An integrated approach to improve whole herd pig survivability


August 27th, 2019
In the U.S., approximately **30-35% of pigs that are born are never marketed due to losses across the lifespan.** In addition, the current annualized sow mortality is approximately 12-13% for the U.S. herd. Furthermore, trend analysis indicates mortality rates across all phases of production are increasing over time. Collectively, these numbers indicate a major need to focus on enhancing pig health, wellbeing and productivity throughout all life stages with the goal of improving whole-herd pig livability.
The overarching objective is to identify causative factors contributing to swine mortality in commercial production and to develop and disseminate strategies and information that can be utilized to maximize pig survivability with the goal of reducing overall mortality nationally by 1 percentage point or more per year of the project.
Specific Objectives

• Specific Objective 1: Evaluation of the management attitudes and economics associated with improving survivability in U.S. swine production.

• Specific Objective 2: Identification of putative mortality causes on U.S. sow farms with the development and implementation of targeted strategies to maximize survivability.

• Specific Objective 3: Reducing wean to finish mortality through the implementation of management strategies founded upon ongoing production research.

• Specific Objective 4: Develop nationally effective and sustainable extension, outreach and education resources and strategies to enable adoption and implementation of strategies that will reduce mortality in pork production.
Project Management Plan

The Pig Livability Consortium: All investigators, collaborators, staff, trainees, undergraduate students, allied industry partners, producer partners, commodity groups, advisory board.
Specific Objective 1: Evaluation of the management attitudes and economics associated with improving survivability in U.S. swine production

- **Research Approach 1.1:** *Identify the economic costs* associated with mortalities within and across different swine production settings.

- **Research Approach 1.2:** To *understand management motivations and barriers* to implementing known and new production strategies that will result in improved survivability in sow and wean to finish pig production.

- **Research Approach 1.3:** *Benchmarking* effectiveness of management practices and economic performance associated with mortalities and model business discussions that result in improving survivability strategies.
Specific Objective 2: Identification of mortality causes on U.S. sow farms to support development and implementation of targeted strategies to maximize survivability.

- **Research Approach 2.1**: Investigate gilt selection and development practices to reduce the number of sows dying related to lameness.

- **Research Approach 2.2**: Perform research investigations to improve our understanding of the underlying causes of pelvic organ prolapse and our ability to mitigate POP occurrence.

- **Research Approach 2.3**: Investigate strategies to maximize piglet survival by altering nutrition and management of sows and piglets.
Specific Objective 3: Define factors that influence wean to finish mortality and implement management strategies founded upon ongoing production-based research.

- Research Approach 3.1: Literature review on causes and contributors to mortality from wean to market.

- Research Approach 3.2: Develop data-driven predictors of mortality tools for production systems.

- Research Approach 3.3: Perform field based research interventions to improve survivability.
Specific Objective 4. Develop a *nationally effective and sustainable extension program* to enable adoption and implementation of strategies that will reduce mortality in pork production

- **Extension Objective 1:** Increase pork producers’ awareness of the factors influencing swine livability and strategies available to achieve improvement.

- **Extension Objective 2:** Ensure the rapid and effective implementation of new technologies to improve swine livability related to their well-being, health and productivity.
**Objective 2:** Gilt Selection & Development Practices to Reduce the Number of Sows Dying Related to Lameness

**Objectives:**

1. Determine if feet and leg/body conformation score differences exist when evaluated at approximately 150 lbs. and at approximately 250 lbs.

2. Estimate the repeatability of the subjectively scored feet and leg/body conformation traits both within and across measurement time and scorer(s).

3. Determine if the ideal feet and leg conformation traits and scores within traits are the same for individual stalled gestation and group housed gestation systems.

**Expected Outcomes**

- Results will determine if the same or similar feet and leg scoring systems can be regardless of the type of sow gestation system being utilized.

- Evaluate how long does it take people with various feet and leg scoring experience to become proficient.

