ORIGINAL RESEARCH

Baysinger AK, Dewey CE, Straw BE et al. The effect of PRRSV on reproductive parameters in swine herds. *Swine Health and Production* 1997;5(5):173–176.

The effect of PRRSV on reproductive parameters in swine herds

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Summary

Objective: To compare 1994–1995 reproductive performance of herds free of porcine reproductive and respiratory syndrome virus (PRRSV) to those infected with PRRSV, and to compare those positive herds that reported clinical reproductive signs to positive herds that did not report clinical reproductive signs.

Methods: A total of 132 swine producers throughout the midwestern United States agreed to participate in this study by supplying a copy of their PigCHAMP® records and completing an eight-page questionnaire regarding management protocols. One year's data (August 1994–July 1995) were summarized for each herd and the yearly production means compared. Herds were categorized according to their PRRS status, as reported by the producers, and assigned to one of the following categories: PRRSV negative ("neg"), PRRSV negative and vaccinating for PRRSV ("neg-vac"), PRRSV positive without reproductive clinical signs ("pos-subclin"), or PRRSV positive with reproductive signs ("pos-clin").

Results: Overall, the reproductive performance of the pos-clin herds was significantly lower than that of neg herds. Pos-subclin herds had reproductive performance similar to pos-clin herds. Neg and neg-vac herds had similar reproductive performance.

Implications: Subclinical PRRS can be as detrimental to the reproductive performance of a herd as clinical PRRS. Vaccinating appears to keep performance at the same levels as are maintained in the negative herds.

Keywords: swine, PRRSV, subclinical, reproductive performance

Received: Jan 2, 1997
Accepted: Jun 10, 1997

It has now been 10 years since the initial reports of a disease syndrome causing reproductive losses and respiratory signs, since indentified as porcine reproductive and respiratory syndrome (PRRS), began to be published in the literature. Keffaber[1] was among the first to describe clinical signs in several herds of what we now recognize to be PRRS outbreaks. The acute outbreaks that characterized the clinical picture of this disease syndrome in the late 1980s and early 1990s have given way to the current widespread prevalence of the chronic form of the disease. In many cases, infection with the causative pathogen—PRRS virus (PRRSV)—is subclinical. As recently as 1996, estimates of the prevalence of PRRS in United States and Canadian swine herds ranged from 60%–80%.[2,3]

Although we have learned a great deal about the etiology, transmission, immunity, impact, and control of this disease,[4–7] we are left with a number of important questions regarding the syndrome, including:

- what is the impact of PRRS (clinical and subclinical) on reproductive parameters in herds?
- what is the impact of a vaccination program against PRRSV on reproductive parameters in herds?

We used PigCHAMP® records from 1 year (August 1994–July 1995) and data collected in a producer survey to investigate the impact of PRRS on reproductive performance in commercial swine herds.

Materials and methods

Data collection

A retrospective longitudinal study[8] was designed to collect a sample of midwestern swine herds. Swine producers who use PigCHAMP® records were identified by veterinarians and from a database collected at the University of Nebraska.[9] Of the 197 producers contacted, 132 (67%) agreed to participate in the study by supplying a copy of their PigCHAMP® data and completing an eight-page survey designed to elicit herd management information (available from authors upon request).

Herd categorization

Herds were included in the study if there were at least 1.5 years of data collected using PigCHAMP® database software. Data collected prior to when the herd began using PigCHAMP® was eliminated as described by Dewey, et al.[10]

A data set was generated using 12 monthly 'Performance Monitor' reports for the period August 1994–July 1995 in PigCHAMP® version 3.0.

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This article is available on the AASP Web site at:

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Each herd record included the following:

- farm identification number,
- weaning-1st service interval,
- percent sows bred by 7 days,
- average parity,
- average gestation length,
- farrowing interval,
- farrowing rate,
- average total pigs per litter,
- average pigs born alive/litter,
- total stillborn pigs,
- total mummified pigs born,
- pigs weaned per sow farrowed,
- pre-weaning mortality,
- litters/mated female/year,
- average age at weaning,
- replacement rate,
- culling rate,
- death rate, and
- ave non-productive sow days.

Herds were classified according to their PRRSV status, based on data supplied in the producer questionnaire (Table 1), into one of the four following categories:

Table 1

Classification scheme for PRRSV status among herds

PRRSV classification	n	Reproductive signs seen on farm*	How PRRSV status was determined†
pos-clin	40	Observable reproductive outbreak	Clinical signs or by laboratory tests
pos-subclin	30	Never a dramatic drop in reproductive performance noted by the producer	Growing pigs had respiratory clinical signs and used lab test
			No clinical signs but tested for own interest
neg	35	No decrease in reproductive performance	Never tested, never saw signs; therefore, assume they are negative
			No clinical signs but tested to determine status
neg-vac	8	Never any drop in reproductive performance-never had a diagnosis of PRRS, but decided to vaccinate	Never tested, no clinical signs, assume they are negative for field virus.

