Maximizing Productivity and Throughput: Reflections from Denmark

Welcome to Denmark
5.4 million people
16,000 sq miles
62% farmed
132 acres average farm size
Crops: wheat, barley, rape

World Pig Meat Production 2004
(estimate - mil. metric tons)
Production

---|---|---
Swine inventory | 60.50 | 16.10 | 13.26
Breeding inventory | 5.97 | 1.07 | 1.40
Market hog inventory | 54.53 | 15.03 | 11.86
Total production | ~103.0 | 29.6 | 25.2
Total slaughter | 29.8 | 22.9 |
Number of pig farms | 65,000 | 8,800 | 10,000

Herd size, sows

Herd size, finishers

Pig producers in Denmark
Overview of Danish Swine Industry

• Producers are owner operators but the whole system is an integrated system
• Slaughtering and processing are cooperatives owned by producers – one large cooperative is Danish Crown
• Problems/priority areas are identified cooperatively
• Joint research and development to address those problems
• Joint marketing activities and market research

Keys to Danish Productivity

- C. Johnson

- quality matings
- use of advisors
- weaning age
- animal movement
- pig environment

The Danish breeding system

... is a cooperative approach

Objectives established by the National Committee for Pig Production and DANSKE SLAGTERIER
Multiplier data is available on-line

Provides:
* Index Scores
* SPF Health Status

Breed Programs
- Purchase replacement gilts
- On-farm “Nucleus” to produce gilts
- Zig-Zag (LY+Y - LYY+L - LYYL = LY)

All Farms can submit data to generate index criteria for on-farm genetic management

Genetics
- Longer sows
- Focused improvement on born alive
- Top herds averaging ~14 born alive

Table 1: Genetic progress in the last four years per breed and year and total as average per breed per year:

<table>
<thead>
<tr>
<th>Breed</th>
<th>Year</th>
<th>Daily gain</th>
<th>Proportion born,</th>
<th>LPS</th>
<th>Number of pigs</th>
<th>Proportion born,</th>
<th>Killing-out percentage,</th>
</tr>
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<tbody>
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</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Daily gain</td>
<td></td>
<td></td>
<td>Daily gain</td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td></td>
<td>12.7</td>
<td>-0.03</td>
<td>0.99</td>
<td>6.28</td>
<td>0.02**10.94*</td>
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</table>

* Average of Landrace and Large White. ** Average of Duroc and Hampshire.

Sow Flow ...

- Sows are in crate 5 to 7 days before farrowing
  - Sows typically not washed pre-farrow
  - Many farrowing barns operated ‘continuous flow’
- Weaning Age - by law - 28 days
- Breeding – breeding stalls or pen
- Gestation –
  - First 28 days – stall housing may be used
  - After 28 days – pen housing is required by 2013
Farrowing Crates Can Be Used

Future:
Level of freedom during the nursing period

Breeding Stalls Can Be Used

Can Be Used Up to 4 weeks post-breeding

Group Sow housing

- Bedded systems
- Pen systems
- Stall feeding various layouts
- Electronic feeding
- Trickle feeding

>60% currently in group housing

More research is necessary!
Danish legislation for sows and gilts

- Loose housing from 4 weeks after service until 7 days before expected farrowing
- Area:
  - 1 - 4 sows/group: 2.8 m² / 30.1 sq. ft./sow
  - 5 - 10 sows/group: 2.2 m² / 23.7 sq. ft./sow
  - 11 - 20 sows/group: 2.0 m² / 21.5 sq. ft./sow
  - 21+ sows/group: 1.8 m² / 19.4 sq. ft./sow
  - 1 - 10 gilts: 1.9 m² / 20.5 sq. ft./gilt
  - More than 10 gilts: 1.7 m² / 18.3 sq. ft./gilt
- Lying area (solid flooring and bedding):
  - Sows: 1.30 m² / 14.0 sq. ft./sow
  - Gilts: 0.95 m² / 10.2 sq. ft./gilt

pen gestation
Denmark ... High Sow Productivity

How are they attaining 30 p/s/yr

- Genetic focus on live born
  - Moving to live pigs at day 5 (LP5)
- Skilled labor
- Management Approaches
  - Two Step Nurse Sows
    (Double cross fostering)
  - Surprise Breeding

