Selection to Improve Feed Efficiency in the Swine Industry – An overview of the DanBred Experience

Tom Rathje, Ph.D. MBA
Chief Technical Officer
Danbred North America

Brief Background

- DanBred Genetics originate from the National Pig Breeding Program of Denmark, supported by a national cooperative of swine producers
- Owned by producers, this genetic program is focused solely on improving the profitability of the commercial pork producers that it serves
- This is the largest nucleus system of sows in the world, numbered at 12,000 females located in Denmark and the U.S.
- Composed of three breeds:
  - Landrace and Yorkshire, maternal breeds crossed to produce the F1 female used in commercial production
  - Duroc, used as a terminal sire

The DanBred Lines

- Landrace
- Yorkshire
- Duroc

Feed Cost in the Swine Industry

- Differences from beef industry
  - Cannot utilize by-products as easily (DDG)
    - Negative impact on feed intake, growth rate, feed conversion
    - Negative impact on carcass yield
    - Negative impact on fat quality
    - Processed DDG is worse (e.g. oil extracted), mycotoxin
  - More exposed to corn (grains) and the impact of those costs
- Historical average = 50-60% of the market pig C.O.P
- New average = 70% of the market pig C.O.P.
- ‘Relative’ value of feed cost to other costs has not changed dramatically (i.e. labor, housing), but there is more financial risk
- Given the substantial contribution to cost, the inclusion of feed efficiency in the selection objective is justified

Considerations for Implementation

- Should you measure?
  - Achieve ~ 70% of the F/G response by selection for growth and percent lean (give up 0.02 units of F/G per year)
  - Value of $0.20 - $0.30 per market pig
- Feed Intake Recording Equipment (FIRE)
  - Measure individual pig feed intake
  - Can measure body weight at the same time
  - One dominant supplier worldwide…Osborne Industries
  - Expensive
  - ‘Messy’ data that requires ‘sanitizing’ prior to analysis
  - Is feeding behavior altered? Does this affect intake?

- What to measure?
  - Feed intake for the finishing growth period (time)
  - Feed intake for a given weight range (weight)
  - Intermittent measures of feed intake
    - Example…2 weeks on FIRE, 2 weeks off FIRE
    - Allows more animals to be measured, impute missing data
    - Impact of changing pens and feeder types?
  - Number of animals to record
    - Males versus females
    - Highest indexing or a broader sample
    - Impact of additional data on response to selection
Considerations for Implementation

- Where to measure?
  - Within ‘normal’ pig flow (a few pens within a larger finisher)
  - ‘Consistent’ health status
  - Opportunity for inclusion of more pens (expanded testing)
  - Dilutes management, interrupts pig flow (12 pigs/pen)
- Central test station
  - ‘Commingling’ of animals from different sources, health
  - Specialized management
  - Better data?

Our approach

- Measure feed intake on top indexing males
  - 25% of Duroc
  - 10% of Maternal lines
- Measure total feed intake in the weight range from 30 to 100 kg, not intermittent, fixed weight gain
- Test station
  - Overcome the commingling effect during nursery stage
  - Ability to implement was the main driver in this decision
    - Specialized labor
    - Higher quality data
- Use the ratio today (F/G), this could change going forward
- Selection is to a fixed end weight, not a fixed age

Number of Animals Performance Tested (125,000)

Selection Objective – Duroc

- Standard Score 11%
- Percent Lean 12%
- ADG 20-50 6%
- ADG 30-100 07%

Selection Objective – Maternal Lines

- Percent Lean 08%
- Weaning 14%
- Backfat 07%
Four Trait Analysis

- Nursery gain = start wt. + YHM + sex + litter + animal
- Finish gain = start wt. + sex + room + pen + litter + animal
- F/G = start wt. + room + pen + animal
- % Lean = sex + room + pen + litter + animal

Comments:
- Pigs must weigh 28 to 32 kg when placed 'on-test', irrespective of age
- Finish gain is gain adjusted to a fixed finish weight
- Therefore, growth, F/G and lean measures are taken at a fixed weight, NOT age

Genetic Parameters, Duroc example

<table>
<thead>
<tr>
<th></th>
<th>Nursery Gain</th>
<th>Finish Gain</th>
<th>F/G</th>
<th>% Lean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nursery Gain</td>
<td>0.23</td>
<td>0.46</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Finish Gain</td>
<td>0.27</td>
<td>-0.30</td>
<td>-0.20</td>
<td>-0.34</td>
</tr>
<tr>
<td>% Lean</td>
<td>0.29</td>
<td>0.37</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Genetic Trend – ADG, during test

Genetic Trend – Percent Lean

Genetic Trend – Feed Efficiency

Genetic Trend, Live Pigs Day 5
Comparison of Danbred Growth Rates:
2003 vs 2005 vs 2008 Barrows

Comparison of Danbred Growth Rates:
2003 vs 2005 vs 2008 Gilts

Comparison of Danbred Feed/Gain:
2003 vs 2005 vs 2008 Barrows

Comparison of Danbred Feed/Gain:
2003 vs 2005 vs 2008 Gilts

Emerging Questions

- Selecting for efficient lean growth and litter size has produced highly efficient, fast growing and lean sows with the ability to produce over 30 pigs per sow per year
  - What are the biological limits of such selection?
  - How is such an animal to be managed and fed to capture the genetic potential available?
  - Impact of selection on:
    - Sow herd feed efficiency? Sow maintenance requirements?
    - Sow feed intake during the lactation period?
    - Age at puberty?