A Systematic Management Strategy for Breeding Herds Based on PRRS Herd Status

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Introduction

Over the last nearly 20 years the scientific community has identified numerous key management practices to limit the transmission of Porcine Reproductive and Respiratory Syndrome Virus (PRRSV) within herds. As producers and veterinarians have attempted to implement these practices in production systems they have been inconsistent with their success in achieving consistent implementation over long periods of time. One can speculate that some of the key reasons that implementation has been challenging is that most of the practices identified to limit the spread of PRRSV within herds have the potential to increase costs or reduce the number of pigs produced over the short term. These two constraints have created a situation where it is difficult for producers and veterinarians to understand what herds would benefit the most from the application of specific management practices and therefore achieve the optimal economic outcomes.

In early 2011 Holtkamp et al[1] proposed a standardized scheme to identify herds based on infection and transmission status of PRRSV within the herd to facilitate communication between producers and veterinarians and to aid the control of PRRSV transmission within herds and regions. This scheme, for the first time allowed for a standardized way to describe herd status across multiple production systems and veterinarians and represented a major breakthrough in applying standardized, science based methods to the control of PRRSV.

With the established status identification scheme it became apparent the next logical step in controlling PRRSV was the definition of which management practices would provide the greatest economic return in each of the four herd stages. This paper describes a standardized plan for application of management practices to limit the spread of PRRSV within the herd and based on the defined herd PRRSV status that has been established by Holtkamp et al[1].

Standardized Management Strategy Development

For any management strategy to be successful it must be consistently implemented over time and across multiple herds. Implementation is defining the issue to be addressed within the context of the system, designing a process by developing a series of tasks in a logical order, teaching the process to the people that are doing each of the tasks necessary, monitoring the success and performance of the process and using monitoring data to correct errors by refining tasks or retraining people on the correct methods to conduct the tasks.

It was clear that to achieve implementation over time and across herds there needed to be a standard objective definition of herd status. The first step in defining the objective definition for herd status was to separate the results of testing into categories based on breeding herd (sow) and off spring (pig) status. Breeding herd status was defined in four categories Infected (PCR, VI test positive), Positive (Antibody positive, Antigen negative) Mixed Status (some Antibody Positive and some Antibody Negative) and Naïve (Antibody and Antigen negative). Pig status was defined as Positive (PCR, VI positive), Test Negative (minimum of 8 consecutive weeks of 95/5 PCR testing on pigs at weaning) and True Negative pigs born to sows that are Naïve. These definitions allowed for clear and accurate descriptions of herd status between all members of the health and production teams to facilitate discussion and understanding of when practices would be implemented.

Working from the assumption that the goal of the breeding herd was to produce pigs that were truly free from PRRSV infection at weaning a risk based approach was adopted where the herds with the highest risk of sow to pig transmission (Stage 1) had the most intensive management strategies applied and the herds with the lowest risk of sow to pig transmission (Stage 4) had the lest intensive strategies applied. The objective of the plan was to create a system that allowed for the most rapid stabilization of the breeding herd followed by different management practices when the herd had achieved its long term operational status. This model assumes that herds that are actively infected (stage 1) will be homogenized and closed to new breeding stock introductions but the manner in how that is accomplished is outside the scope of this process and does not influence the implementation of this process in any way. The pig and sow status for each of the six subgroups is summarized in Figure 1. This refinement to the published scheme allows management practices to be applied in a scientifically sound manner that reflected true herd status and for the most intensive practices to be applied where they create the greatest return for the system.

Once each of the categories was clearly defined a review of management practices that have been identified in the scientific literature for the control of PRRSV transmission within herds was conducted. These practices were then ranked as to their ability to limit sow to sow transmission of the virus, pig to pig transmission of the virus and their intensity. Intensity of a management practice was defined as the amount of labor required, the skill required to complete the process, additional costs associated with the process, and any reduction in short term output of the sow farm. It was assumed that the most intensive tasks were the least likely to be sustained over the long term. Priority was given to applying high intensity tasks to herd stages where they would have the most impact.

Management practices were separated into three groups depending on the primary area that the practice would be applied. This was done to simplify communication at the farm level. Once the key practices were identified they were summarized in a simple table that could be placed on the farm for constant reference to aid in implementation of practices over time. It was an attempt to borrow from football coaches who translate the play book onto a single page for game day so that everyone on the team has a simple list of the plays that they will use to win the game.

Standardized Management Strategy Description and Implementation

The standardized management strategy based on PRRSV herd infection status is outlined in table 1. The table is separated into 4 sections: Testing Strategy to Prove Status; Sow and Gilt Management Practices; Farrowing House Management Practices and Piglet Management Practices. Each practice is defined and either allowed or not allowed for each herd PRRS stage. Customization of the management practice descriptions by referencing specific sections of a specific production system's operating manual has been useful in improving implementation.

