Challenges to Pig Health Improvement

Scott Dee DVM MS PhD Dipl;ACVM
Swine Disease Eradication Center
University of Minnesota

I appreciate the opportunity to lead off this very interesting program. Thanks to Dr. Rodney Goodwin for the invitation. My task for today is two-fold: 1) To establish the definition of the healthy pig and to 2) To identify the challenges to pork production from an infectious disease point of view. My background consists of 12 years in a swine practice and now almost 5 years in academia doing applied research on the transmission and elimination of porcine reproductive and respiratory syndrome virus (PRRSV). Therefore, I will be addressing this issue from the position of an applied scientist who spends a great deal of his time in the field.

To begin, infectious diseases have always proven to be very worthy opponents for swine veterinarians. I vividly recall the statement made by one of our industry leaders in the early 1990’s that because of the development of new technologies such as segregated early weaning, infectious disease was no longer an issue. Unfortunately, this was incorrect. In fact, the changes in the US swine industry that occurred during those early years actually perpetuated and magnified the impact of a number of infectious diseases. Rapid expansion, the use of multiple gilt sources, segregated production and the commingling of weaned pigs resulted in inconsistent pathogen colonization of offspring, animal-to-animal circulation of organisms, genetic change and the production of emerging and re-emerging diseases.

A primary example of the impact of these strategies have enhanced the significance of a pathogen is the case of PRRSV. PRRSV has been a great teacher over the years, exposing all our faults and taking advantage of our mistakes! However, PRRSV is also a very good model for new methods of managing infectious diseases in the future. Therefore, I will use PRRSV as a model pathogen for presenting today’s topics. Please recognize that I am not trying to make this into a “PRRS talk”. There are many other important infectious disease challenges such as PMWS, that need attention. However, I believe I can convey my message for today quite clearly if I use PRRSV as an example, so please bear with me!

**Topic 1. The Definition of a Healthy Pig**

Following the PRRSV model, I will propose that the definition of a healthy pig is a “PRRSV-naïve” pig, that is, a pig which has never been exposed to PRRSV and originates from a population of pigs that have never contacted PRRSV since its establishment. The combination of commercially available diagnostic assays such as the IDEXX ELISA and polymerase chain reaction can identify and confirm these animals and population quite easily. Their data are very distinct and examples will be provided in the lecture. The justification for this definition is the cost of PRRS. There are several publications that have attempted to calculate the cost of PRRSV. The National Pork Board 2003 PRRS compendium contains an excellent chapter written by Polson and Houck that summarizes these studies, and I refer all readers to that chapter (2.4 pp.51-58). In this reference, the mean cost of PRRS on a per sow basis has been estimated to be $255 while the cost on a per pig basis ranges from $6.25-$15.25! These are overwhelming figures, and it is not surprising to see that many producers have been forced to exit the industry following losses of this level. Finally, from a “pain and suffering” point of view I will argue that PRRSV is also very inhumane to producers, particularly those that have
experienced the “post-re-population-re-infection traumatic syndrome”, following the introduction of a new strain of the virus before the first gilt of a new depopulation-repopulation project has farrowed.

**Topic 2. Identify the Challenges to Pork production from an Infectious Disease Point of View**

Keeping with the PRRSV model, I will argue that the future of the US industry will depend on how we choose to manage PRRS. Looking into the crystal ball, I believe that in 10-15 years, the US will be free of PRRSV. However, it will take some significant change in the industry to make this happen. I feel we need a “3-point plan” to get this accomplished. This plan consists of 1). Team building 2). The development of new research models to answer key questions, and 3). The fostering of a regional mentality to PRRS. Let’s look at these points individually:

**Team building**

One producer or a single University cannot solve the PRRS problems alone. We need to work together. Scientists from around the country need to become integrated with industry. Federal agencies do not need to function as regulatory bodies. Rather, they need to provide large sums of money dedicated to PRRS research at both the basic and applied level with the desired outcome being the development of new information that furthers the national eradication effort. Producers and industry need to provide resources as well. Everyone must contribute in order to succeed.

**New research models**

There are still a number of questions that remain unanswered, in the areas of PRRSV genomics, immunology, eradication and biosecurity. To answer these questions correctly, I believe we need new models of research, that incorporate controlled field settings, and involve large populations of pigs in order to “bridge the gap” between University research settings and the real world. The lack of these models in the early 1990’s led to the formulation of a number of erroneous conclusions on how PRRSV would behave in the field.

**Fostering a regional mentality to PRRS**

This refers to producers realizing that they cannot win the PRRS war on their own. The industry must collaborate and cooperate to achieve the desired goal. US producers should take note that such collaborations are already underway in competing markets and the longer that we delay and do battle amongst each other, the further and faster we fall behind. New research from our group indicates that recently identified routes of regional spread of PRRSV such as flies and transport may be impossible to manage unless producers cooperate and organize regional projects.

