Finding New Technologies in the Pork Industry

Towards Precision Farming or just High-Tech Hype?

Lee Whittington, President/CEO
How Many Meals in a Pig?

- Guess - Write it down
- 130 KG BW
- 70% yield
- 8 oz serving (generous)
- 400 servings
- Have you served the “pork message” today?
Safety Tip

• Be careful lifting > 15% of your BW
• Avoid heavy carry over 15 meters
• Safety innovation – sow removal
Key Outputs Model

Research  Pork

People  Communications
Defining what is really an innovation - it will contribute value to our businesses, to the welfare of the animals or the environment.
Our future partnerships/hiring need to be data specialists to support our animal scientists and engineers.
African Undersea Cables (2012)

SILICON SAVANNAH
WHY NAIROBI IS THE NEXT WORLD TECH CAPITAL
Sensors will drive the future of hardware

- Speed
- Moisture
- Carbon Monoxide
- Pressure
- Proximity
- Light Colour
- Irradiance
- Torque
- Flow
- Electrical Conductivity
- Vibration
- Fuel Consumption

- Temperature
- Distance Travelled
- Nutrient Load
- Displacement
- Barometric Pressure
- Sodium
- Blood Pressure
- Estrus
- Humidity
- Glucose
- Air Quality
- Bend
- Wearables
- Position
- Heartbeat

Western Beef
PAMI
Westnest
Automated Disease Detection

Website Jan 2018, estimating costs as low as $3 per sensor

- Early in situ detection.
- Focused on when spores become motile.
- Low cost ~ $25.00/unit.
- Focused on Oomycota.
- Fusarium is a oomycete.
- Supports forecasting and timely application of fungicides.

Kerry O'Donnelly and Angela do Manzanos: Fungi Alert
What will determine the success of these technologies will be:

1) the ability to use in the barn (robust, communicate through walls ...) and
2) their ability to address a fundamental business need (collect, analyze and act on aspects of production that have economic value)
Biosecurity Compliance

- Boots: 52.5%
- Log book: 33.3%
- Coveralls: 71.0%
- Hand washing: 35.8%
- Overall compliance: 34.7%

© J-P. Vallaincourt
BE SEEN BE SAFE
Confidential monitoring of disease movement.
Be Seen Be Safe

Farmer/User Secure Login

Administrator Access

Client Database

Be Seen Be Safe Server
You have entered Master Farms on Nov 20 @ 09:24. Welcome!

You have left Master Farms on Nov 20 @ 10:24. Thank you for visiting!
Other Systems

Farm Health Monitor
• Available 2018
• Uses clinical signs to provide alerts in time to reduce the impact of a disease threat
• Allows service representatives, field officers, and producers to report clinical signs of disease within the farm’s network before official diagnosis
• Allows for proactive action
Potential Disease Spread Report (mapped)
Castene Trailer Manufacture & DrySist
Assessing cleanliness of trailers
Activities: Simulation Work

- started _________ and completed February 2017

- recommended the S2 – S4 (2 front air inlets and 4 rear air outlets) design configuration as the best design option
Activities: Moving of the Trailer
Sensor Motes

Every bean measures temperature, humidity, air quality including VOCs, air pressure, altitude, orientation and movement - all useful in bulk-storage facilities.
WHAT WE DO

Building the future of livestock transport

- Real time communications
- Instant alerts
- Long lasting battery life
- Ease of use
- Easy to disinfect
- IoT
- Enable smart decisions
Initial lipid content and HTL oil conversion efficiency for different feedstocks. Energy recovery ratio is 3~11 to 1. Note that the HTL can convert the very low-lipid algae into crude oil – a paradigm shift from ‘extracting’ to ‘converting’.
Batch Reactor, 1998 \((He \ et \ al, \ 2000)\)

\[ E_{out} : E_{in} = 3:1; \] without heat recovery
Pilot Plant, 2007 (40 barrel/day, Houston, Texas)

E_{out} : E_{in} = 11:1; with heat recovery
Commercial Plant
(160 barrel/day, Park Hill, SC, 2010)
Air Scrubbers
‘Make Good Neighbours’

Biotrickling air filtration study between CDPQ/PSC in 2013
Reduced ammonia 77%, Dust 92%, Odour 75%
Move Inside the Barn
Use of nanoparticles

• To assess impact of nanoparticles on manure gases and determine best deployment mode

• To test various deployment modes:
  – Embedded in filter
  – Dispersed in headspace
  – Mixed with slurry
Mixing – effect on $\text{H}_2\text{S}$ levels