Testing strategies have been developed starting with95/5 testing (95% confidence of detecting a 5% prevalence) for all samples. The frequency of testing has been developed over time to minimize the risk of failure during the stabilization process. Testing begins with 2-5 day old pigs to establish the infection status of pigs at birth. This is important to determine the rate of in-utero infection of piglets. Once it is established that the rate of infection at birth is low, the weaned pig testing is started. The use of both newborn and weaned pig testing allows for a better understanding of transmission patterns (sow to pig prior to birth vs. piglet to piglet post birth) on the farm and therefore a better chance to direct management interventions in the right area if testing results are not what is expected. In addition, the establishment of firm testing timelines was a key step in setting expectations for management and farm teams. These timelines were established to minimize the risk of "positive" test results and the inevitable frustration that results from them. The testing schedule is communicated in a manner that emphasizes that we EXPECT positive results for testing prior to the schedule but we EXPECT negative results once we start to test. The establishment of a timeline and expectations may be the single most important part of implementing the overall scheme.

Sow and Gilt management strategies were designed to minimize the risk of sow to sow transmission of PRRSV. The most intensive practices were implemented in herds with the highest rates of viremic/shedding sows with rapid removal of those intensive practices as the rate of sow viremia/shedding was reduced. The practices utilized are stopping gilt Introductions (stages 1,2a); Use of PRRS Negative Semen/Boars (all), stopping Prebreeding and prefarrowing vaccines[2] (stage 1), changing needles between sows and gilts[2] (stages 1,2,3), stopping manure feedback prefarrow[3,4] (stages 1,2,3) and manure feedback prebreeding[3,4] (stage 1) and stopping tissue or serum feedback (mummies, placentas) to gilts[3,4] (stages 1,2,3).

Farrowing house management practices were defined as those that involved the physical use of the farrowing house. These practices were implemented as farrowing house management in many systems is not on strict All in-All out basis as productivity has increased and design capacities do not meet current sow flow or target weaning ages. There were all designed to limit litter to litter transmission of PRRSV in the farrowing house. The practices that are utilized are wash all crates with dry time between litters[5] (stages 1,2,3), do not allow part weaning of rooms[5] (stages 1,2a,2b); change needles and blades between litters when processing or treating pigs[2] (Stages 1,2,3), stop the use of use of warming tubs/ split suckle boxes at birth[3,4] (stage 1), and stop the use processing carts[3,4] (stage 1).

Piglet management practices were designed to stop pig to pig (or litter to litter) transmission of PRRS in the farrowing house. These practices were adapted from the original "McREBEL" processes[6] but were separated into specific practices for clarity and ease of implementation. The practices employed in this section are: stop movements of pigs between litters (stage1,2a) Limit movements between litters to less than 24 hours of age but only for number of pigs per litter (stages 2b, 2c, 3,4), allow use of one fall back litter (nurse sow) per 26 crates (stages 2b,2c, 3,4), allow pooling of small pigs at birth in one litter (stages 2c, 3, 4), hold pigs for 7 additional days at weaning for quality reasons (stage 4).

Piglet movement strategies were developed in the context of both the best veterinary science and the needs of the production team to optimize the number of quality pigs at weaning. At the time of farrowing, litters are balanced for numbers so that a sow has the same number of pigs as she has functional teats. For any litter, pigs should only be added or removed but not both (Sows are either donors or recipients of pigs but not both). The goal is to minimize the number of piglet movements at the time of farrowing. Piglets need to suckle their own dam's colostrum to optimize both the transfer of passive immunity and the development of their own immune system. We also know that throughout the sucking period there continues to be transfer of immunity from dam to offspring that is most effective between related animals. This means that the more pigs that are raised by their own dam the better. In addition, teat order is firmly established by 24 hours of age and movements after this time is likely to result in two pigs competing for the same gland and another gland drying up from lack of use. This will result in additional "fall back" pigs that would have to be placed on a nurse sow or will die prior to market. After litters are established (>24 hours of age) pigs can be moved to nurse litters (new litter) but at no time should pigs be replaced on litters that have had a dead pig or individual pigs swapped between litters.

To improve the survival of very small pigs intensive management is often employed. Small pig litters are litters that are made at 24 hours of age or less were all of the small pigs in the room are placed in one or more litters. Often these pigs are moved when wet. By definition these sows are both a donor and a recipient. This is higher risk than all other forms of movement and is only used when there is a high degree of confidence that the pigs are negative at birth.

