Welcome to the Feed Mill and Biosecurity Webinar

Learn the best practices for biosecurity and quality assurance measurements at feed manufactures.
Welcome

Uislei Orlando
PIC Global Nutrition Team
Feed Mill & Biosecurity Webinar

Background:

- 2017: Jose Soto - Economic model to optimize dietary net energy for maximum profitability in growing-finishing pigs
- 2019: Carine Vier – Updates in calcium and phosphorus recommendations for PIC pigs
- 2021: Kara Dunmire – Development of quality feed manufacturing guidelines and resources
Feed Mill & Biosecurity Webinar

Feed Mill Biosecurity:

- Biosecurity continues to be at the top of mind for the pork industry. Understanding, identifying, and eliminating risk are key to any biosecurity program - including feed manufacturing

www.pic.com/resources/nutrition
www.pic.com/services/bioshield-program/
www.asi.k-state.edu/research-and-extension/swine/calculators.html
www.grains.k-state.edu/research/AnimalFeedandPetFood/feed_science_research_extension/index.html
FEED MILL AND BIOSECURITY WEBINAR

Kara M. Dunmire
Kansas State University – Feed Science and Management
Quality Feed Manufacturing

**Kara M. Dunmire, Charles R. Stark, and Chad B. Paulk**

Kansas State University, Manhattan

*September 1st, 2021*
Importance of Feed Quality

• Consistent feed quality provides opportunity to minimize cost and meet nutritional goals.

• Feed quality can be considered the most important and the most overlooked factor of feed manufacturing.

• Industry need
  – Emphasis on feed quality
  – No focus on feed quality until something goes wrong
  – Transition from a reactive response to a proactive response
Primary Audience

• Feed mill managers
  – Target a larger population of the industry
  – Most likely to implement change
  – Can use to help train employees
  – Value quick, easily used resources

• Secondary audience
  – Nutritionists
Outline of Materials

• Goal: To develop quality feed manufacturing resources entailing the basics of a feed quality assurance program and quality control measures to ensure the production of high quality and consistent feeds for predictable pig performance.

  https://www.grains.kstate.edu/research/AnimalFeedandPetFood/feed_science_research_extension/index.html

  – Guidelines
  – Key concepts
  – Evaluations
  – Visual reminders

• Designed to be supplemental and in no way replace QA manuals, standard operation procedures, or regulatory procedures.
Quality Feed Manufacturing Guide

Ingredient Receiving and Sampling
Pelleting
Particle Size Reduction
Finished Feed
Batching and Mixing
Feed Mill Biosecurity

Guidelines

Key concepts

Evaluations

Visual reminders

Ingredient Storage
- Store ingredients in airtight containers to maintain quality and prevent contamination.
- Ensure proper temperature and humidity control for sensitive ingredients.
- Keep ingredients away from sources of moisture and direct sunlight.

Pelleting
- Pelleting is a process of forming pellets from dry ingredients.
- Pellets are more easily stored and transported than loose feeds.
- Pelleting improves palatability and digestibility of feeds.

Finished Feed
- finished feed is the product ready for sale or distribution.
- Quality control measures are in place to ensure product safety and consistency.

Feed Mill Biosecurity
- Biosecurity measures are essential to prevent contamination of feed.
- Regular cleaning and disinfection of feed mills are necessary.
- Training staff on biosecurity practices is critical.

Visual reminders
- Pellet size and shape should be consistent.
- Finished feed products should be properly packaged and labeled.
- Feed mill biosecurity measures should be strictly followed.
Outline: *Introduction and Instructions*

• Communicate the goal of implementing these resources

• Add a brief, general base of the importance of feed quality
  – Example analytical schedule
  – Template for SOP writing

www.ksufeed.org
Outline: *Guidelines and Key Concepts*

- **Section 1: Guidelines**
  - To clearly and concisely convey importance of feed quality on pig performance for feed mill managers.
  - Areas within each topic category
    - Collecting
    - Monitoring
    - Interpret data for decision making

- **Section 2: Key concepts**
  - One-page of key information from the guidelines, easily digested for quick answers
Outline: Evaluations

- **Section 3: Evaluations**
  - To apply knowledge used in established guidelines to monitor practices used for feed quality for feed mill managers.
    - Similar to an internal audit
    - Evaluator should indicate compliance and provide a score of 0 or 1
      - Never = 0 points
      - Always = 1 points
    - Use comments to provide further explanation
    - Scores will provide indication for areas of improvement providing data to uphold and observe changes in feed quality.
    - Adjustments to total possible points may need to occur if a question is not applicable.
Outline: Visual reminders