- Ultimately reduced lameness, culling, and mortality (including euthanasia) of breeding herd females for feet and leg problems
Objective 2: Improving gilt selection strategies that maximize gilt survival

Summer Data Collection

- Data collected at 3 commercial growers
- >4,500 pigs were tagged and had a tissue sample taken for DNA analysis
- >7,000 total observations
  - All 4,500 (1500/farm) were evaluated at “250lbs”
  - 1,500 (1 farm) were also evaluated at “150lbs” and a subset of 600 were re-evaluated at the end of the week for both weight points to check repeatability of the scorers

- Next Steps
  - Continue entering on-farm data
  - Start statistical analysis
**Objective 2:** Perineal scoring of sows as a tool to understand the underlying physiology preceding prolapse

<table>
<thead>
<tr>
<th>Perineal Score 1</th>
<th>Perineal Score 2</th>
<th>Perineal Score 3</th>
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<tbody>
<tr>
<td>85%</td>
<td>81%</td>
<td>70%</td>
</tr>
<tr>
<td>14%</td>
<td>18%</td>
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<tr>
<td>1%</td>
<td>0%</td>
<td>1%</td>
</tr>
<tr>
<td>4%</td>
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<table>
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<tr>
<th>Gestation Week</th>
<th>Project Week 1</th>
<th>Project Week 2</th>
<th>Project Week 3</th>
<th>Project Week 4</th>
<th>Project Week 5</th>
<th>Project Week 6</th>
<th>Project Week 7</th>
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<tbody>
<tr>
<td>Week 12</td>
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**3035 sows scored over 2 farms over a 7 week period**
**Objective 2:** Biology of perineal scores during late gestation

- Biological samples collected
  - Vaginal microflora swabs, blood samples
  - Assays investigating the vaginal microflora, immunological status, and steroid hormone profile that precedes pelvic organ prolapse.

<table>
<thead>
<tr>
<th>Perineal Score</th>
<th>Percentage of Prolapsed Sows in Each Perineal Score</th>
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<tbody>
<tr>
<td>1</td>
<td>20%</td>
</tr>
<tr>
<td>2</td>
<td>40%</td>
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<tr>
<td>3</td>
<td>37%</td>
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<table>
<thead>
<tr>
<th>Perineal Score</th>
<th>Percentage of Sows Prolapsed According to Perineal Score</th>
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<tbody>
<tr>
<td>1</td>
<td>1.0%</td>
</tr>
<tr>
<td>2</td>
<td>2.7%</td>
</tr>
<tr>
<td>3</td>
<td>23.4%</td>
</tr>
<tr>
<td>4</td>
<td>100%</td>
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Zoe Kiefer

Erika Johnson
Objective 2: Investigating the genetic influence on a piglet’s ability to thrive.

→ Approach:
  • Research will be conducted on commercial relevant facilities
  • Lab work conducted at ISU labs

→ Examining differences in colostrum IgG, IgA, fat, lactose, protein, and total metabolites.

→ Expected Outcome:
  • Results will be applied to the industry and used to determine what animals will be culled and not bred for another parity
  • Determine whether genetic line impacts the quality and quantity of colostrum produced by sows. This could impact producer decisions regarding internal multiplication programs.
  • Any colostrum differences due to teat location could impact piglet management at farrowing
  • Improve number and quality of animals that make it to market by reducing pre-weaning mortality

→ Colostrum has been collected from 89 total animals, 24 gilts, 14 parity 2, 29 parity 3-5, and 22 parity 6+. Lab work has begun, and we will be analyzing the data this semester.
**Objective 2:** Evaluation on farrowing induction strategies on farrowing and piglet performance

- Pilot Project: Purdue University (May-June 2019)
  - Evaluated three induction protocols
    - Natural farrowing
    - Lutalyse on day 114
    - Lutalyse on day 114 followed by Oxytocin 6 and 12 hours later
  - Response variables
    - Farrowing process, assistance needs, piglet oxygenation at birth, colostrum consumption, piglet performance and survival
  - Status
    - In-life phase completed, data analysis in process
Objective 2: Evaluation on farrowing induction strategies on farrowing and piglet performance

- Commercial Trial: The Maschhoff’s, Crawfordsville, IN (June – present)
  - Evaluating three induction protocols
    - Natural farrowing
    - Lutalyse on day 115 followed by Lutalyse 6 hours later
    - Lutalyse on day 115 followed by Oxytocin 6 hours later
  - Response variables
    - Farrowing process, assistance needs, colostrum consumption, piglet performance and survival
    - Working to collect data on >100 litters per treatment
  - Status
    - In-life phase underway with approx. 150 total litters data collected
**Objective 2**: To determine the impact of timing and amount of meal immediately prior to farrowing on:

✓ Piglet survival  
✓ Farrowing duration  
✓ Sow blood glucose and piglet blood gases  
✓ Sow and litter performance

**Study Design:**

✓ Treatment 1: 6 lbs lactation feed once daily  
✓ Treatment 2: 1.5 lbs lactation feed every 6 hours (4 meals daily)  
✓ Treatment 3: Ad libitum lactation feed, sows made to stand up every 6 hours  

