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 and semen
- Problem is *managing purebred females*

GGP Closed Herd

X

GGP
L x L

X

Grandparent
Y x L

X

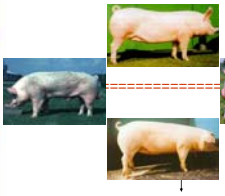
Parent
Duroc x F1 Y/L

Market Hogs

Closed Herd Genetic Systems

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

Roto-terminal Mating System



Grandparent
best Y x L crossbred sows mated to GGP Y or L semen

X

Parent
Duroc x LW/LR cross

Market Hogs

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

Genetic Costs	Purchased PS	Internal Rototerminal	Internal PB GGP
Per Pig Sold	$ 4.92	$ 4.10	$ 3.82
Annual Cost	$ 291,863	$ 229,280	$ 221,098
Difference	$ 70,765	$ 8,182	Least Cost

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?

LIST DATA PigCHAMP 4.10
FARM: ELK CITY SOW FARM (C) 1985,87,88,91,96 Univ of Minn
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Printed: 31 JAN 06

Filter :
STATUS = "WEANED" AND
BORNALIVE EXISTS

ID	GENETICS	FARROWDATE	BORNALIVE	ADJ21DAYWT	WEAN1STSERVINT	PARITY
Y1442	Y	7/11/05	11	151.5		3
Y2044	Y	7/10/05	12	157.1		4
Y2045	Y	7/16/05	10	162.6		4
Y1074	Y	7/16/05	10	143.3		4
Y2186	Y	7/12/05	15	160.6		3
Y2190	Y	7/12/05	14	137.8		3
Y2358	Y	7/13/05	7	160.1		2
Y2361	Y	7/12/05	10	169.9		2
Y2392	Y	7/12/05	14	155.4		2
Y2402	Y	7/17/05	8	138.6		2

- 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***

BREEDING VALUE LIST

#	ID	Sire	Dam	NoRec	NoProg	Gen	BV-LS	BV-LW	BV-W2E	SPI	Note
1	Y2392	Y19	Y1844	2	0	Y	1.28	23.88	-1.45	134.77	
2	Y2361	Y19	Y1679	2	0	Y	1.11	15.34	-1.75	128.70	
3	Y2190	Y20	Y1210	3	0	Y	0.85	17.19	-0.94	123.70	
4	Y2074	Y19	Y1073	4	0	Y	0.75	9.83	-2.50	122.42	
5	Y2186	Y20	Y1210	3	0	Y	0.50	19.65	-0.99	119.80	
6	Y2044	Y19	Y1249	4	2	Y	0.39	13.98	-2.41	118.87	
7	Y1442	Y11	Y941	8	0	Y	0.24	20.47	-0.91	116.31	
8	Y2402	Y22	Y1837	2	0	Y	0.27	14.03	-1.44	114.67	
9	Y2045	Y20	Y885	4	2	Y	0.08	20.31	-1.08	114.06	
10	Y2358	Y19	Y1824	2	0	Y	0.31	4.88	-1.56	110.99	

SOW PERFORMANCE LIST PigCHAMP 4.10
FARM: ELK CITY SOW FARM (C) 1985,87,88,91,96 Univ of Minn
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STATUS: WEANED

SOW ID	GENETICS	BOAR(S)	LAST FARROW PERFORMANCE: FARROW DATE	PARITY	TOT. BORN	NET FOST	TOTAL WEANED	WEAN WEIGHT	AVERAGE PERFORMANCE: FARR. INTER	TOT. BORN	PIGS WEANED	ADJ 21 DAY WT	BVSP
1. Y1442	Y	NEB NEB	123ALO5	8	11	0	10	143.0	140	11.6	10.4	158.1	114.4
2. Y2190	Y	KARLSON KARLSON	123ALO5	3	16	-2	11	133.6	138	14.3	11.3	151.7	108.1
3. Y2186	Y	L27 L27	123ALO5	3	16	-2	11	135.0	138	11.3	9.7	144.9	107.5
4. Y2361	Y	KARLSON KARLSON	163ALO5	4	11	0	10	134.0	139	11.8	10.0	147.6	106.8
5. Y2392	Y	NOBEL NOBEL	122ALO5	2	14	-2	11	150.0	136	12.0	10.0	141.0	105.7
6. Y2361	Y	NOBEL NOBEL	123ALO5	2	10	2	12	164.0	137	12.0	11.0	136.8	104.3
7. Y2044	Y	KARLSON KARLSON	103ALO5	4	13	0	10	161.0	138	11.0	10.3	139.1	101.2
8. Y2074	Y	L27 L27	163ALO5	4	13	0	10	118.0	132	11.8	10.3	130.9	100.5
9. Y2358	Y	KARLSON KARLSON	133ALO5	2	7	5	11	149.0	138	9.5	11.0	160.1	99.6
10. Y2402	Y	NOBEL NOBEL	173ALO5	2	8	0	8	103.0	135	10.0	9.5	131.5	97.8
AVERAGES					3.8	12.2	0.0	10.4	141.9	137	11.9	10.5	145.4

10 SOWS LISTED.

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
- 131.75 – 119.9 = 11.85
- 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 litter produced

Economic Difference

- $ 11.85 / 2 = $ 5.92 per daughter 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

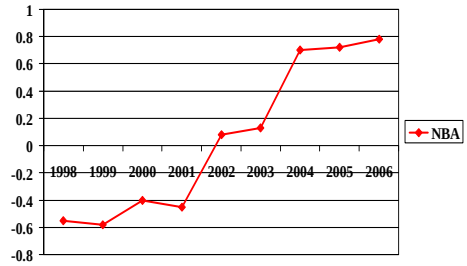
- PigChamp or PigWin or equivalent data management system
- Computer with math co-processor (486DX or higher CPU)
- Pedigree information entered on the sows (her sire and dam) preferable
- BLUP system that can be made extremely user friendly to use at the farm

Demonstrate On-Farm BLUP System

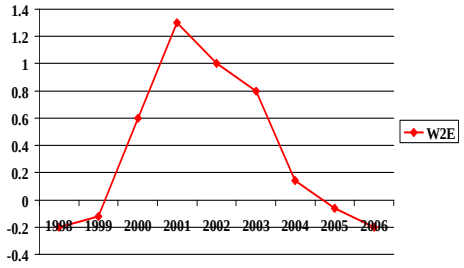
BLUP Sow Indexing

- 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



Genetic Progress Example



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*

Alternative Gilt Production Strategies: Rototerminal Cross

- Instead of breeding the best 15% of sows weekly, breed all Parity 0 (gilts) to make replacement females
- Advantage = simpler breeding plan to manage, shorter generation interval
- 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