Maximum reduction rate: 99%
Antimicrobial properties of nanoparticles

- Surface treatment to control pathogens
Antimicrobial properties of nanoparticles

Effect of MgO on *Salmonella* spp.
### Cleanliness and Performance

#### MS Schippers

**Passion for Farming**

<table>
<thead>
<tr>
<th>Rendementstal</th>
<th>Regulier</th>
<th>Landelijk</th>
<th>Doelstelling</th>
</tr>
</thead>
<tbody>
<tr>
<td>Efficiëntie huis</td>
<td>Leistung</td>
<td>Regular</td>
<td>National</td>
</tr>
<tr>
<td>€3.82</td>
<td>€5.28</td>
<td>€0.00</td>
<td>€10.00</td>
</tr>
</tbody>
</table>

| | | | | |
| €2.61 | €4.28 | €0.00 | €2.35 |

**Bent u klaar voor het Management van Morgen?**

Are you ready for the Management of Tomorrow?

Sind Sie bereit für das Management von Morgen?

**Prairie Swine Centre**

25 years
Water

- Use of endoscope to look in pipes for grunge caused by iron-loving bacteria
- Water pH 4.0 desirable use of organic acids. Acid treated water good for gut health
Daily water and feed intakes at the barn for trials #1 and #2 along with daily maximum temperature inside the barn and the number of individual treatments (used as a proxy of sanitary status). Three different alerts levels, based on daily variations of water and feed intakes, were used to predict health treatments for trial #1. For trial #2, high temperatures prevent the prediction of health issues.
SuperSow – PigChampPro Europa

- > 15 born alive first parity;
- 26 more born alive lifetime productivity

In addition to this, high performing SUPER SOWS have a farrowing rate 6% higher than the rest, especially in the three first parities. This good productivity from the beginning of their reproductive lives has an immediate consequence: The
PigChamp Pro Europa

Developed by PigChamp Pro Europa based on records of over 1,000,000 matings.

- 1st litter >15 born alive
- These sows have 6% higher farrowing rate, produce 26 pigs more lifetime than herdmates.

All starts with selection of gilt reject animals with birth wt <1.2kg (53% vs, 1.13kg.92% survive).

This method of selection is reducing COP of 20kg pig by $6 USD.

When we create super sows we need super stock people.

- Long-term goal is determining what data will allow us to move to predictive analytics.
The pattern of dots surrounding this letter “a” uniquely identifies its location.
Web based data / Digital Pen Data collection Analysis – Monitoring
PRRSons Project
Data Gathering & Management

Body Weight
Other Innovations

• Burlap sheet in farrowing crate
  – Nest building, calm the animal, reduce farrowing times and stillbirths
• PigNap – general anesthesia at castration
JYGA Lactation Feeding System
Influence of a modified lactation feeding system on sow and piglet performance

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INTRODUCTION

Electronic feeding systems for lactating sows have multiple advantages over manual feed delivery including collection of feed intake data, controlled delivery of fresh feed, and reduced feed wastage, however, these feed systems are costly to install and maintain.

A modified feeding system was developed which consists of a feed drop tube which extends to just above the base of the feeder and requires the sow to manipulate the tube to release feed.

The modified system provides the advantage of delivery of fresh feed to the sow without the expense of the electronic feeding system.

OBJECTIVE & HYPOTHESIS

The objective of this study was to compare the impact of manual feeding, an electronic feeding system, or the modified feeding system on sow and piglet performance during lactation.

It was hypothesized that the modified feeding system would result in similar animal performance as the electronic system and, therefore, be a viable option for sow and piglet feeding.

METHODOLOGY

Animals and Treatments

- A total of 45 sows and litters were randomly assigned to treatments over 3 blocks (15 sows/block).
- Treatments were 1 of 3 feeding systems:
  - Manual feeding (MNL, n=15; fed large meals by hand).
  - Electronic feeding system (EFS, n=15; delivery of small meals as requested by sow).
  - Modified feeding system (MOD, n=15; feed drop tube above feeder requiring sow manipulation for delivery of feed).
- Sows were moved into farrowing crates approximately 7 days prior to expected farrowing date.
- Within litters, farrowing piglets were cross-fostered to equalize number of piglets per litter.

