History of National Genetic Improvement Programs in Swine

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Trends in Swine Production

Areas of Largest Pork Producers

Existing Seedstock Suppliers

• Independent purebred producers servicing a small local area
  – Duroc, Hampshire, Landrace, Yorkshire
• Regional independent breeding companies utilizing the “National Nucleus” of purebreds
  – Premier, Comparts, Forkner, Waldo, Shaffer, etc.
• Corporate breeding companies
  – DeKalb, PIC, Newsham, Danbred

Trends in Seedstock Suppliers

• Independent purebred producers
  – fading in importance (market share and image)
• Regional breeding companies
  – growing in importance
• Corporate breeding companies
  – most growth in market share and influence
USA Purebred Genetic System

Genetic System Structure

Historical Evolution of Performance Programs
- Within herd performance evaluation programs (hopefully genetic improvement)
  - 1938 Production Registry Program
- Across-herd performance evaluation programs
  - 1954 Central test stations started in USA
- Across-herd genetic evaluation programs
  - 1988 Central Test Station Sire Summary - Spots

Production Registry (P.R.)
- 1938
- National Association of Swine Records
- P.R. Litters
  - Sow – 56 day weights of 320 lbs.
  - Gilt – 56 day weight of 275 lbs.
  - 8 pigs weaned

Production Accredited Herd
- 60% of litters qualify for P.R.
- Must keep records on entire herd
- First herd to qualify was Louisiana State University

Production Registry (P.R.) Boar
- Sire 15 P.R. litters
- 10 daughters qualify a P.R. litter
Problem: Too Much Fat

- Office of price stabilization (OPS)
- Chops being sold with 1 ½ to 2 ½ of fat
- OPS limited fat cover on chops to ½ inch
- 500 lbs. Of pork loins = 100 lbs. Fat trim

Meat Type Hog Program: 1950

- National Barrow Show
- International Livestock Show
- Carcass contests became popular
- 1952 International Dressed Carcass contest won by Yorkshires
- Ohio State, Michigan State and Purdue – show Berkshires
- Oscar Anderson – Polands begin to win carcass contests

Hazel and Kline Develop Mechanical Backfat Probe 1950-51

- 96 hogs used to develop new procedure
- Correlation of .81 to carcass measurements
- Best locations – just behind shoulder and middle of loin 1 ½ inches off midline
- Very important step

Certification Standards 1953

- Must meet P.R. requirements
- Weigh 200 lbs. In 180 days
- Weigh between 180 – 230 lbs. At slaughter
- Three weight categories

Carcass Requirements by Weight Categories

<table>
<thead>
<tr>
<th>Live weight (lbs)</th>
<th>Length</th>
<th>Backfat</th>
<th>Loineye</th>
</tr>
</thead>
<tbody>
<tr>
<td>180 – 199</td>
<td>28.5 – 31.5</td>
<td>1.1 – 1.6</td>
<td>3.5</td>
</tr>
<tr>
<td>200 – 214</td>
<td>29.0 – 32.0</td>
<td>1.2 – 1.7</td>
<td>3.75</td>
</tr>
<tr>
<td>215 – 230</td>
<td>29.5 – 32.5</td>
<td>1.3 – 1.8</td>
<td>4.00</td>
</tr>
</tbody>
</table>

Colleges and Universities

- Give moral support and encouragement
- Recommend and instruct slaughters
- Occasional spot check work of slaughters
- Determine area on loin tracing with plenometer
- Check figures and averages of measurements on farm
- Cooperate with breed offices to see that program is properly conducted
**Emphasis on Swine Breeding Research**

1953

- Dr. L.N. Hazel – Iowa State College
- Need research useable to all swine producers
- Response of the industry may well determine if hogs remain the “mortgage lifters”
- Pork acquiring a reputation as a low quality product because of fat
- Emphasizing production of meat type hogs

**Swine Improvement Association of Ohio**

1954

- Carcass data measured at OSU meat lab
- Built test station to test 108 littermate pairs
- Based on percent of primal cuts

**Electric Backfat Probe: 1954**

- Developed at Purdue University
- Dr. R.M. Whaley – Physics Department
- Dr. F.N. Andrews – Animal Husbandry
- Manufactured by Duncan Electric
- Sold by breed association for $82.00