• **Section 4: Visual reminders**
  – To provide a simple reminder to be used on the feed mill for employees.
    • One page that can be hung on wall
    • Highlight quality steps throughout the feed mill
    • Picture of process flow, checklist, or signage
      – Tools needed for procedure
      – Process
      – End result
Summary of Materials

• 6 guidelines + 1 supplemental introduction
• 6 one-page key concept sheets
• 6 evaluations + 1 supplemental evaluation
• 31 printable visual reminders across 6 topics
Topic 1: Ingredient Receiving and Sampling
Ingredient Receiving and Sampling

Guideline and key concepts

– Sampling
  • Equipment, representative sample, sample frequency, sample labeling and storage

– Receiving procedures
  • Rejection or deficiency, documentation, visual and physical inspection, unloading

– Testing
  • On-site testing options, moisture content, NIRS, fat, mycotoxins
Topic 1
Ingredient Receiving and Sampling

Evaluation

– Questions on sampling, receiving and testing

– Summary
  • 16 questions and possible points
Ingredient Receiving and Sampling

Visual reminder

- Ingredient Receiving Checklist, Sampling from bags and barrels, Automatic sampling, Riffle Dividing, Example Moisture Analysis, Example NIR, Example Mycotoxin testing
2. **Particle Size Reduction**
   - Hammermills and roller mills
   - Monitoring and Testing Particle Size
   - Interpreting particle size results

3. **Batching and Mixing**
   - Ingredient storage
   - Batching
   - Mixing
   - Feed sequencing and flushing

4. **Pelleting**
   - Influence of the pelleting process on ingredient characteristics
   - Monitoring and data collection during the pelleting process
   - Testing pellet quality

5. **Finished Feed**
   - Sample collection
   - Feed delivery procedure
Topic 6: Feed Mill Biosecurity
Feed Mill Biosecurity

Guideline and key concepts

– Prevention strategies
  • Risk in feed ingredients, feed mill production flow strategies, employee and visitor flow strategies

– Mitigation strategies
Feed Mill Biosecurity

**Evaluation**

– Questions on prevention feed mill, employee and visitor flow strategies.

– Summary

  • 15 questions and possible points
Feed Mill Biosecurity

Visual reminders

– Printable signage

• Feed mill visitor log, feed mill visitor responsibility, ingredient driver responsibility, finished feed driver responsibility, stops and checks
Additional Resource Links

- AAFCO Official Publication
- Feed Additive Compendium
- AFIA Quality Manual Template
- AFIA Electronic Feed Ingredient Guide
- AFIA Feed Inspectors Manual
- AFIA Resource Center
- Particle Size of Feedstuffs – Kansas State University
- Feed Pelleting Reference Guide
- PIC Bioshield
- K-State Swine Feed Mill Biosecurity Audit

- Swine Health Information Center AFIA Guide: “Developing Biosecurity Practices for Feed & Ingredient Manufacturing”
- FDA Guidance for Industry #235: “Current Good Manufacturing Practice Requirements for Food for Animals.”
- FDA Guidance for Industry #245: “Hazard Analysis and Risk-Based Preventive Controls for Food and Animals”
- FDA Guidance for Industry #246: “Hazard Analysis and Risk-Based Preventive Controls for Food for Animals: Supply-Chain Program”
- FDA Guidance for Industry #239: “Human Food By-Products for Use As Animal Food”
# Opportunity: Feed Mill Data

<table>
<thead>
<tr>
<th>Subject</th>
<th>Total Possible Points</th>
<th>FM1 Score</th>
<th>FM2 Score</th>
<th>FM3 Score</th>
<th>FM Total</th>
<th>Percent of total</th>
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<td>1. Ingredient Receiving and Sampling</td>
<td>16</td>
<td>10</td>
<td>15</td>
<td>16</td>
<td>41</td>
<td>83.3</td>
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<td>2. Particle Size</td>
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<td>8</td>
<td>5</td>
<td>6</td>
<td>19</td>
<td>47.9</td>
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<tr>
<td>3. Batching and Mixing</td>
<td>13</td>
<td>6</td>
<td>12</td>
<td>13</td>
<td>31</td>
<td>50.0</td>
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<td>4. Pelleting</td>
<td>15</td>
<td>15</td>
<td>13</td>
<td>6</td>
<td>34</td>
<td>40.5</td>
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<tr>
<td>5. Finished Feed</td>
<td>16</td>
<td>11</td>
<td>10</td>
<td>10</td>
<td>31</td>
<td>32.3</td>
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<tr>
<td>6. Feed Mill Biosecurity</td>
<td>15</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>7</td>
<td>6.9</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>81</strong></td>
<td><strong>52</strong></td>
<td><strong>57</strong></td>
<td><strong>54</strong></td>
<td><strong>163</strong></td>
<td><strong>36.8</strong></td>
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<td><strong>Percent of total</strong></td>
<td><strong>100</strong></td>
<td><strong>64.2</strong></td>
<td><strong>70.4</strong></td>
<td><strong>66.6</strong></td>
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</table>
Summary of Quality Feed Manufacturing Guide

