

Using BLUP Technology on Swine Farms

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BLUP Breeding Value Estimation

- BLUP = **B**est **L**inear **U**nbiased **P**rediction
- Prediction of an animal's genetic merit (BV)
- Unbiased means estimating BV after removing all non-genetic influences
 - Time of year sow is bred, parity, breed
- Best means most accurate predictor of BV
- Developed in the 1970's for use on mainframe computers, now can be run on any PC at the farm

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Traits of Economic Importance

Reproductive Traits

- Litter size, litter weight, wean to service interval
 - Easily measured at GGP, GP and PS farms when using reproductive management software such as PigChamp®, PigWin®, Herdsman®, GBS)
- Mortality, Longevity
 - Use of phenotypic selection at all farms

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Traits of Economic Importance

Growth Traits

- Days to market, backfat, loin muscle area, percent lean
 - Important in both terminal and maternal breeds
 - Can measure accurately at farm using Realtime Ultrasound
 - Selling of pigs before 100kg does not allow for measurement and selection

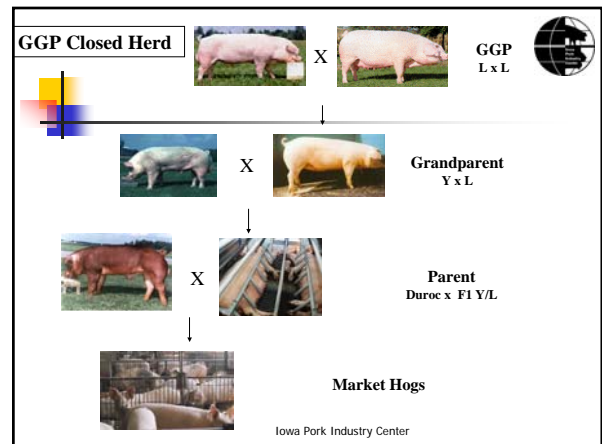
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Traits of Economic Importance

Meat Quality Traits

- Marbling, pH, color, water holding capacity
 - Important in both terminal and maternal breeds
 - Hard to measure on the live animal
 - Estimate marbling with Realtime Ultrasound
 - Selling pigs before 100kg does not allow for measurement and selection

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Traditional Genetic System

GGP York sows x York boars → Yorks

GP York sows x Land boars → LY parents

Parent LY sows x Duroc boars → market hogs

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Genetic Pyramid Structure

- GGP = 250 Yorkshire or Landrace sows
 - Y sows X Y boars → York GGP gilts
 - Selection on reproductive traits first, then growth traits, meat quality if possible
- GGP = 50 Duroc sows
 - D sows X D boars → Duroc terminal boars
 - Selection on terminal traits (growth, percent lean, meat quality, muscle shape)
- Can use BLUP for all traits

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Genetic Pyramid Structure

- GP = 1200 Yorkshire or Landrace sows
 - Y sows X Landrace boars → LY parent gilts
- What selection is done at the GP level?
- Can identify the poor performing sows to cull
- Reproductive information from GP can be used to augment the data from the GGP
 - Lowly heritable traits so more value
 - BLUP will be most effective

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Genetic Pyramid Structure

- Parent = 8500 LY sows
 - LY sows X Duroc boars → market hogs
- What selection is done at the PS level?
- Can identify the poor performing sows to cull
- Reproductive information from PS can be used to augment the data from the GGP
 - Lowly heritable traits so more value
 - BLUP will be most effective

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What If You Had A 1500 Sow Combined GGP/GP Herd ?

- GGP = 250 Yorkshire or Landrace sows
 - Y sows X Y boars → York GGP gilts
- GGP = 50 Duroc sows
 - D sows X D boars → Duroc terminal boars
- GP = 1200 Yorkshire or Landrace sows
 - Y sows X Landrace boars → LY parent gilts
- An extra question arises here
 - 1450 York sows ? Which are the GGP sows ?

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? Breed Pure or Breed Cross ?

