Nutrition to Support Healthy Weaned Pigs

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Nursery nutrition for the healthy weaned pig vs. challenged pig

Traditional thinking with healthy pigs

• Lower cost diets
• Transition quicker
• Lower cost protein sources and byproducts
• Reduced feed additives
• Feed intake is already high
Estimated costs and calculations

• Decrease phase 1 diet by $200/ton on a 3.5#/pig budget = $0.35/pig reduction in cost

• 0.75#/pig of phase 1 budget with an expensive prestarter ($500/ton more) = $0.18/pig increase in cost

• Reduce mortality 1% wean to market $1/pig

Can you actually measure differences between nursery programs? Need around 7000 pigs/trt
Similarities and must do’s

• Get high intake immediately
• Stop interruptions in feed intake
• Quality control on ingredients used in diet formulation
• Accurate formulation
• Transitioning of phases – Move on
• Pull/treat/graduate fall behind pigs out of the general population
• Use appropriate technologies that reduce opportunistic secondary pathogens and improve growth rate
Goals of presentation

1. Discuss practical “nutritional” examples of when healthy pigs haven’t reached their potential in the field

2. Discuss foundational concepts that are critical for successful nursery nutrition program – regardless of healthy or sick.

3. Some additive examples; not designed to give detailed lists of commercial products

4. Open discussion today, and in the field.
Intestinal Health: What is it?

- Intestinal growth and development.
- Improve intestinal function.
  - Nutrient absorption
  - Immune response
  - Barrier function
- Balance and promote beneficial microbial populations
Summary: Rapid feed intake at weaning is mission critical.

- Reduced dry matter intake is the **INITIAL** intestinal insult that reduces intestinal integrity. (McCracken et al., 1995)
- Prolonged period of no intake – more intestinal damage.
  - Gut becomes leaky to pathogens
  - Gut generates an immune response to diet components.

**Common statement:**
You can’t put that much SBM in the phase 1 diet of the pig.
They will have an allergic reaction!

**Reality:**
Yes you can. If the pig is eating well and the gut isn’t compromised, the pig can handle a lot of SBM.
Things to consider for high initial intake at weaning

- Genetic lines, age, environment
- Antibiotics
- Water and feed restrictions
- Vaccines
- Mycotoxins
- Quality control of ingredients
- Creep feeding and exposure to sow additives
- Gruel
- Water additives to stimulate dry feed intake
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Critical to pull, treat, and graduate pigs falling behind in general population.
Gruel feeding – start up for small pigs

Grueling Steps:

• Mix 70% water & 30% feed together to soup-like consistency in a temporary feeder designed for grueling or a black rubber pan. There should be ~ ¼ inch of liquid on top. (Prestarter ration or dense electrolyte and lactose product)

• Decrease water as pigs gain acceptance, should be 30% water & 70% feed by day 7 (oatmeal consistency)

• Have dry feed (Phase 1 or 2 use what is being fed to the general population for diet transition) available on mats and feeder to encourage transition to dry feed.

• Need to feed gruel a minimum of 3-4x per day with enough for 1 hour. Pans/feeders should be cleaned between feedings.

• Once pigs have recovered and have made the transition to dry feed then move back into graduation pens.
PIGS PULLED 1-2 weeks post weaning

Pull, get started, and get on appropriate diet quickly
Intestinal Health –
Balance and promote beneficial microbial populations

How do you alter the microbial populations in the GI tract of pigs?

Why is this important?
Sows Inoculate Their Litter

- Pathogenic population of the piglet is drastically different than that of the sow early.

- Pathogen profiles begin to mimic that of the sow as the piglet matures

Opportunities:
- Reduce pathogen load coming from the sow
- Inoculate the piglets in the crate with beneficial microbes
How do you alter the microbial populations in the GI tract of pigs? – common methods found today

- Feeding nutrients that enhance beneficial bacteria (Prebiotics)
- Feeding bacterial cultures (Probiotics, direct fed microbial, DFM, live culture)
- Feeding of live yeast
- Acidification – Inorganic and organic acids
- Feeding components of yeast, or plants (botanicals), that bind or inhibit bacteria
- Nutrition – Fiber, lactose, protein level, Zn, Cu
Probiotics/Direct Fed Microbials (DFM), Bacterial cultures, live inoculants for feed...

Do they work???

DeRouchey et al., 2017
• Review of 44 publications
• Over 70% showed numerical improvements in ADG
• But only 6.8% of the experiments showed an improvement in ADG that was statistically significant
• Why the inconsistency??
Nursery pig ADG improvement compared to control within each trial – Visano Nursery

<table>
<thead>
<tr>
<th>Individual Trial</th>
<th>Growth rate response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5.3%</td>
</tr>
<tr>
<td>2</td>
<td>5.3%</td>
</tr>
<tr>
<td>3</td>
<td>10.3%</td>
</tr>
<tr>
<td>4</td>
<td>5.0%</td>
</tr>
<tr>
<td>5</td>
<td>2.6%</td>
</tr>
<tr>
<td>6</td>
<td>3.3%</td>
</tr>
</tbody>
</table>

Meta analysis average of 5%
Prebiotics - Fructooligosaccharides (FOS)

GF₂  1-kestose

GF₃  nystose

GF₄  Glucose
     Fructose
     Fructose
     Fructose

β-fructofuranosylnystose
Impact of FOS on nursery pig intestinal morphology

- Villous height

Control: 200 Microns
scFOS: 225 Microns

- Crypt Depth

Control: 150 Microns
scFOS: 125 Microns

P < .01

Spencer al., 1997
Pigs Challenged with *E. coli* K:88

<table>
<thead>
<tr>
<th></th>
<th>FOS -</th>
<th>FOS +</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Survival rate, %</strong></td>
<td>62.5</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>(5/8)</td>
<td>(8/8)</td>
</tr>
<tr>
<td><strong>Clinical Symptoms, %</strong></td>
<td>75.0</td>
<td>12.5</td>
</tr>
<tr>
<td></td>
<td>(6/8)</td>
<td>(1/8)</td>
</tr>
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</table>

Russell et al. 1995
Why should diets be acidified??