Sows were fed treatments beginning at loading into farrowing crates (approx. day 113 of gestation) until parturition, then fed lactation diet ad libitum until weaning.
Conducted on a commercial sow farm in Jackson, MN from May-August 2019

- 250+ sows per treatment
- Over 12,000 piglets individually tagged and weighed at birth, 24 hr, and weaning
- All farrowings were attended to record birth interval, birth order, farrowing duration and stillborn rate
- Measurables:
  - Sow bodyweight and backfat at d 113 and weaning
  - Sow daily feed intake pre-farrow and lactation
  - Sow blood glucose at start of farrowing, 2 hours into farrowing, and at end of farrowing
  - Piglet colostrum intake
  - Piglet survival to weaning
  - Piglet birth weight, 24 hour weight and weaning weight
Objective 3: Literature review: Causes of post-weaning mortality

- Objective: Describe the current state of knowledge regarding factors contributing to post-weaning mortality.
- Dissemination
  - 2 peer-reviewed publications outlining identified causes (1 on infectious causes and 1 on non-infectious causes).
  - 1 publication discussing statistical analysis concepts and strategies to effectively design studies to evaluate morbidity/mortality.
  - Incorporate into website and factsheets.
  - Use to design prospective studies.
**Objective 3: Literature review: Causes of post-weaning mortality**

- Key areas identified:
  - Non-infectious causes
    - Weaning age/weight
    - Pre-weaning management (colostrum management, cross-fostering, etc.)
    - Micro-environment (season, ventilation, etc.)
  - Infectious causes
    - Respiratory disease
    - Enteric disease
    - Systemic disease
**Objective 3:** Develop data-driven predictors of mortality tools for production systems

- **1\textsuperscript{st} Objective** - Develop an automated framework to capture, merge and consolidate multiple data streams such as:
  - Breeding-to-wean (BTW) Productivity parameters
  - Closeout data of growing pig groups
  - BTW and growing pig health status
  - Facilities structure information and management factors

- **2\textsuperscript{nd} Objective** - Using the aforementioned final compiled data, we did an automated statistical model to report the effect of major whole-herd drivers of growing pigs mortality and to forecast closeout mortality
Develop data-driven predictors of mortality tools for production systems.

**1st Objective**
Develop an automated framework to capture, merge and consolidate multiple data streams such as:
- Breeding-to-wean (BTW) Productivity parameters
- Closeout data of growing pig groups
- BTW and growing pig health status
- Facilities structure information and management factors.

**2nd Objective**
Using the aforementioned final compiled data, we developed an automated statistical model to report the effect of major whole-herd drivers of growing pigs mortality and to forecast closeout mortality.
1st Model Result

The model accounted for 82.28% of the observed variability of wean-to-market mortality.

<table>
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<tr>
<th>Observations</th>
<th>651</th>
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<tbody>
<tr>
<td>Correlation</td>
<td>0.8228</td>
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<tr>
<td>p-value</td>
<td>&lt;0.0001</td>
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<tr>
<td>Estimated Mort</td>
<td>9.19%</td>
</tr>
<tr>
<td>Actual Mort</td>
<td>9.58%</td>
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Internship Program- Erika Johnson

I love swine and learning, and the versatility of this internship allowed me to do just that. I was able to immerse myself into different areas in the swine industry to not only learn, but to connect with others. This internship gave me the opportunity to learn how to work with a team and how to grow as an individual. Going into this internship I thought I would just have a project and do a few things here and there, but I was able to do more. Going to different sow farms to help with other teams was great learning experience since I have never been a part of a sow trial. It was not what I was expecting, but I enjoyed it! Overall, it was a great learning experience that went by quickly!
Objective 4: Extension and Outreach

• **Extension Activity #1:** Delivery of information through high impact conferences
• **Extension Activity #2:** Dedicated development of content to be delivered and stored electronically
• **Extension Activity #3:** Applied research and demonstration projects with producer partners
• **Extension Activity #4:** Train the Trainer: Development and delivery of workshops and training sessions to improve swine survivability
Improving Pig Survivability

https://piglivability.org

Welcome to the Improving Pig Survivability project.
Improving Pig Survivability

https://piglivability.org

Announcing the International Conference on Pig Survivability
October 28-29, 2020 | Omaha, Nebraska

Bringing the swine industry together to discuss solutions and motivate change toward improving pig survivability.