* Producer-defined clinical observations from survey
† Producer information from survey

- PRRSV negative ("neg"),
- PRRSV negative and vaccinating against PRRSV ("neg-vac"),
- PRRSV positive with reproductive clinical signs ("pos-clin"), or
- PRRSV positive with no reproductive clinical signs ("pos-subclin").

One year's data were summarized for each herd from the 12 monthly reports, and yearly production data were compared among PRRSV categories. Only data on herds that had at least 1 year of post-outbreak data prior to the beginning of the study period were included. Nineteen herds were excluded for this reasonm leaving a total of 113 herds that participated in the study. This allowed us to compare pos-clin herds to herds of all other PRRSV statuses without temporal confounders.

Statistical analysis

After herds were categorized, reproductive performance variables were analyzed to determine significant differences ($P < .05$) among the herds according to their PRRSV status, based on yearly means. ANOVA was used for the initial analysis to compare among multiple variables; then, a Student's t-test was used to determine which of the four groups was driving the significant result. Simple statistical associations of all reproductive parameters were investigated among all four status designations using Student's t-tests for continuous variables.[11]

Results

The majority of herds included in this study (70 of 113) were positive for PRRSV (Figure 1). Eighty-one percent of the pos-subclin herds and 84% of pos-clin herds were vaccinating the breeding herd against PRRSV.

The pos-clin herds had significantly higher mean stillborns and average nonproductive sow days compared to all other herds ($P < .05$).

The pos-clin and pos-subclin herds had significantly decreased performance ($P < .05$) when compared to either neg herds or neg-vac herds for several important reproductive parameters(Figure 1):

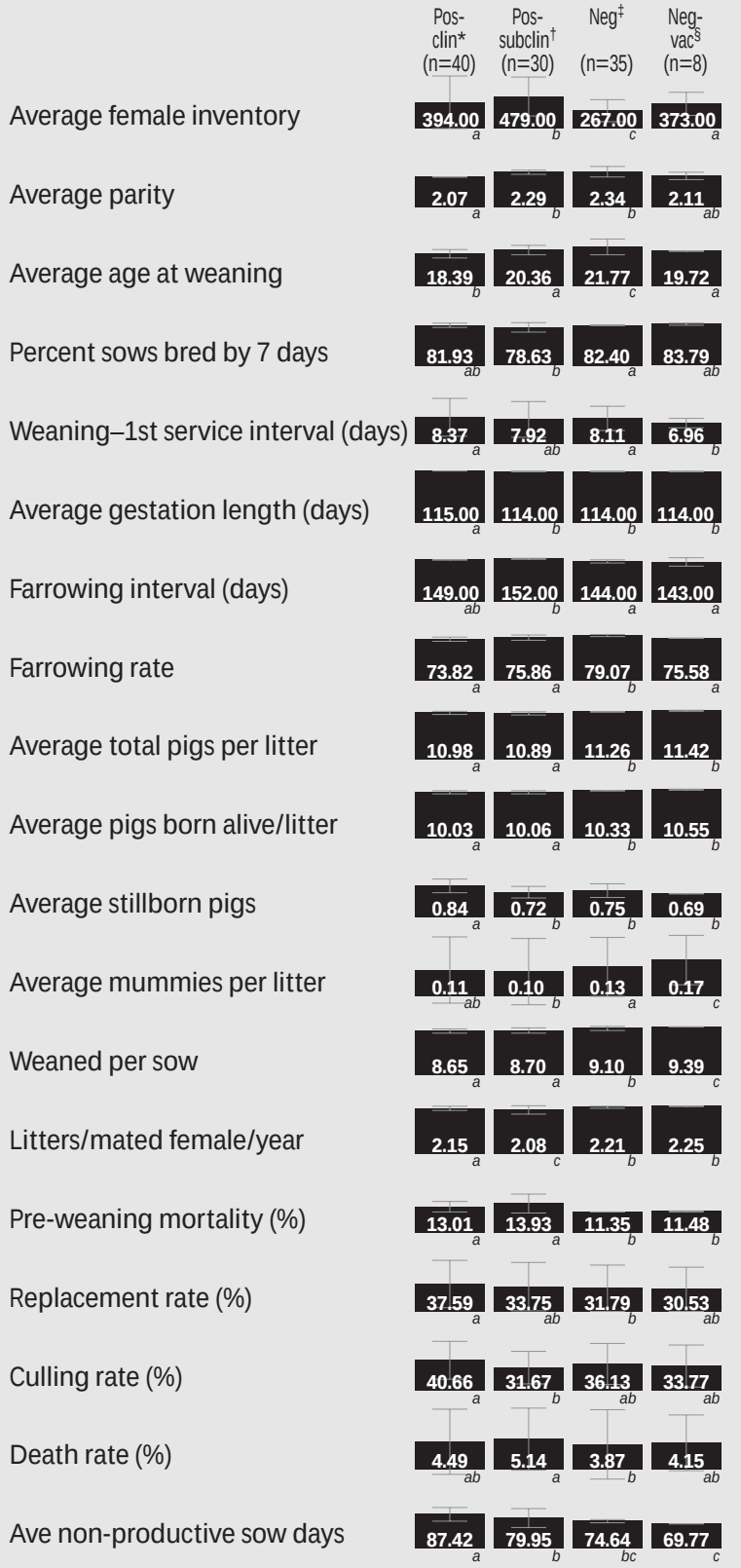
- fewer mean total pigs born,
- fewer mean live pigs born,
- fewer mean weaned per sow,
- fewer litters per mated female per year, and
- increased preweaning mortality.

