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Focus of Presentation
• Focus will be on “managing stocking density in Wean-to-Finish barns
• Optimum “stocking density” is likely to be system/situation specific
• Review research results that illustrate some “basic principles”
• These need to be adapted to each system/situation

Objective for Optimizing Stocking Density in Wean-to-Finish Barns
• Objective is not to maximize individual pig performance
• Objective is to:
  – Maximize total weight of full-value pigs produced from the facility
  – At minimum feed inputs

What is Stocking Density?
• Number of animals per unit area:
  – Cows per acre
  – Pigs per square foot
• Live weight of pigs per unit area:
  – Pounds/square foot
• Unit area per animal:
  – Square feet/pig
Increasing Stocking Density

- Increasing stocking density under commercial conditions is normally achieved by increasing the number of pigs/pen:
  - Reduces floor space/pig
  - Reduces amount of other resources/pig
    - Feeder space
    - Drinker space
    - Vencilation rate
- Presentation will focus mainly on effects of floor space
  - Assume that other resources are not limiting pig performance

Recommended Floor Spaces

<table>
<thead>
<tr>
<th>Floor space to produce a % reduction in ADG, ft²/pig</th>
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<tbody>
<tr>
<td>100</td>
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<tr>
<td>150</td>
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<tr>
<td>200</td>
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<tr>
<td>250</td>
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<td>300</td>
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Floor space for maximum growth rate

Commercial floor spaces in finishing 7.2 ft²/pig

Range 6.8 to 8.0 ft²/pig

(Brumm et al., 2004)

Why Re-visit Floor Space Allowances in Commercial Wean-to-Finish Systems?

- Do pigs in wean-to-finish systems respond differently to floor space levels than those in conventional nursery and grow-finish systems?
  - Pigs in large groups may respond differently to floor space levels than those in small groups
    - “Free (Shared) space”
    - “Wasted-space” early in the growth period for single-stocked pigs

Effects of Floor Space in Grow-Finish (Shull, 2012)

- Study carried out from week 10 post-weaning (100 lb) to 265 lb live weight
- Used 3240 pigs in 108 groups of 30 animals
- Floor Space treatments
  - 5.0 ft²/pig
  - 5.5 ft²/pig
  - 6.0 ft²/pig
  - 6.5 ft²/pig
  - 7.0 ft²/pig
  - 7.5 ft²/pig

Effect of Floor Space on Grow-Finish Performance (Shull, 2012)
Effect of Floor Space on Fat-O-Meter® Backfat Depth (Shull, 2012)

Conclusions – Floor Space Effects in Grow-Finish

- Reducing floor space reduced:
  - Growth rate
  - Feed intake
  - Feed efficiency

- Reducing floor space increased:
  - Carcass leanness
  - Total live weight produced from the facility

- Rate of reduction in performance was greater below 6.5 ft²/pig

- Is the minimum space for maximum growth rate in commercial facilities lower than historical recommendations?

Effect of Nursery Floor Space on Nursery Performance (Shull, 2012)

- Restricted 3.3 ft²/pig
  - Nursery Floor Space
  - Restricted
  - Unrestricted 7.6 ft²/pig

- Effects of Floor Space in Nursery on Wean-to-Finish Performance (Shull, 2012)

- What is the link between floor space at different stages of the Wean-to-Finish period?

- Study carried out from weaning to week 10 post-weaning (100 lb)
  - Used 3240 pigs in 108 groups of 30 animals
  - Floor space treatments
    - Restricted (3.3 ft²/pig)
    - Unrestricted (7.6 ft²/pig)
  - Floor space in grow-finish 6.3 ft²/pig
Effect of Nursery Floor Space on Overall Wean-to-Finish Growth Performance (Shull, 2012)

- Restricted 3.3 ft²/pig
- Unrestricted 7.6 ft²/pig

Impact of Overstocking in the Nursery Period on Wean-to-Finish Performance

- We have carried out a number of studies evaluating the impact of double-stocking in the nursery period on Wean-to-Finish performance
- Double stocking resulted in:
  - Reduced growth performance in the nursery period
  - Increased growth performance in grow-finish
  - No impact on overall Wean-to-Finish performance

Effect of Double-stocking in the Nursery Period on Wean-to-Finish Performance (Wolter et al., 2002)