- Each week there will be many purebred Yorkshire (or Landrace) sows to breed
- The best ones need to be bred purebred
 - To produce replacement purebred Y or L
- The worst need to be culled
 - For genetic progress
- The rest will be bred to make LY gilts
- Must accurately ID the genetic best

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Estimation of Breeding Values (BV's)

- Goal is to allow the animals that are genetically superior to reproduce, thus making permanent genetic progress
- First, you must measure the traits
- Must then separate the genetic effects on an animal's performance from the environmental effects
- Most accurate BV estimation = BLUP

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Advantages of BLUP System

- Defines performance as the pigs contemporary group deviation (CG)
 - Reproductive contemporary group is a group of sows that were bred together, housed together and farrowed together (same environment)
 - CG deviation allows performance to be expressed without those environmental effects
- Increases accuracy of BV estimation

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Advantages of BLUP System

- Combines the performance information on a pig with its relatives data
 - Example: sow BV based on 4 of her litter records plus litter records from her daughters, half sisters, cousins, etc.
 - This greatly increases the accuracy of the BV estimation
- Proven to produce the fastest genetic gains

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BLUP Sow Indexing (On Farm)

- Primary reproductive traits are farrowing rate, number born alive, litter weaning weight and wean to estrous interval
- Farrowing rate is confounded with boar fertility and not clean to measure
- Other traits are lowly heritable
- Therefore, BLUP genetic evaluation system is needed to make genetic progress

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BLUP Sow Indexing (On Farm)

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

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BLUP Sow Indexing

- What does it do?
 - Estimates the breeding value of animals for litter size, litter weight and wean to estrous interval
 - Creates an SPI from the BV estimates for use in selection
 - Estimates this BV with the most accuracy

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Demonstrate On-Farm BLUP System

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Weaned Sow Animal Report
 Farm: Colorado Farm Rec: 24 Date: 3-9-99

ID	Sire	Dam	No. Rec	No. Prog	Sow Brd	NBA	LWT	W2E	SPI		
258LW	553LW	202LW	6	9	LAR	1.58	6.6	1.3	160		
133L	0196L	0145L	12	32	LAN	1.23	2.8	0.4	145		
147LW	1844LW	3829LW	11	55	LAR	1.62	0.9	1.7	145		
103D	196D	80D	7	0	DUR	0.68	1.1	-2.2	139		
271LW	555LW	147LW	7	0	LAR	1.53	-2.0	0.9	139		
423LW	KINWAALI	270LW	2	0	LAR	1.10	1.6	-0.4	138		
76D	173D	1220D	11	21	DUR	0.75	-1.6	-1.8	133		
165LW	531LW	2822LW	10	0	LAR	0.73	-0.3	-0.9	130		
442LW	565LW	270LW	1	0	LAR	0.73	3.4	-0.9	127		
274L	UUNI	211L	4	0	LAN	0.54	2.4	-0.4	127		
415LW	JAKARD	219LW	2	0	LAR	0.68	2.1	0.3	126		
436LW	TUKOQ	218LW	2	0	LAR	0.74	3.5	-1.3	124		
443LW	DIAMOND	244LW	1	0	LAR	0.18	2.5	-1.0	119		
292LW	557LW	117LW	6	4	LAR	0.19	2.1	-0.8	116		
252L	973L	182L	5	0	LAN	0.34	1.0	-0.1	114		
304L	974L	192L	2	1	LAN	0.77	-2.8	0.8	113		
444LW	565LW	249LW	1	0	LAR	0.30	-2.3	0.2	103		
133D	BERNARD	134D	3	0	DUR	0.34	-5.5	0.9	92		
305LW	557LW	91LW	6	2	LAR	-0.23	-1.8	0.2	87		
0499L	563LW	284L	1	0	XB	-0.53	0.8	-0.1	84		
445LW	565LW	270LW	1	96	LAR	-0.44	-2.4	-0.3	81		
426LW	563LW	286LW	2	0	LAR	-0.55	-1.3	-0.4	81		
405LW	UPPISALA	297LW	3	0	LAR	-0.65	1.5	0.3	80		
422LW	KINWAALI	166LW	2	0	LAR	-1.15	0.6	-0.7	68		
						4	9	0.44	0.6	0.0	115