**Conclusions**

While the challenge of national PRRS eradication is enormous, in my opinion, the timing is perfect. New initiatives from the National Pork Board and the National Research Initiative are calling for the integration of the industry and academia in an effort to band together to achieve the goal. A lot of what I have described is underway and already progress is being made. I feel that this is a very nice model for managing infectious diseases, and perhaps it can be applied to other pathogens. Thank you for the opportunity to present my views. I hope they have been interesting and thought-provoking.
Challenges to Pig Health Improvement

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Topics for Today

• 1. Establish the definition of a healthy pig.
• 2. Identify the challenges to pork production from an infectious disease point of view.

A long time ago, a wise old veterinarian once said.....

• “Due to the development of SEW technology, infectious diseases will no longer be an issue for the swine industry.”

Changes in the US swine industry have allowed pathogens to thrive!

• 1. Expansion
• 2. Multiple gilt sources
• 3. Segregated production
• 4. Commingled nurseries
  – All of the above has resulted in inconsistent colonization of offspring, animal-to-animal circulation, genetic change, and the production of new strains!

Therefore, let’s address the topics for today using PRRSV as a model pathogen and provide a model for managing other pathogens....
Justification

- The cost of endemic PRRS!
  - $255/sow
  - $6.25-$15.25/pig

- PRRS is inhumane to humans too!
  - “post-repopulation re-infection traumatic syndrome”

1. A healthy pig is a “PRRSV-naïve” pig!

- What is a PRRSV-naïve pig?
  - A pig which has never been exposed to PRRSV during its lifetime.
    - ELISA s/p ratio = 0.000
  - A pig which originates from a population of that has never been exposed to PRRSV during its existence.

### PRRS-naïve Breeding Herd

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<th>ELISA HERD CHECK</th>
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</table>
2. Identify the Challenge

The future of the US industry will depend on how we manage PRRS!

Simple…..yet Complex!

The Fate of the Virus

- 1. Little will change over the next 5 years at the farm level...BUT
  - Great scientific progress will be made.
  - Regional PRRS eradication will be successful in competing swine markets.
  - US producers will begin to band together...

The Fate of the Virus, cont.

- 2. Significant progress will be made at the farm level during years 6-10.
  - Regional eradication models will be applied and tested across the nation.

The Fate of the Virus, cont.

- 3. Beyond year 10, PRRSV will be eliminated from the US.
Who Will Drive This Change?

- **Producers**
  - National Pork Board PRRS initiative

- **AASV**
  - PRRS eradication projects already underway

- **Academia**
  - NC-229 regional PRRS team
  - SDEC

- **Federal Agencies**
  - NRI Integrated Projects: $4 million over 4 years
    - PRRSV biosecurity/eradication

How Do We Get There?

- I propose a 3-Part Plan:
  1. Building integrated teams.
  2. Developing new research models to answer key questions.
  3. Fostering a regional mentality to PRRS.

1. Team Building

- Ex: NC-229 regional PRRS team
  - 20 Universities, 57 collaborators
  - Share resources
    - ideas
    - students
    - grant money
    - facilities

Team Building, cont.

Ex: SDEC advisory board
Directs research
- AASV, NPB, MPB membership
- Industrial partners
  - Annual graduate student stipends
  - Endowed fellowships
- Production companies
  - 2 million sows represented
  - Access to sites, pigs and data

2. New Research Models

- **Justification:**
  - Key PRRSV research questions remain unanswered.
  - Answering these questions correctly depends on the development of new research models....

Research Questions...

- **Viral genomics**
  - identification of determinants of virulence and protection

- **Immunology**
  - mechanisms of protective immunity
  - cross-protection
Questions, cont.

- **Eradication**
  - regional projects
- **Biosecurity**
  - preventing pathogen entry

New Research Models

- “Bridge the gap” between University facilities and the real world…
- Require a higher level of risk…
- **Ex: SDEC research farm**
  - 16 km from other farms
  - Commercial facilities
  - Large populations
3. Fostering a Regional Mentality to PRRS
- One producer cannot win the PRRS war working alone.
- Producers need to develop and drive PRRS regional programs.
- The entire industry needs to function in an eradication mode to succeed.

Justification
- New research suggests:
  - That the capacity for regional spread of PRRSV is greater than once believed.
  - That the non-porcine vectors and fomites that play a role in this spread may be very difficult to control......

The Potential Role of Insects as Vectors of PRRSV (Otake, et al.)
- 1. Mechanical transmission of PRRSV by mosquitoes and houseflies has been described.
- 2. A single housefly can transmit the virus.
- 3. PRRSV remains viable in the GI tract of mosquitoes and houseflies for 6 and 12 hours.
Comparison of Sanitation Protocols

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Therefore…..

• An individual producer located in a swine-dense area that is attempting to remain free of PRRSV for an extended period is likely to fail.

However,

• a UNIFIED REGIONAL TEAM of producers, working together with industry and academia will succeed!!

Conclusions

• 1. PRRSV has been a great teacher in the past and will continue to be if we allow it to do so.
• 2. PRRSV can be a model for how we as an industry handle the challenge of infectious diseases of swine.
• 3. Its up to all of us to work together as a team and develop strategic plans for designated pathogens.

Acknowledgments

• SDEC industry advisory board
  – PIC, Genetiporc, Dekalb
  – BIVI, Merial, Newport, VetRx, Pfizer
• National Pork Board
• Minnesota Pork Board
• UMN Rapid Response Fund