- Improved protein digestibility
  - pH driven in the stomach
  - Inorganic acids
    - Phosphoric acid
- Microflora modification
  - Release in the intestine
  - Organic acids
    - Fumaric, Citric, Lactic
- Fuel to grow intestinal mucosa
  - Very short chain fatty acids
  - Butyric acid
Yeast Cell Wall Study with E. coli

Source A showed superior binding with E. coli

Source A: 81% E. coli 12, 85% E. coli 297, 81% E. coli 299
Source B: 72% E. coli 12, 70% E. coli 297, 70% E. coli 299
Source C: 79% E. coli 12, 72% E. coli 297, 55% E. coli 299
Quality control – Mission Critical

• Biosecurity
• Contamination
• Toxins
• Nutrient content accuracy for formulation
• Digestibility to the pig
• Oxidation and shelf life
**Effect of oral administration of FB1 on bacterial colonization of piglet intestines by E. coli strain 28CNal**

<table>
<thead>
<tr>
<th>Bacterial colonization of sections (log_{10} [CFU/g]) of</th>
<th>Ileum</th>
<th>Cecum</th>
<th>Colon</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Exp. 1</strong>a</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>1.66 ± 0.14</td>
<td>2.99 ± 0.32</td>
<td>3.32 ± 0.77</td>
</tr>
<tr>
<td>FB₁ extract</td>
<td>4.26 ± 0.42</td>
<td>5.85 ± 0.40</td>
<td>6.03 ± 0.37</td>
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<tr>
<td><strong>Exp. 2</strong>a</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>2.74 ± 0.34</td>
<td>3.72 ± 0.42</td>
<td>3.73 ± 0.38</td>
</tr>
<tr>
<td>Purified FB₁</td>
<td>3.67 ± 0.64</td>
<td>5.07 ± 0.58</td>
<td>5.62 ± 0.63</td>
</tr>
<tr>
<td><strong>P value</strong></td>
<td>&lt; 0.001</td>
<td>&lt; 0.001</td>
<td>&lt; 0.001</td>
</tr>
</tbody>
</table>

a Pigs were dosed for 7 days with 0.5 mg of FB1/kg of BW, administered as a crude extract (Exp. 1) or as a purified toxin (Exp. 2). (Estimated to be 5-8 ppm of a diet)

b Values represent treatment mean bacterial counts + SEM for a group of 4 to 5 pigs.

Comparison of carbohydrate product with and without chocolate

16 pens of 27 pigs per treatment (approx. 430 pigs/trt)
Average start weight = 10.5 pounds BW

** = P < 0.05

UAH unpublished data
Ingredients – Don’t take anything for granted

• Check milk products for total coliform level
  • Suggest total values be less than 10 CFU/g

• Chocolate milk products can be susceptible to increased bacterial load

• By-products – ask questions
  • How is the product dried down?
  • How is the product stored?
  • Age of the product?
  • Shelf life?
  • Maillard reactions reducing amino acid and CHO availability
Trial Temperature Curve

- Control
- Challenge

Days postweaning

Temp (°F)
Performance from Week of Temperature Challenge (Day 0 to 8)

- ADG: Control (0.28) vs. Challenge (0.33), ↑2.8% (P = 0.005)
- ADFI: Control (0.23) vs. Challenge (0.31), ↓14.3% (P = 0.01)
- Feed/gain: Control (1.30) vs. Challenge (1.45), ↑16.6% (P = 0.01)
Performance for Week Following Challenge (Day 9 to 15) – Why is my phase 2 diet so bad?

![Bar charts showing performance metrics for ADG, ADFI, and Feed/gain](chart.png)

- **ADG**: Control - 0.68 (P = 0.45), Challenge - 0.64 (P = 0.05), ↓ 4.3%
- **ADFI**: Control - 1.17 (P = 0.05), Challenge - 1.12 (P = 0.07), ↓ 7.8%
- **Feed/gain**: Control - 1.17 (P = 0.07), Challenge - 1.12 (P = 0.05), ↓ 5.2%
Effect of Temperature Challenge on Pig Viability

- 10 X more shots given
- 8 X more fall behinds

Number of Pigs

- Control
- Challenge
Take home message: When performance drops....

- Find the real problem
- Higher density nutrition could compound the problem
Additional comments on feeding healthy weaned pigs

- Hit nutrient requirements. Get updated specifications.
- Double stocking impact.
- What drives value in your system? Goals?
- Collaboration and communication among teams
Summary:

Drive initial feed intake
Transition the pig
Don’t just throw a more complex diet at the problem
Use appropriate additives that fit goals
Communicate and work with teams
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