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BLUP Sow Indexing

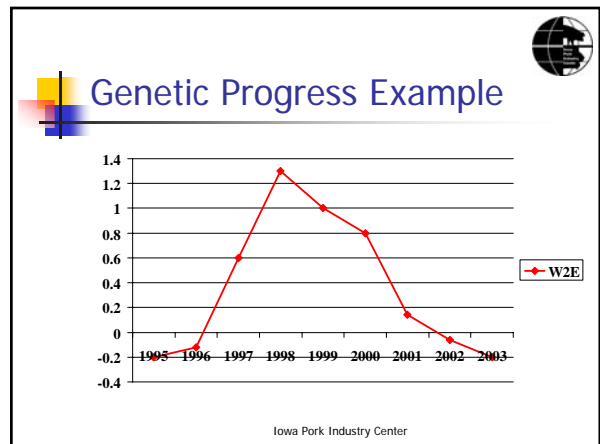
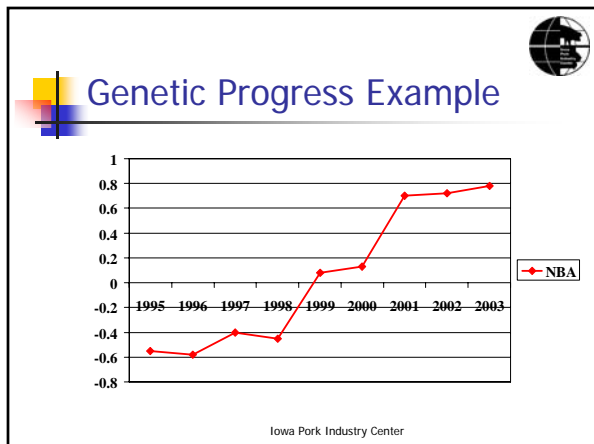
- How are these BV estimates used?
 - As an aid to select the genetically superior pigs
- Where is this selection done?
 - At weaning, decide which GGP and GP sows to breed pure and which to breed cross and which to cull
 - Evaluation of current herd sires and potential herd sires

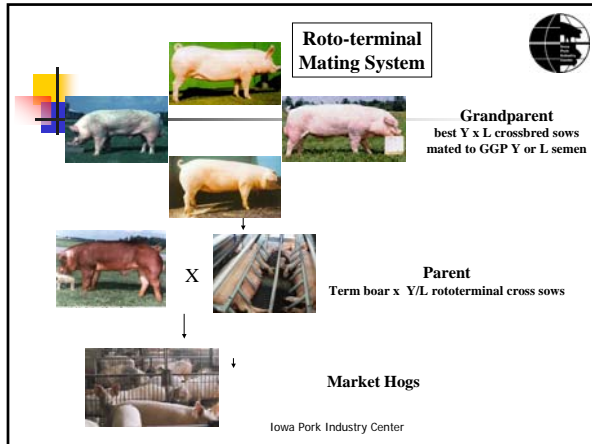
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BLUP Sow Indexing

- How does this improve profitability?
 - Uses selection to make permanent genetic improvement in the herd for litter size, litter weight and wean to estrous interval component of non-productive sow days
- Adds to genetic progress made from across herd BLUP selection programs
- The pig farmer feels they are 'doing something' fun and profitable

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- ## Technologies to Enhance Genetic Improvement
- Quantitative Genetics
 - BLUP based BV estimation systems
 - Phenotypic selection on structural and reproductive soundness
 - Molecular Genetics
 - Marker assisted selection
 - Which can be used at the farm??
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- ## Requirements to Do BLUP Indexing
- PigChamp® or PigWin® or Herdsman® or GBS or an equivalent data management system that can extract data
 - Computer with math co-processor (486DX or higher CPU)
 - Pedigree information entered on the sows
 - BLUP system that can be made extremely user friendly to use at the farm
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- ## 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
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- ## Summary
- BLUP technology is the most accurate tool for estimation of breeding value in pigs
 - BLUP technology used at the farm level adds to genetic progress realized from across herd BLUP programs
 - Important selection and mating decisions require accurate estimates of BV
 - Profit will be maximized when cost effective technologies are used at the farm
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