- Ingredient Receiving and Sampling
- Particle Size Reduction
- Batching and Mixing
- Pelleting
- Finished Feed
- Feed Mill Biosecurity

Guidelines

Key concepts

Evaluations

Visual reminders
Final Thoughts

• The key to feed quality
  – Identify the most valuable aspects of quality
  – Monitor that they are done correctly

• Resources and tools for success

Thank you!


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FEED MILL AND BIOSECURITY WEBINAR

Jason Pooley
PIC Health Programs Manager
Updates in Bioshield Feed Section

Jason Pooley
PIC North America
Introduction

- Proper execution of biosecurity protocols at PIC associated feed mill facilities is essential to:
  - Reduce the likelihood that pathogens will be introduced into the feed chain
  - Prevent the spread of animal disease through feed or feed ingredients.

- BioShield is an evolving program that will be continuously updated as new science-based information and industry knowledge become available.
Ingredients and Complete Feed

- **Prohibited:**
  - Use of porcine origin ingredients.
  - Feed manufacturing in mills that utilize porcine origin ingredients in non-PIC diets.
  - Use of porcine origin fat source.
Ingredients and Complete Feed

- **Conditionally allowed:**
  - By-product sources of non-porcine origin **if** no porcine products are processed at the plant of origin, transported in the same vehicles, or stored in the same container.
  - Dried distillers' grain with solubles (DDGS) **if** stored in bird-proof facilities or with bird-control protocols.
Ingredients and Complete Feed

• Purchase and handle ingredients in a bio secure manner.

• Transport ingredients in power units / trailers that have not had contact with swine.

• Attempt to purchase grains from producers with no swine.

• Maintain and control feed ingredients to prevent exposure to contaminated materials.

• Have a feed ingredient risk assessment for all imported ingredients.

• Implement appropriate mitigation strategies for imported ingredients, if required.
Decision tree to Assess and Minimize FAD Transmission Risk from Feed Ingredients

Is the ingredient manufactured or packed in a country with active FMD, ASF, or CSF?
- **NO**
- **YES**

Low Risk.
No additional actions are needed as long as supplier and processes are maintained

Is the ingredient considered high risk for harboring virus?
- **NO**
- **YES**

Minor risk.
Product need to be stored at room temperature in the feed mill for at least 30 days

Is the ingredient subjected to validated mitigation procedures (chemical treatment, thermal processing, etc) to reduce its risk?
- **NO**
- **YES**

Heightened risk.
Use and presence of the feed ingredient is forbidden in the ration and feed mill serving the PIC farm

Moderate risk.
In addition to the mitigation procedures, the product must be stored for at least 30 days at room temperature

To further reduce risk:
- Consider sourcing from a country without active viral transmission or mitigating risk prior to receiving (if bulk) or unpacking (if tote or bagged).
- Consistently implement a decontamination protocol for exterior of containers, totes, bags, buckets, or barrels originated from risky countries.
Use receiving processes that reduce risk

- Don’t sweep dirt into pit
- Stay in truck, or use disposable shoe covers and limit traffic
- Keep receiving pit covered

Picture: Cochrane et al., 2016
Manufacturing best practices

• Defining clean/dirty lines
• Daily cleaning of manufacturing areas
• Flushing of feed manufacturing and delivery equipment
• Sequencing by species and biosecurity pyramid
• Maintaining a pest control protocol
• Disposing of collected dust
Delivery procedures to mitigate the risk of contamination

**Elite Farms, SLN and GTC:**
Dedicated feed trucks or an inner-sanctum truck.

- Feed trucks to follow a dynamic biosecurity pyramid.
- Wash, disinfect, dry and inspect when needed.
- Truck drivers never come in contact with the feed.
- Dispose of any feed spillage.

