PEDV Update and Lessons Learned

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Porcine Epidemic Diarrhea virus

- On May 17\textsuperscript{th}, 2015 the US reached the 2-year mark post-diagnosis of the first case of PEDV.

- Since that time, nearly all major (and many not so major) swine states have had positive cases reported for PEDV.
  - 32 different states involved

- Swine Enteric Coronaviral Diseases (SECD) have “upped the ante” for biosecurity on-farm

- Highlighted gaps in protection for incoming diseases
Early Knowledge About PEDV in the US

• PEDV is in the same virus family as TGE & PRCV

• Different strains of PEDV exist with varying severity of clinical signs

• Genomic evaluation showed:
  – U.S. PEDV strain was 99.4% similar to a Chinese isolate from 2012 (strain info from Genbank)
  – Subsequent strains from Canada are similar to US strain

• Viruses considered part of SECD:
  – PEDV
  – Porcine Deltacoronavirus
  – TGE
PED Worldwide Status

• PEDV currently is active and considered endemic in different parts of the world
  – China, South Korea, Thailand, Vietnam, Japan and South America
  – Different from UK strain seen in the 1970’s
  – More virulent strains appeared in 2010 + and continues to be problematic
PEDV Messaging

• PEDV = fecal/oral method of infection and transmission
  – Transmits through contaminated manure
  – Keep from spreading through use of biosecurity plans

• PEDV does NOT affect pork and cannot infect humans...
  – PEDV is not a public health or food safety issue
  – Pork Is Safe!!!
Clinical Signs in Sows

• Sows were febrile, lethargic and scouring during late gestation or 2-3 days before farrowing

Courtesy of Dr. Joe Connor
PED in baby piglets – most severe

Day 1

Day 2

Day 3

Day 4

Courtesy of Dr. Joe Connor
Clinical Signs in Growing Pigs

Courtesy of Dr. Joe Connor
Current Status of PEDV
National Status of PEDV

- Two main sources of information:
  - [Swine Health Monitoring Project](http://www.cvm.umn.edu/sdec/SwineDiseases/pedv/index.htm)
USDA SECD Tracking


✓ Federal Order on June 5, 2014 = PEDV/PDCoV now reportable diseases

✓ Information is site-specific for PEDV + locations

✓ Tracking of premises/cases is from June 5th, 2014 to current
Status to Date

Week Received

Number of Premises

06/01/14 06/27/14 07/13/14 08/03/14 08/24/14 09/14/14 10/05/14 10/26/14 11/16/14 12/28/14 01/19/15 02/08/15 03/01/15 03/22/15 04/12/15 05/03/15 05/24/15 06/14/15 07/05/15 07/26/15 08/16/15 09/06/15 09/27/15 10/18/15

DUAL INFECTION  PDCoV  PEDV

People. Pigs. Planet.
States with PEDV Cases

PEDV Confirmed Positive and Presumptive Positive Premises since June 5, 2014 (confirmed/presumptive)
Created: 09/22/2015
U.S. Swine Health Monitoring Project

http://www.cvm.umn.edu/sdec/SwineDiseases/pedv/index.htm

- 752 breeding sites
  (20 systems)
- 2.1M sows
Chart 4 - PED EWMA Analysis for years 2013 - 2016

EWMA weekly % cases of at risk

- (n = 614)
- (n = 914)
- (n = 997)

Weekly # of new cases

- 0.0%
- 0.5%
- 1.0%
- 1.5%
- 2.0%
- 2.5%
- 3.0%

- May 13
- Jul 13
- Sep 13
- Nov 13
- Jan 14
- Mar 14
- May 14
- Jul 14
- Sep 14
- Nov 14
- Jan 15
- Mar 15
- May 15
- Jul 15
- Sep 15

- EWMA
- Epidemic Threshold
- Actual

9/4/13
People. Pigs. Planet.

Research/Knowledge Update
Research for PEDV & PDCoV

2013
• ~$1 million for research
• Funded 14 projects
  – Basics of disease
  – Sow immunity (initial work)
  – Foundation for biosecurity

2014
• ~$2 million for research
• Funded 30 projects
  – Feed focus
  – Animal focus
  – Biosecurity validation
  – Disease monitoring

2015
• ~$150,000 for research
• Funded 2 projects
  – Vaccine platform
  – Chemical mitigants for feed

www.pork.org/PEDV
PEDV Research Priorities

Research Priorities – 2013:

• Basic Research of PEDV: (project duration = 6 months)
  – Who - What - Where - When - Why - How...
  – Diagnostic test development
  – Basics of disease transmission and survivability

• Sow immunity: (project duration ~ 12 months)
  – Duration of immunity
  – Optimizing feedback protocols
  – Diagnostic tests to assess sow and piglet immunity to PEDV
PEDV/PDCoV Research For 2014

Research priorities – 2014:

• **Feed Focus:**
  – Risk assessment for feed as transmission source
  – Intervention methods for feed (pelleting/additives)
  – Post-processing time on virus
  – Novel bioassay models

• **Biosecurity Validation**
  • Manure management
  • Impact of lime?

• **Animal Focus:**
  – PEDV immunity development
  – PDCoV = pathogenicity & diagnostic test development
PEDV/PDCoV Research For 2015

• Hone in on more specifics of development, duration and optimization of sow immunity (based on 2013/2014 work)

• Feed interventions (based off of info from 2014)
  ✓ RFP yet this fall (2015)

• Novel vaccine administration technologies
Survivability of the virus

- PEDV can survive in many different conditions:
  - Pits; feed slurry; manure; water – fresh and recycle; feed ingredients
  - Survive in cold conditions
  - Survivability in pits can be time dependent
    - PEDV + PCR found at 4 & 6 months
    - PEDV bioassay only + for 4 month
Immunity - What have we learned?

