History of National Genetic Improvement Programs in Swine

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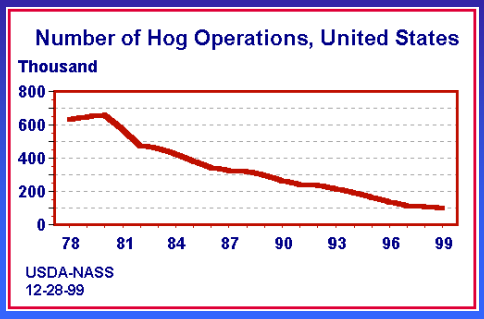
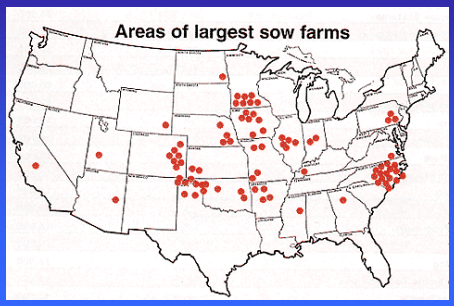
Trends in Swine Production



Areas of Largest Pork Producers



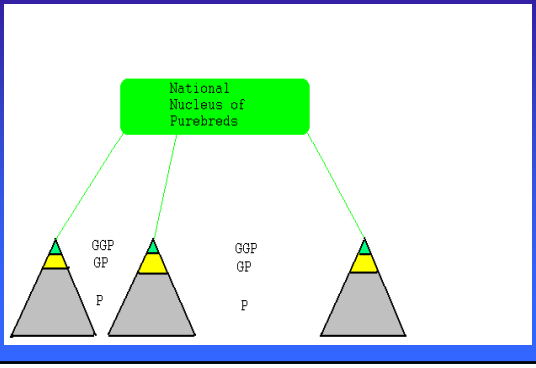
Existing Seedstock Suppliers

- 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

Live weight	Length	Backfat	Loineye
180 – 199	28.5 – 31.5	1.1 – 1.6	3.5
200 – 214	29.0 – 32.0	1.2 – 1.7	3.75
215 – 230	29.5 – 32.5	1.3 – 1.8	4.00

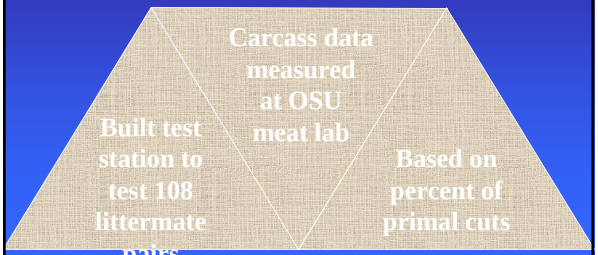
Colleges and Universities

- 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



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% of 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 sonoray techniques for estimating yield in live hogs

Reported correlation of .9 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)

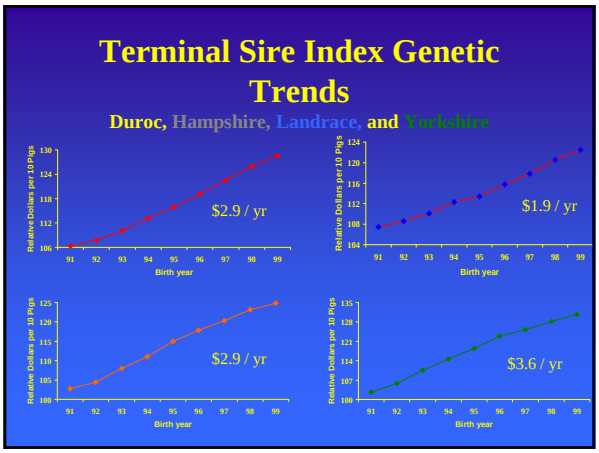
- EPDs from multiple trait animal model BLUP technology
- Daily National Genetic Evaluations
- Breed specific adjustments and variance components
- BV-Economic Indexes (SPI, MSI, TSI)
- Program direction from Genetic Advisory Board

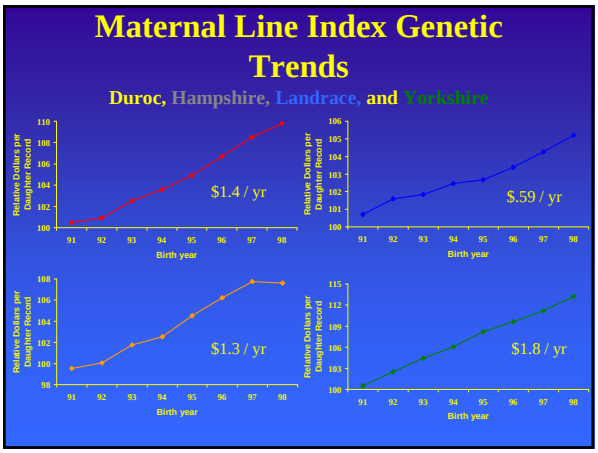
NSE in USA Purebreds

- 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
Relative Dollars per 10 Pigs
Birth year
$2.9 / yr
$1.9 / yr
$2.9 / yr
$3.6 / yr


Maternal Line Index Genetic Trends
Duroc, Hampshire, Landrace, and Yorkshire
Relative Dollars per Daughter Record
Birth year
$1.4 / yr
$.59 / yr
$1.3 / yr
$1.8 / yr