Summary

The development of this management scheme was not intended to define new practices or procedures for sow farm PRRSV management. It was developed as a way to improve communication of what needed to be done to improve the chances of success in stabilizing and managing breeding herds. The scheme categorizes the key management interventions in a way that can be used by the farm team and creates a way to streamline communication within an between production systems to crate long term opportunities to understand what practices are of the greatest value and adaption of the scheme over time to improve outcomes.

References

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Figure 1: PRRS Herd Stage with Pig, Sow and Gilt Antibody and Antigen Test Status

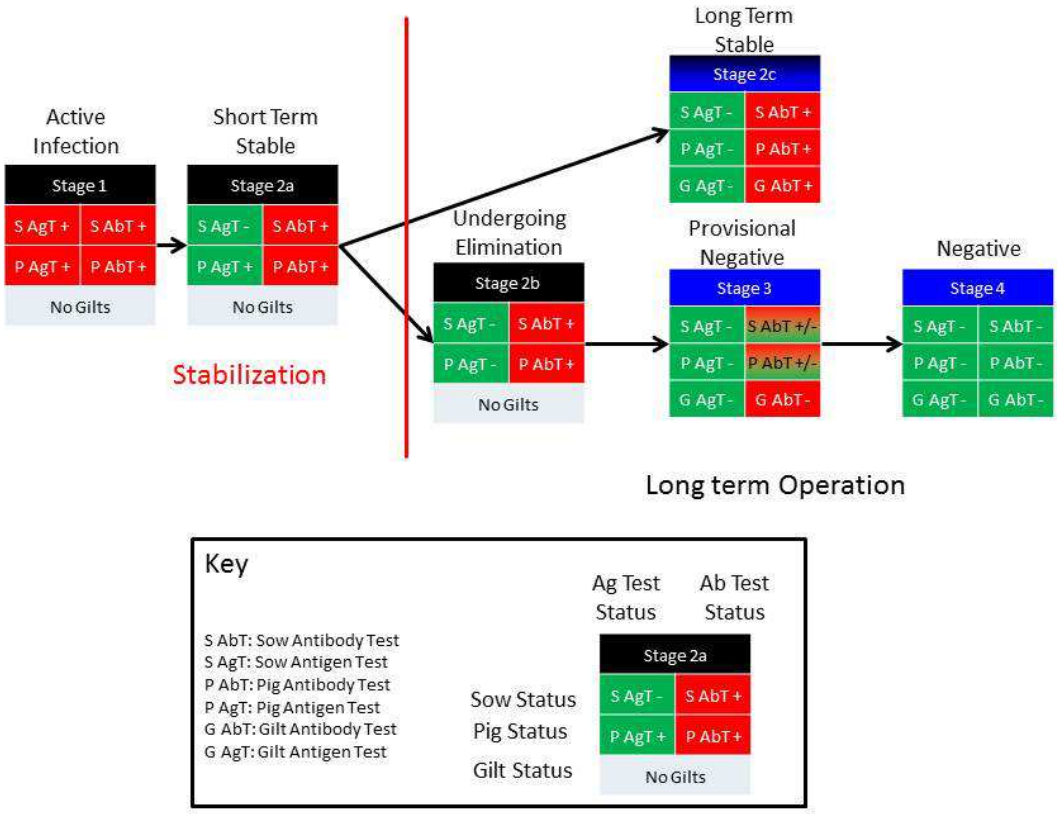

Table 1: Summary of Breeding Herd and Offspring Test Status in herds based on a modified Holtkamp et al Terminology for classifying swine herds by porcine reproductive and respiratory syndrome virus status.

Herd Status	Sub Status	Description	Breeding Herd Test Status		Offspring Test Status at Weaning	
			Virus Test	Antibody Test	Virus Test	Antibody Test
1	A	Active infection	Positive	Positive	Positive	Positive
	B	Approaching Stability	Negative	Positive	Positive	Positive
2	A	Short term stable	Negative	Positive	Negative	Positive
	B	Long Term Stable	Negative	Positive	Negative	Positive
3		Transitioning to Negative	Negative	Mixed	Negative	Mixed
4		Negative	Negative	Negative	Negative	Negative

Table 2: Management strategies for swine breeding herds based on PRRSV infection status

