
</tbody>
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Maintaining Genetic Improvement While Making Their Own Females

- Purchase terminal semen and GGP semen from seedstock supplier
- Utilize the most effective technology currently being used by your seedstock supplier
  - Computerized BLUP technology

Potential Genetic Improvements

- Two ways to create genetic improvement
  - Selection (Deciding which animals to mate)
    - Which breed, which animals in the breed, use BV's
    - Permanent improvement
  - Mating System (Deciding how to mate)
    - Breeds for dam lines, breeds for sire lines
    - Use of heterosis (hybrid vigor) and breed complementarity (temporary improvement)
  - New genetic technologies give most profit

Goal of Selection

- Identify the animals with the best genetic merit
- Allow them to reproduce
- Cull the other animals with lower genetic merit
- Result = Permanent improvement in performance due to better genetics

Which Ones Are The Best?

- Pick the best two sows for purebred matings (and drive genetic progress)?

BLUP Genetic Evaluation

- Reduce environmental effects not related to genetics using computer based technology
  - Use of Contemporary group deviation
  - Account for other fixed effects in computerized data analysis
- Include performance information of animals that are relatives to better estimate the genetic merit of each animal
- Result = great increase in accuracy of selection
Pick the Top 10% Sows For Purebred Matings

- Based on Phenotype
  - Y1442, Y2190
- Based on BV's
  - Y2392, Y2361
- What is the difference?
- The ranking on BV's has been shown to be much more accurate, therefore assume these are correct.

Economic Difference

- Based on BLUP
  - Sow SPI
  - Y2392 134.8
  - Y2361 128.7
  - Avg 131.75
  - Based on raw data
  - Sow SPI
  - Y1442 116.1
  - Y2190 123.7
  - Avg 119.9
  - Difference between these two sows = $11.85

- These sows produce daughters that have litters in the herd
- They transmit ½ of their genes to the daughters
- Difference in daughter performance is ½ the difference between the sows
- $11.85 / 2 = $ 5.92 per litter produced

Requirements to Do BLUP Indexing

- PigChamp or PigWin or equivalent data management system
- Computer with math co-processor (486DX or higher CPU)
- Pedigree information entered on the sows (her sire and dam) preferable
- BLUP system that can be made extremely user friendly to use at the farm

BLUP Sow Indexing

- Estimate the breeding value of animals for litter size, litter weight and wean to estrous interval
- Create an SPI from the BV estimates for use in selection
BLUP Sow Indexing

- **Purebred GGP system:**
  - At weaning, decide which GGP and GP sows to breed pure and which to breed cross and which to cull

- **Rototerminal system:**
  - At weaning, identify the top 15% of sows to breed maternally to make replacement females
  - Breed the rest terminally or cull

Genetic Progress Example

- **Genetic Progress Example**

- **Alternative Gilt Production Strategies**
  - Instead of breeding the best 15% of sows weekly, every six to seven weeks, breed all the sows to make replacement gilts
  - **Advantage** = larger group of replacement gilts to manage
  - **Disadvantage** = no genetic improvement from sow selection

Summary

- Closed herd management systems offer the potential for an improved health status
- Internal multiplication of females offers the potential for cost savings
- Internal multiplication of females requires more management by the farm
- A genetic supplier with high quality genetics and health and AI is still required
Summary

- Health concerns have forced some farms to move to a closed herd management system.
- Economic concerns force them to try to capture all the genetic improvement possible.
- It is possible for the better managed farms to use BLUP technology plus phenotypic selection.
- Improvement from molecular technology still must come from genetic supplier.