Immunity to the virus

• We now have many different diagnostic tools to detect PEDV:
  – Can detect the virus (PCR)
  – Can detect exposure to the virus (ELISA or IFA)
  – Can evaluate the level of immunity to the virus (FFN, IFA)

• Basics of immunity:
  – Gut immunity is needed for protection
  – Piglets need to consume milk to be protected against PEDV
  – The response to PEDV can vary by sow and so can protection passed to piglets
Immunity to the virus

- Sows do respond to feedback and develop antibodies
  - Oral exposure is best but exposure also causes clinical illness
  - Vaccines can help, but killed products may not have enough foreign protein to stimulate immunity

- Sow immunity:
  - Immunity has been seen for at least 6-7 months
  - Work being done on cross-protection and some degree of protection may be happening
  - Will use results of these studies for continuation of work for 2015*
Transportation - What have we learned?

Transportation management is critical!!!

- Packing plants present a high risk for spread of PEDV

- Certain procedures for trucks can kill the virus:
  - 160°F for 10 minutes kills PEDV
  - Clean, disinfect and heat (see above) can kill PEDV and other pathogens!
Feed management

– Takes a very small amount of virus to infect pigs (7 infectious units of cell culture)
– Some potential products can help to eliminate virus in feed
– Assessment of pelleting and heat treatment may be effective for point-in-time virus control
– Sequencing batches of feed can aid in mitigation of risk
Feed/Feed Systems - What have we learned?

Feed management

- Feed mills can become extensively contaminated including dust!

- Key is to reduce mechanisms by which products and ingredients can become contaminated

- Decontamination of mills is very labor intense and +/- do-able
Transportation Research

• Modeling of potential infection spread at packing plants
  – Plants still provide high risk for downstream contamination of GF floors but for sow farms as well
  – How to mitigate risk?
    • REMOVE manure!!!
    • Removal of manure from flooring and trailers CAN help to minimize the risk of spread by reducing survivability of the virus on surfaces.

• What else can be done?
  – Follow basic biosecurity for washing/disinfecting trailers to get rid of manure
  – Heating to 160º F for 10 minutes can kill PEDV
  – Use disinfectants according to label to kill PEDV
Removal of Organic Material Is KEY!
Examples of the Line of Separation
Feed and Feed Systems Biosecurity

• Mills can be easily contaminated and be a point source for contamination for feed, ingredients and equipment

• Limit external contamination:
  – Cover receiving grain pits
  – Avoid sweeping in spills or dust from mill back into processed feeds
  – Sequencing batches of feed can reduce level of PEDV and reduce potential risk
Feed and Feed Systems Biosecurity

• Point-in-time interventions can work to control the virus:
  – Organic acids, essential oils, other additives and formaldehyde have shown ability to kill PEDV
  – Pelleting temps can kill PEDV, but feed can easily be contaminated post-processing

• Need to maintain appropriate temps consistently – avoid pellet plugs or start up to assume you have virus kill
Feed and Feed Systems Biosecurity

• Sanitation interventions for live-haul can work for feed trucks to reduce contamination.
• Keep cabs of tractors clean to minimize contamination.
• Further research underway to look at other in-feed interventions post-processing.
• Other areas of risk:
  – Tote bags (USDA)
  – Other container sanitation
USDA Study on Totes - PEDV

- PED survival ~ 5wks at room temp (not at 6wks)
  - Stable for 10 wks at 4⁰ C and -80⁰ C
- No federal regulations yet; +/- FSMA
- USDA Root-cause Investigation complete
Manure Handling

• Since PEDV can survive in colder weather, need to make sure steps are in place to prevent spread of the virus through contaminated equipment!
  – Hoses, drag lines, manure, boots etc.
  – Clean, dry and downtime
  – Track where equipment/teams have been
  – Maintain a Line of Separation
PEDV Materials and Research

- All research and updates available at www.pork.org

- Created a PEDV-specific site for all information

- Compiled factsheet booklet available for procedures/protocols
Disease Preparedness
Emerging Disease Issues

- PED has highlighted a gap in protection of animal health (domestically and internationally)
- PED has shown the need to focus on identifying key needs and resources to support US agriculture/animal health
- Identified a need for an Emerging Disease Response plan
Development of an Emerging Disease Plan

- **USDA - ongoing**
  - Working on Emerging Disease Response plan
  - National List of Reportable Animal Diseases (NLRAD)

- **NPPC - ongoing**
  - Reinstate concept of Swine Health Board
  - Working on Emerging Disease Plan – all stakeholders (USDA included)

- **Swine Health Information Center (SHIC)**
  - NPB one-time funded at $15 million for 5 years
  - Utilize the AASV disease “Matrix” identifying future diseases/risks for research roadmap
  - Primary focus is on new and emerging diseases of swine
    - i.e. Seneca Valley Virus focus
Summary

• PED has proven to be a major swine health challenge AND highlighted a gap in disease protection (domestic and international).

• Spring/summer of 2015 has been quiet but unsure of what fall/winter will bring.

• Plans for dealing with emerging diseases are solidly underway including the development of the SHIC to focus efforts/research on emerging diseases.

• Cooperation and collaboration with all industry and government sectors a must for effective and timely disease control.
Questions?

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