source: The National Committee for Pig Production Annual Report 2005

Denmark … High Sow Productivity

<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Weaning age</td>
<td>25</td>
<td>24</td>
<td>27</td>
<td>28</td>
<td>26</td>
</tr>
<tr>
<td>Born alive / litter</td>
<td>14.5</td>
<td>14.8</td>
<td>14.9</td>
<td>14.7</td>
<td>14.7</td>
</tr>
<tr>
<td>Still born / litter</td>
<td>1.3</td>
<td>1.7</td>
<td>1.5</td>
<td>1.6</td>
<td>1.5</td>
</tr>
<tr>
<td>Weaned / litter</td>
<td>13.2</td>
<td>13.5</td>
<td>13.7</td>
<td>13.5</td>
<td>13.5</td>
</tr>
<tr>
<td>Mortality before weaning, %</td>
<td>9</td>
<td>9</td>
<td>8</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>Mortality after weaning, %</td>
<td>1.2</td>
<td>1.1</td>
<td>1.2</td>
<td>1.2</td>
<td>1.2</td>
</tr>
<tr>
<td>Age at 30 kg (66 lb)</td>
<td>80</td>
<td>84</td>
<td>90</td>
<td>89</td>
<td>89</td>
</tr>
<tr>
<td>Weight at leaving heard</td>
<td>34.2</td>
<td>28.9</td>
<td>30.5</td>
<td>32.7</td>
<td>31.6</td>
</tr>
<tr>
<td>Non-productive days / litter</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>Litters / sow / year</td>
<td>2.45</td>
<td>2.46</td>
<td>2.38</td>
<td>2.41</td>
<td>2.42</td>
</tr>
<tr>
<td>Pigs at 30 kg / sow / yr (66 lbs)</td>
<td>32.5</td>
<td>32.8</td>
<td>30.5</td>
<td>30.2</td>
<td>31.6</td>
</tr>
<tr>
<td>Gross margins, DKK</td>
<td>71,200</td>
<td>79,040</td>
<td>57,099</td>
<td>56,283</td>
<td>59,912</td>
</tr>
</tbody>
</table>

Internal AI; On farm gilt multiplication; 2 employees; owner in the stable everyday

source: LandboFyn

• Genetic focus on live born
- Moving to live pigs at day 5 (LP5)
• Skilled labor
• Management Approaches
  - Two Step Nurse Sows
    (Double cross fostering)
  - Surprise Breeding

source: The National Committee for Pig Production Annual Report 2005

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source: The National Committee for Pig Production Annual Report 2005
Keeping pigs alive after farrow
- Sows and pigs are handled gently with care
- Sows are in crate 5 to 7 days before farrowing
- Environment set for sow w/ floor heat and/or hoover for piglets
- Two or three step cross foster system to keep at least 12 pigs on each sow.

Two Step Nurse sows
- Wean piglets from a sow
  - It has to be a good litter size and piglets in a good condition
  - Make sure that the sow can function as a nurse sow
  - Don’t move the piglets
- Move the sow to a litter with 4-7 days of age, coming from a 1st or 2nd litter sow.
- Move the 1st or 2nd litter sow to a farrowing pen where you have collected a litter of newborn piglets with a good condition and after they’ve had enough colostrum (bigger piglets down to 6 hours after birth)
One- or Two-step nurse sow?

<table>
<thead>
<tr>
<th></th>
<th>Piglet stayed with mother</th>
<th>One-step nurse sow</th>
<th>Two-step nurse sow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mortality rate %</td>
<td>6a</td>
<td>18b</td>
<td>6a</td>
</tr>
<tr>
<td>Weaning wt., lbs</td>
<td>13.9a</td>
<td>12.1b</td>
<td>14.1a</td>
</tr>
</tbody>
</table>

Nurse Sow Justified because of High Number Born Live .... more dinner plates required

Breeding - Surprise effect

Example:
- Thursday: Weaning: Boar contact
- Friday: Boar contact
- Saturday: Boar contact
- Sunday: No contact (24 hr before insem.)
- Monday: Boar contact, insem. w/in 20 min.
- Tuesday: Boar contact, insem. w/in 20 min.
- Wednesday: Boar contact, insem. w/in 20 min.

Gilt Development

- Selection
- Housing space
- Feeding program
  - Avoid ulcers and stress
  - Slower growth
- Stimulating heat

Feeding for good gastro-intestinal health

- Coarse feeding structure
  - Coarse degree of grinding, rolled oats
- High-fiber feeds
  - Oats, barley or wheat bran, sugar beet pulp
- Low energy concentration
- Straw
Feeding strategy - gilts

<table>
<thead>
<tr>
<th>Weight</th>
<th>FU/day</th>
<th>Dig. Prot.</th>
<th>Feed</th>
</tr>
</thead>
<tbody>
<tr>
<td>30-50 kg (66-110 lb)</td>
<td>Ad lib.</td>
<td>130</td>
<td>Finisher</td>
</tr>
<tr>
<td>50-90 kg (110-200 lb)</td>
<td>Max. 2.5</td>
<td>110</td>
<td>Lactation, good structure</td>
</tr>
<tr>
<td>Over 90 kg (&gt;200 lb)</td>
<td>Condition (2-3)</td>
<td>110</td>
<td>Lactation, good structure</td>
</tr>
</tbody>
</table>

5-10 day before service: 3.5
After service: 2.0

**Gilt Development**

Heat management
- Age: 7 months
  - Move to service unit (1 move)
  - Boar contact (at least 20 min. every day)
  - Register heat (move back?)
- 3 weeks later / 1 week before service
  - Move to service unit
  - Boar contact (At least 20 min. every day)
  - Service at about 8 months