Herd PRRS Status[1]	I (positive unstable)	II (positive stable)			III (provisional negative)	IV (negative)
Status Description	**1: Unstable / Active Infection**	**2a: Short Term Stable**	**2b: Undergoing Elimination**	**2C: Long Term Stable**	**3: Transitioning to Negative - n**egative gilt replacements remain sero-negative for >= 2 months	**4: Negative -** no ELISA positive and previously infected sows have been removed
Testing to Prove Status[2]	Default State without diagnostics	60 pigs per sampling; 4 consecutive weeks of 4 day old pigs; PRRR PCR Pool 5	60 pigs per sample: 4 weeks of 4 day old pigs and pigs at weaning; PRRS PCR, Pool 5 (total of 8 consecutive weeks of negative testing)	60 pigs per sample: 4 weeks of 4 day old pigs and pigs at weaning; PRRS PCR, Pool 5 (total of 8 consecutive weeks of negative testing); Ongoing testing of 30 every other week or 60 every 4 weeks of weaned pigs; PCR, Pool 5	>= 30 gilts are PCR and ELISA negative at least 1 month post introduction and remain negative; ongoing monthly testing of 30 weaned pigs; PCR, Pool 5	60 head PCR and ELISA negative over 2 consecutive samplings at least 30 day apart
Earliest to initiate testing to confirm status after herd closure	n/a	>= 22 weeks post infection (inoculation) and pigs born dead <12% of TB	After 4 consecutive negative tests of >= 60 4 day old pigs	After 4 consecutive negative tests of >= 60 4 day old pigs	9 months	
	Sow and Gilt Management					
Gilt Introductions	No	No	Yes – Naïve	Yes – Prev. Infected	Yes – Naïve	Yes – Naïve
PRRS Negative Semen/Boars	Yes	Yes	Yes	Yes	Yes	Yes
Prebreeding vaccines	No	Yes	Yes	Yes	Yes	Yes
Prefarrowing vaccines	No	Yes	Yes	Yes	Yes	yes
Change needles between sows and gilts	Yes	Yes	Yes	Yes	Yes	No
Manure feedback prefarrow	No	No	No	No	No	Yes
Manure Feedback prebreeding	No	Yes	Yes	Yes	Yes	Yes
Tissue or serum feedback to gilts	No	No	No	No	No	Yes

Herd PRRS Status[1]	I (positive unstable)	II (positive stable)			III (provisional negative)	IV (negative)
Status Description	**1: Unstable / Active Infection**	**2a: Short Term Stable**	**2b: Undergoing Elimination**	**2C: Long Term Stable -** no shedding detected for >= 6 months	**3: Transitioning to Negative - n**egative gilt replacements remain sero-negative for >= 2 months	**4: Negative -** no ELISA positive and previously infected sows have been removed
	Farrowing House Management					
Wash all crates with dry time between litters	Yes	Yes	Yes	Yes	Yes	No
Allow part weaning of rooms	No	No	No	Yes	Yes	Yes
Change needles and blades between litters	Yes	Yes	Yes	Yes	Yes	No
Use of warming tubs/ split suckle boxes	No	Yes	Yes	Yes	Yes	Yes
Use Processing carts	No	Yes	Yes	Yes	Yes	Yes
	Piglet Movements					
Movements at less than 24 hours of age only for litter size[3]	No	No	Yes	Yes	Yes	Yes
Fall back litter (1 nurse sow per 26 crates)[4]	No	No	Yes	Yes	Yes	Yes
Pool small pigs in one litter[5]	No	No	No	Yes	Yes	Yes
Holding pigs at weaning for quality	No	No	No	No	No	Yes

1-Based on AASV working PRRS herd classifications, 2010

2- Individual herd PRRS testing plans will be implemented and reviewed for each herd. These are to serve as a guideline for testing plan development and interpretation.

3- At the time of farrowing, litters are balanced for numbers so that a sow has the same number of pigs as she has functional teats. For any litter, pigs should only be added or removed but not both (Sows are either donors or recipients of pigs but not both). The goal is to minimize the number of piglet movements at the time of farrowing. Piglets need to suckle their own dam's colostrum to optimize both the transfer of passive immunity and the development of their own immune system. We also know that throughout the sucking period there continues to be transfer of immunity from dam to offspring that is most effective between related animals. This means that the more pigs that are raised by their own dam the better. In addition, teat order is firmly established by 24 hours of age and movements after this time is likely to result in two pigs competing for the same gland and another gland drying up from lack of use. This will result in additional "fall back" pigs that would have to be placed on a nurse sow or will die prior to market.

4- After litters are established (>24 hours of age) pigs can be moved to nurse litters (new litter) but at no time should pigs be replaced on litters that have had a dead pig or individual pigs swapped between litters.

5-Small pig litters are litters that are made at 24 hours of age or less were all of the small pigs in the room are placed in one or more litters. Often these pigs are moved when wet. By definition these sows are both a donor and a recipient. This is higher risk than all other forms of movement.