**Certified Meat Sire Program**

1959

- Offspring of sire that had qualified 50% or more of his litters on P.R.
- 15 or more barrows and gilts tested from at least 5 different litters
- 10 or more pigs slaughtered from at least 5 litters

**CMS Carcass Requirements**

- 29 inches or more carcass length
- 1.5 inches or less in backfat
- 4 or more square inches of loin
- 200 pounds in 165 days
- Feed efficiency of 3.20 or better
- Certified Meat Sire (CMS) or Superior meat type sire (SMS)

**Ultrasound Gives Accurate Carcass Estimate - 1965**

- L.H. Hazel of Iowa State University
- Developed sonar techniques for estimating yield in live hogs
- Reported correlation of .8 compared to the actual percent lean
Best Linear Unbiased Estimation and Prediction - 1970's

- Dr. C.R. Henderson – Cornell University
- Published in *Biometrics*
- Made more accurate predictions possible

Sow Productivity Index Program - 1981

- Developed by Ohio State University
- Dr. Keith Irvin, Dr. Andy Swiger, Dr. Gene Isler
- Initiated by the American Yorkshire Club

SPI Program Components

- Prolificacy – number of pigs born live
- Milking ability – by weighing pigs 21d
- Breeding values calculated (w/in CG)
- Ranked sows in contemporary groups
- Sow ranking by family
- Sire of sow ranking
- SPI required to exhibit in national show

STAGES 1985

- Developed by Purdue University
- Dr. Dewey Harris – USDA, ARS
- Dr. Alan Schinckel
- Dr. Terry Stewart
- Dr. Donna Lofgren

Six Stages

- Stage 1: W/in herd growth traits for one CG
- Stage 2: Stage 1 extended to multiple CG
- Stage 3: Revision of the SPI program to include additional w/in herd information from relatives
- Stage 4: Analysis of growth traits extended to include individual or full-sib pen FCR and carcass data
- Stage 5: Indexes (Maternal, General, Terminal)
- Stage 6: Across herd sire evaluation

STAGES Genetic Evaluation

- Details were submitted to NSIF committee
- BV estimation by Short-Cut BLUP
- Details of the breeding value estimation procedures did not match up very well to existing industry procedures (Dairy, Beef)
- Acceptance was mixed
Central Test Station Genetic Evaluation Program

- **1986 Reference Sire Project (AYC and UGA)**
  - Produced pigs by one reference sire at 50 farms
  - Progeny pens by reference sire were entered in 15 test stations across the USA
  - CTS data was entered into a national database using common software at UGA
- **1988 Central Test Station Sire Summary**
  - Spotted breed first
  - Hampshire, Duroc and Yorkshire followed

Central Test Station Genetic Evaluation Procedures

- Single trait analysis
- Reduced animal model breeding value estimation procedure (similar to beef cattle)
- Days to 230 and Backfat at 230
- Minimum numbers of pigs tested per sire to be listed
- Program lasted from 1988 to 1994
- BV estimation procedure was upgraded

NPPC Genetic Evaluation Grant

- In 1990 the NPPC contracted with UGA to develop multiple trait animal model breeding value estimation procedures for use in swine
- Dr. Brent Woodward was initial scientist
- Dr. Xin Feng expanded to multiple trait PC based programs (1993)
- Implemented by Duroc and Hampshire breeds in 1993 (PAGE1 Program)

PAGE1 Program
(Purebred Across-herd Genetic Evaluation)

- EPDs from multiple trait animal model BLUP technology
- Daily National Genetic Evaluations
- Breed specific adjustments and variance components
- BV-Economic Indexes (SPI, MSI, TSI)
- Program direction from Genetic Advisory Board

NSE in USA Purebreds

- Four major breeds organized under one general management (1995)
  - National Swine Registry
  - Duroc, Hampshire, Landrace, Yorkshire
- Two different genetic evaluation programs
  - STAGES, PAGE1
- Unified program put forth in 1997
  - PAGE1 methodology, STAGES indexes
  - STAGES name

STAGES 2000

- Herds (full program) 958
- Maternal Records 476,567
- Post-weaning Records 698,650
- Total Records 1,175,217
- Active Sires 1,504
- Active Dams 7,722
Terminal Sire Index Genetic Trends

Duroc, Hampshire, Landrace, and Yorkshire

Maternal Line Index Genetic Trends

Duroc, Hampshire, Landrace, and Yorkshire