**Den-Thought ...**

**Swine Welfare**
- The discussion reflected the strong and continuing welfare pressure within the EU to increase space allowances and phase out fully slatted floors.
**EU Space Requirements**

<table>
<thead>
<tr>
<th>Stage and live weight in lbs.</th>
<th>Min. total area (sq ft/pig)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weaners</td>
<td></td>
</tr>
<tr>
<td>Up to 22</td>
<td>1.61</td>
</tr>
<tr>
<td>22 – 44</td>
<td>2.15</td>
</tr>
<tr>
<td>44 – 66</td>
<td>3.22</td>
</tr>
<tr>
<td>Rearing pigs</td>
<td></td>
</tr>
<tr>
<td>66 – 110</td>
<td>4.30</td>
</tr>
<tr>
<td>110 – 187</td>
<td>5.92</td>
</tr>
<tr>
<td>187 – 242</td>
<td>6.99</td>
</tr>
<tr>
<td>More than 242</td>
<td>10.76</td>
</tr>
</tbody>
</table>

“*The EU Directive on Pig Welfare*”

**Provide all pigs with permanent access to materials for investigation and manipulation**

- Pigs in fully slatted, or partial slatted, unbedded systems may find that providing hanging chain or tire is no longer acceptable; consider the use of troughs or racks with a rooting material.

“*The EU Directive on Pig Welfare*”

**Bedding**

- Straw
- Hay
- Wood
- Sawdust
- Mushroom compost
- Peat
**Hospital pens**

- The flow of pigs around the unit should be one-way. Small, weaker pigs should be moved to a specialized sick pen, not held back and (not) mixed with healthy younger pigs.

**Swine Feeding**

**Denmark’s “Corn Crop”**

Feed Grains for Swine
- Wheat
- Barley

Protein Source for Swine
- Soybean meal (imported)
- Fishmeal
- Canola meal

**Example of feed mixtures (%)**

<table>
<thead>
<tr>
<th></th>
<th>Sow</th>
<th>Sow</th>
<th>Weaner</th>
<th>Weaner</th>
<th>Weaner</th>
<th>Finisher</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nursing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Barley</td>
<td>38</td>
<td>87</td>
<td>15</td>
<td>10</td>
<td>29</td>
<td>24</td>
</tr>
<tr>
<td>Wheat</td>
<td>37</td>
<td></td>
<td>50</td>
<td>59</td>
<td>43</td>
<td>50</td>
</tr>
<tr>
<td>Soy</td>
<td>13</td>
<td>9</td>
<td>8</td>
<td>16</td>
<td>16</td>
<td>20</td>
</tr>
<tr>
<td>Minerals</td>
<td>4</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Fat</td>
<td>4</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Fishmeal</td>
<td>4</td>
<td>0</td>
<td>10</td>
<td>8</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>Milk</td>
<td>0</td>
<td>0</td>
<td>10</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
Danish Feed Facts

- Guidelines for iodine levels (number of iodine units capable of binding 100 g of fat) - not to exceed 70 in fat and 62 for the feed as a whole.
- Meat and bone meal has been banned from use in pig feeds.
- Approximately 50% of Danish pig feed is manufactured as complete feed; 50% is mixed on-farm.
- Guidelines for feed storage, mixing, etc. to eliminate salmonella.
- Feedstuff manufacturers receive at least 2 visits per year from Danish Plant Directorate.

Danish Feed Evaluation System

- Recommendations for digestible amino acids, vitamins and minerals are given as amount per energy unit of feed; any effect of daily allowances is not considered.
- Optimizing for the cheapest feed unit with fixed requirements per feed unit means lower protein content and higher levels of synthetic amino acids.
- The practical effect is - lower cost per kg gain, less nitrogen in the manure and fewer problems with diarrhea.

Conventional Dry Feeding Systems

Liquid Feeding Systems
Electronic Feeding Systems

Gilt and Sow Feeding - good gastro-intestinal health

- Coarse feeding structure
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Water

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<tr>
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<th>Liters / day</th>
<th>Gals / day</th>
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<tbody>
<tr>
<td>Gestating sow</td>
<td>12-30</td>
<td>3.2-7.9</td>
</tr>
<tr>
<td>Nursing sow</td>
<td>25-60</td>
<td>6.6-15.8</td>
</tr>
<tr>
<td>Boar</td>
<td>15-40</td>
<td>4.0-10.6</td>
</tr>
</tbody>
</table>
DENMARK ... AGP’s
(antibiotic growth promotants)
• Industry initially voluntary removal
• Jan 2000 – mandatory removal

Will know if using because –
• All swine operations must be visited by a veterinarian every 35 days
• 5% operations checked by authorities
• Veterinarians can not sell antibiotics

Grow-Finish

• Finishing removal ... minimal impact
• Nursery removal ... challenge

Management methods with removal:
• Move to AIAO
• Limiting age variation
• Delay weaning to get larger pig
• Feed additives – acids, focused use of zinc oxide