**Other herds:**
Segregated feed trucks between multiplication and commercial herds.

- Truck drivers follow a dynamic biosecurity pyramid.
- Wash, disinfect, dry and inspect when needed.
- Truck drivers never come in contact with the feed.
- Dispose of any feed spillage.
Critical risk factors at the feed mill level

1. Use of prohibited ingredients, e.g. porcine protein origin ingredients

2. Lack of biosecurity pyramid flow

3. Lack of ingredient reception protocol

4. Unverified origin of high-risk ingredients
Summary

- **Risk mitigation strategies**
  - Contamination can occur at numerous points during feed manufacturing:
    - The use of contaminated ingredients
    - Contamination during ingredient reception
    - Cross-contamination during manufacturing at the feed mill
    - By delivery vehicles and personnel

- **Routine monitoring and Proactive Communication**
  - Periodical educational and problem-solving sessions:
    - Feed mill ownership/management, the
    - Multiplier ownership/veterinarian
    - PIC
Thanks!
FEED MILL AND BIOSECURITY WEBINAR

Jordan Gebhardt
Kansas State University – Diagnostic Medicine/Pathobiology
Latest research in feed mill biosecurity

Jordan Gebhardt
Assistant Professor
Diagnostic Medicine/Pathobiology
Kansas State University
Mechanics of disease transmission

**Infected host**
Habitat where agent lives, grows, multiplies
- Domesticated swine
- Wart hog
- Wild boar

**Transmission**
Method of transport from reservoir to susceptible host
- Direct
- Indirect

**Susceptible host**
Individual susceptible to the specific agent
- Domesticated swine
- Wart hog
- Wild boar
Mechanics of disease transmission

Transmission
Method of transport from reservoir to susceptible host

Direct

Indirect

What do we influence on a daily basis?

Exclude High Risk Ingredients
Biosecurity practices
Active Mitigation

Active Mitigation
Biosecurity practices
Exclude High Risk Ingredients

K-STATE
Research and Extension
Research partnership

Production system located in Vietnam
Goal: Use diagnostic testing capabilities to understand the risk of ASFV spread within their production system
1. Feed production system
   a. Feed mill
   b. Ingredients and finished feed
   c. Feed trucks
2. Live animal transport
3. Market animal transfer center

Gebhardt et al., 2021
Feed delivery vehicles

1,027 total samples
7 PCR-positive samples
  6 from cab surfaces
  1 from exterior surfaces

Gebhardt et al., 2021
How can this be accomplished?

Step 1: Remove organic material

Step 2: Dry

Step 3: Apply disinfectant

Gebhardt et al., 2021
How can this be accomplished?

Avoid this

Gebhardt et al., 2021
Feed mill surfaces

1,159 total samples
9 PCR-positive samples
- 1 from driver resting area
- 3 from feed contact surfaces
- 3 from non-feed contact surfaces
- 2 from worker clothing

Gebhardt et al., 2021
Feed and ingredients

142 total samples so far

40 ingredient and water samples
102 complete feed samples

1 complete feed sample PCR positive
• Batch of feed did not contain added formaldehyde-based product

0.7% PCR positive

Gebhardt et al., 2021
Where is the contamination at?

• 17 of 2,328 samples (0.7%) from the feed supply chain contain ASFV DNA as determined by PCR
  o 3 Feed-Contact Surfaces in Mill
  o 4 Non-Feed-Contact Surfaces in Mill
  o 2 Employee clothing in Mill
  o 1 Complete Feed
  o 7 Feed Trucks

Key finding: People and fomites are incredibly important!

Gebhardt et al., 2021
Risk of ASFV carryover if feed after contaminated batch

<table>
<thead>
<tr>
<th>Batch</th>
<th>Ingredients</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Negative</td>
</tr>
<tr>
<td>2</td>
<td>ASFV Inoculated</td>
</tr>
<tr>
<td>3</td>
<td>Negative</td>
</tr>
<tr>
<td>4</td>
<td>Negative</td>
</tr>
<tr>
<td>5</td>
<td>Negative</td>
</tr>
<tr>
<td>6</td>
<td>Negative</td>
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</table>
### Detection of African swine fever virus (ASFV) p72 DNA in feed samples

<table>
<thead>
<tr>
<th>Batch</th>
<th>Non-detected</th>
<th>Suspect</th>
<th>ASFV detected</th>
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<tbody>
<tr>
<td></td>
<td>10</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
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<td>0</td>
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<td>10</td>
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<td>9</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>3</td>
<td>7</td>
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</table>