- Study carried out from weaning to week 24 post-weaning (250 lb live weight)
- Treatments:
  - Single stocked
    - 52 pigs/pen
    - Floor space 7 ft²/pig
    - Feeder space 1.6 inches
  - Double stocked
    - 104 pigs/pen
    - Floor space 3.5 ft²/pig
    - Feeder space 0.8 inches
- Double stocking was for 10 weeks post-weaning (90 lb live weight)
- After week 10, all pigs were kept in groups of 52 at floor space of 7 ft²/pig and feeder space of 1.6 inches

Results (Wolter et al., 2002)

Compensatory Gain

- After a period of growth restriction, when the factor(s) restricting growth are removed, pigs will (compared to unrestricted animals):
  - Grow faster
  - Have improved feed efficiency
  - Reach the same size as unrestricted pigs
- Pigs have incredible potential to recover from even very severe periods of growth restriction
- Growth Restriction and Compensatory Growth can occur "intentionally" (and sometimes “unintentionally”) in swine production systems
- Opportunities to “exploit” compensatory growth to increase output &/or reduce costs on commercial operations
Caveat

• Not suggesting that producers should “intentionally” restrict the growth of the pig just to exploit compensatory gain

• There are instances where restricting “early growth” (when feed is relatively expensive) and exploiting compensatory gain later in the growth period (when feed is cheaper) makes sound economic sense and can reduce costs and/or increase output

How Long Can You Double Stock Before You Limit Overall Performance?

• Depends on the severity of the growth restriction during and the conditions after double stocking

• Wolter et al. (2003) kept pigs at floor and feeder spaces equivalent to double stocking for 14 weeks post weaning and found no effect on:
  – Live weight at 25 weeks post weaning
  – Wean-to-finish growth rate, feed intake, or feed efficiency

Conclusions – Overstocking of Pigs in Nursery Period of Wean-to-Finish

• Not all producers can use overstocking as a “tool” to increase facility output and/or reduce costs

• Facilities can be “double/overstocked” for a considerable part of the Wean-to-Finish period without compromising overall growth performance

• The greater the growth restriction due to overstocking (i.e., the lower the floor space/pig) the longer it will take for full recovery of growth performance

Impact of Wean-to-Finish Floor Space on Feed Efficiency & Carcass Leanness

• Relatively limited research carried out

• General conclusion is that pigs reared at floor spaces that restrict growth rate:
  – Have similar or reduced feed efficiencies?
  – Produce leaner carcasses

Pig Marketing Strategy

• Another opportunity to exploit floor space effects comes at the end of finishing when pigs are being removed from the pen for harvest

• Removing pigs from a group has a major impact on the performance of the pigs remaining in the pen:
  – Increased growth rate and feed intake
  – Improved feed efficiency
  – Reduced sort loss

Effect of Proportion of Pigs Removed from a Pen on Subsequent Performance (DeDecker et al., 2005)

• Pens of 52 pigs at time of pig removal (250 lb) – Floor space prior to removal 7 ft²/pig
• 19 day study period after pig removal

<table>
<thead>
<tr>
<th>Trait</th>
<th>25% Removed</th>
<th>50% Removed</th>
<th>75% Removed</th>
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<tbody>
<tr>
<td>Average daily gain</td>
<td>+26</td>
<td>+27</td>
<td>+14</td>
</tr>
<tr>
<td>Feed efficiency</td>
<td>-4</td>
<td>-6</td>
<td>-4</td>
</tr>
<tr>
<td>Total live weight produced</td>
<td>+0.1</td>
<td>-3.3</td>
<td>-3.5</td>
</tr>
<tr>
<td>Total feed intake</td>
<td>-15</td>
<td>-52</td>
<td>-49</td>
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Pig Marketing Strategy

• Relatively limited research has been carried out in this area

• We don’t know the effects on overall growth performance of
  – More frequent removals
  – Time between pig removal
  – Proportion of pigs removed at each “removal”

Conclusions

• Current recommendations may overestimate the minimum floor space that maximizes growth performance under commercial conditions

• Pigs ability to compensate after a period of growth restriction can be exploited to increase Wean-to-Finish output and/or reduce costs:
  – “Overstocking” in nursery period
  – Pig removal strategy at marketing

• The optimum stocking density for Wean-to-Finish is likely to be:
  – System/situation specific
  – Vary over the Wean-to-Finish period
  – Change over time

• Ideally decisions need to be based on data from studies carried out in specific systems.