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 due to 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 and semen
- 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>$ 4.92</td>
<td>$ 4.10</td>
<td>$ 3.82</td>
</tr>
<tr>
<td>Annual Cost</td>
<td>$ 291,863</td>
<td>$ 229,280</td>
<td>$ 221,098</td>
</tr>
<tr>
<td>Difference</td>
<td>$ 70,765</td>
<td>$ 8,182</td>
<td>Least Cost</td>
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</tbody>
</table>
Maintaining Genetic Improvement While Making Your Own Females?

- Compare what you can do, to what the gilt supplier does for genetic progress
- Purchase terminal semen and GGP semen from seedstock supplier
- Utilize the most effective technology currently being used by your seedstock supplier for maternal matings
  - 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

Midwest Pork Conference 2008
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

Economic Difference

- 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 daughter litter produced

Economic Difference

- $5.92 / 2 = $2.96 per litter produced
- Each sow could produce 10 replacement females in her lifetime
- 10 sows * four litters each = 40 litters
- $5.92*40 = $236.80 in economic impact
- What if the grand-daughters have litters?
- Continuing economic loss
- Accuracy of these selection decisions have long term economic impact

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

Demonstrate On-Farm BLUP System
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

<table>
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<tr>
<th>Year</th>
<th>Value</th>
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<tbody>
<tr>
<td>1998</td>
<td>-0.8</td>
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<tr>
<td>1999</td>
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<tr>
<td>2000</td>
<td>-0.4</td>
</tr>
<tr>
<td>2001</td>
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<tr>
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<td>2006</td>
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<td>2007</td>
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Alternative Gilt Production Strategies: Rototerminal Cross

- 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