<table>
<thead>
<tr>
<th>Batch of feed</th>
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<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
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<tbody>
<tr>
<td>Negative</td>
<td>10</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<tr>
<td>Positive</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Negative</td>
<td>0</td>
<td>10</td>
<td>10</td>
<td>9</td>
<td>9</td>
<td>7</td>
</tr>
</tbody>
</table>

ASFV was still detected after 4 subsequent batches of feed
Detection of African swine fever virus in contaminated feed over time

ASFV DNA very stable up to 180 days in finished feed
Need to confirm whether virus still infectious
Risk of ASFV carryover on feed surfaces and within environment after contaminated batch
Risk of ASFV carryover on feed surfaces and within environment after contaminated batch

Prevalence of ASFV on surfaces

Feed Contact Surface < 1 m > 1 m Shoes

Elijah et al., 2021
Recent research with ASFV

- Key findings:
  - ASFV has similar characteristics to PEDV within a feed mill
    - Can be found on surfaces and in environment after mixing known inoculated feed
    - High traffic areas
  - Contamination of feed and surfaces can be detected after multiple batches of feed pass through the equipment
  - People are extremely important to consider!
Investigating methods for decontamination of interior surfaces (cabs) of transportation vehicles

- PRRSV and PEDV
- 4 chemical treatments applied via spray, fumigation, or gaseous application
  - Bleach
  - Synergize
  - Intervention
  - Chlorine dioxide
- Rubber, plastic, and fabric surfaces

Elijah et al., 2021

Final results to be discussed at 2021 KSU Swine Day
Visual training aid – Glo Germ

The percent difference in Glo Germ coverage after increased people traffic through an area

- Control
- Entry bench
- Shower floor
- Clean side of locker room

% difference in Glo Germ coverage

P < 0.0001
SEM = 0.824
What has the research told us?

• Prevent contamination of ingredients/feed/fomites
  – Ingredient sourcing (manufacture, storage, delivery)
  – Biosecurity in feed mill and transportation
  • PEOPLE AND TRUCKS
    • Surveillance and visual training tools extremely helpful
• Reduce pathogen survival
  – Holding time, use of active intervention strategies
  – Avoid recontamination
Kansas State University Feed Safety Team
Dr. Jordan Gebhardt – Diagnostic Medicine/Pathobiology
Dr. Cassie Jones – Animal Sciences & Industry
Dr. Chad Paulk – Feed Science
Dr. Jason Woodworth – Animal Sciences & Industry

www.ksuswine.org → Feed Safety Resources
Feed Mill Bio-Security
Feed mill zones

- Implemented zones in our feed mill to minimize foot traffic and cross contamination
- Load out zone (Green Zone)
- Manufacturing, office, control room and warehouse zone (Blue Zone)
- Ingredient receiving zone (Red Zone)
- Corn receiving zone (Yellow Zone)
Bench System

- All mill team members, visitors and maintenance personnel are required to use the bench system when entering the manufacturing, office and warehouse zone (Blue Zone)
- Mill team members change into the provided clean clothing
- Visitors put provided coveralls over their clothing
- Designated shoes are only worn in the manufacturing, office and warehouse zone
Ingredient Receiving

- A funneling cone is used to unload each load of product.
- Any product that has spilled over the funneling cone is left on the scale and is disposed of at the end of each day.
- Limits risk of having pathogens tracked or dropped into ingredient receiving pit.
Additional Bio-Security Measures

- All brooms and shovels are color coded and can only be used in the designated zone.

- Feed mill was designed to implement bio-security measures and have a seamless flow, which has three bays with scales in each.

- Use an industrial floor scrubber to thoroughly clean the warehouse floor.
  - Load out, ingredient receiving pit and corn receiving pit

- 72-hour downtime for visitors who have had contact with swine.

- Restrooms
  - Trucker restroom
  - Restroom inside of blue zone

- Buffer zones are in place for new equipment such as rollers, motors and other special items.
  - These are set inside the outlined area and are disinfected before going into production.

- Pallet ingredients
  - We disinfect our loading dock, back of delivery trailer and tires of the forklift during the unloading process to limit risk of tracking pathogens into the mill.
Questions?

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Kansas State University – Feed Science and Management

Charles Stark
Kansas State University – Feed Science and Management

Steve Dritz
PIC Global Technical Services
Thank you for joining!

Feed Mill & Biosecurity Webinar