Sow characteristics and performance (Table 1)

<table>
<thead>
<tr>
<th></th>
<th>MNL</th>
<th>EFS</th>
<th>MOD</th>
<th>SEM</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial BW, kg</td>
<td>286.7</td>
<td>272.9</td>
<td>288.3</td>
<td>10.3</td>
<td>0.49</td>
</tr>
<tr>
<td>Final BW, kg</td>
<td>263.7</td>
<td>241.3</td>
<td>257.3</td>
<td>10.8</td>
<td>0.31</td>
</tr>
<tr>
<td>Initial BC5</td>
<td>3.1</td>
<td>3.3</td>
<td>3.2</td>
<td>0.12</td>
<td>0.71</td>
</tr>
<tr>
<td>Final BC5</td>
<td>2.7</td>
<td>2.7</td>
<td>2.8</td>
<td>0.14</td>
<td>0.80</td>
</tr>
<tr>
<td>Initial backfat, mm</td>
<td>16.8</td>
<td>17.0</td>
<td>16.9</td>
<td>0.39</td>
<td>0.001</td>
</tr>
<tr>
<td>Final backfat, mm</td>
<td>15.4</td>
<td>14.7</td>
<td>15.5</td>
<td>0.57</td>
<td>0.04</td>
</tr>
<tr>
<td>Live born</td>
<td>14.8</td>
<td>13.0</td>
<td>13.3</td>
<td>0.80</td>
<td>0.21</td>
</tr>
<tr>
<td>Feed intake, kg/d</td>
<td>5.13</td>
<td>3.46</td>
<td>2.68*</td>
<td>0.32</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Note: *Significantly different from baseline (d 0).

Results

Sow characterization and performance (Table 1)

- Initial body weight, backfat thickness, body condition score, and total piglets born alive were similar across all treatment groups.
- Feed system had no impact on final body weight, backfat thickness, or body condition score, which all decreased during lactation.
- Sow feed intake was significantly higher when manually fed when compared to either the electronic or modified feeding system in week 1, 2, and overall.
- There was no effect of feeding system on sow feed intake in week three post-farrowing.

Litter performance (Table 2)

- Litter average daily gain (g/pig/d) was higher with manual feeding compared to electronic feeding during the third week post-farrowing.
- There was no impact of dietary treatment on total litter weight or litter weight on a per-pig basis.

DISCUSSION & IMPLICATIONS

- All three feeding systems evaluated resulted in similar performance of the sow and litter.
- Both the electronic sow feeding system and the modified feeding system resulted in lower feed intake during the first two weeks of lactation. This is most likely the result of decreased feed wastage as there was no difference in sow or litter performance.
- The reduction in feed intake would result in approximately $8.50 savings per 21-d lactation compared to manual feeding.
- The modified feeding system is a viable option for sow and piglet feeding.

ACKNOWLEDGEMENTS

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Optimal Pork Production, Lleida, Spain

3400 sow research barn.
320,000 sow, 8M finisher system
Data Analysis

• Big Data is upon us
  • Culling decisions based on FE of offspring and total sow/litter performance, not just feet and legs and sow reproductive performance.
  • In large herds analytics allows you to identify, find and manage the individual.
    The data is a welfare tool.
Automation

- Saw the originator of this, a ‘flapper’ at Agromek 2009. still looks like prototype
- Creep feeder, also added iron supplementation, feed curves drops just what is needed.
- Automated milk delivery for ever increasing litter size supplementation, only one system shown in 2016 Eurotier.
Farm Innovation’s LISA LIfeSaver Farrowing Monitoring Device
Microfluidics
The 9 Billion People Question

Can modern mechanized agriculture be sustainable?

HUMAN POPULATION GROWTH CHART
(including projections)

I THINK I CAN...
I THINK I CAN...
I HOPE I CAN...
I REALLY HOPE I CAN...
MAN, I HOPE I CAN...

YEAR
1954–2000
1
2
3
4
5
6
7
8
9
10
BILLIONS
12.5
10
7.5
5
2.5
1
0

PAMI
Westest
Calorie Production Deficits

In the next 10 years...we will be facing a 214 trillion calorie gap.

That’s equal to 379 billion Big Macs for China and Africa
“In today’s marketplace it is organizational capability to adapt that is the only sustainable competitive advantage”

- Willie Pietersen, Reinventing Strategy
7 Habits of Highly Effective Research Organizations

1. Issues not Disciplines will engage your client
2. Industry driven mandate, and stay connected to the customer
3. Professional management; free researcher from administration
4. Be a catalyst - share facilities and collaborate
5. Develop people who will make a difference
6. Global vision, plus a BHAG
7. Quantify benefits - ROI, IRR. $ per pig marketed

Adapted from Source: Steven Covey, 7 Habits of Highly Successful People
Independence; be proactive, begin with end in mind, put first things first
Interdependence; win-win, seek first to understand then be understood, synergize/teamwork
Continuous improvement; sharpen the saw
Prairie Swine Centre –
A Regional Initiative
A National Resource