Several parameters, however, were not statistically associated ($P \geq .05$) with PRRSV status:

- mean number of breeding females that were bred by 7 days,
- weaning-to-first-service interval,
- farrowing rate,
- mean number of stillborns and mummified fetuses,
- breeding female mortality rate, and
- mean nonproductive breeding female days.

Among the PRRSV-positive herds, gestation length was 1 day longer in pos-clin herds compared to pos-subclin herds ($P < .05$), and mean numbers of stillborns were significantly higher in pos-clin herds compared to pos-subclin herds ($P < .05$) (Figure 1). However, pos-clin herds had significantly more litters per mated female per year than did pos-subclin herds ($P < .05$), as well as a significantly higher cull rate and significantly more nonproductive sow days ($P < .05$).

Figure 1



Mean (± SD) reproductive performance by PRRSV status during study year (August 1994–July 1995)

abc Data with different subscripts differ significantly ($P<.05$).
* Herds positive for PRRSV with producer reporting clinical reproductive signs
† Herds positive for PRRSV with producer reporting no clinical reproductive signs
‡ Herds negative for PRRSV
§ Herds negative for PRRSV and routinely vaccinating against PRRSV

The neg-vac herds showed a significantly ($P < .05$) shorter weaning-to-first-service interval and increased number weaned per sow when compared to neg herds ($P < .05$) (Figure 1). However the herds with a neg-vac status had a higher mean number of mummified fetuses than the neg herds ($P < .05$), and farrowing rate was higher in neg herds than in neg-vac herds ($P < .05$).

Discussion

Herds in this study were assigned a PRRSV status designation based on the information obtained by the producer survey. Diagnostic testing was not made a prerequisite for inclusion of data in this study; thus, some of the herds classified as "negative" in this study could actually be positive. False negatives, however, would bias the PRRSV-negative data toward the performance of the PRRSV-positive herds. The statistical differences we observed between herds designated as PRRSV-positive (pos-clin or pos-subclin) and those designated as PRRSV-negative (neg or neg-vac) supports the probability that most of the herds designated as negative were, indeed, free of wild-type PRRSV.

Other field studies have reported recurrent episodes of reproductive failure due to PRRSV in isolated herds,[12] but the present study documents reduced performance across a number of PRRSV-positive herds. Although gestation length, mean numbers of stillborns, mean litters per mated female per year, cull rate, and nonproductive sow days differed between pos-clin and pos-subclin herds, many of the reproductive parameters measured in this study did not differ between the pos-clin and pos-subclin herds. There have been documented reports of endemically infected breeding herds that are clinically normal.[2] Alternatively, dynamic serological profiles within PRRSV-positive herds have been observed,[13–15] suggesting that the immune status of these herds may have been in the process of changing.

The increased prevalence of mummified fetuses born per litter observed in the neg-vac herd may be due to vaccination of sows during gestation. Both available vaccines include modified-live virus, and because PRRSV infection during gestation affects reproductive

performance,[16–18] the vaccination of pregnant swine has been demonstrated to be detrimental. Veterinarians throughout the swine industry have recently begun to question the safety of vaccinating all sows in breeding herds with a modified-live vaccine for control of PRRSV infections.[19,20] Dee, et al., have hypothesized that vaccinating breeding stock (an extra-label use of the product) might eliminate naive subpopulations and prevent shedding of the virus from sow to piglet.[15] There were not enough positive herds that were not vaccinating to provide adequate statistical power to compare reproductive parameters between vaccinating and nonvaccinating herds nor between positive vaccinating and negative vaccinating herds. The producers of the neg-vac herds may have been vaccinating as a preventive measure against field exposure. Limited heterologous protection may exist for cross-protection between strains in pregnant swine.[21]

Caution should be exercised when generalizing the results of this study to the swine industry at large. The herds included in this study were not selected at random. Veterinarians who provided the producer names were members of the AASP. The dataset was comprised of PigCHAMP® users who were willing to share their production data and to complete the survey. Thus, these results should be interpreted and generalized only to herds owned by cooperative, record-conscious producers. However, the productivity of the herds included in this study was similar to that of other midwestern herds; the reproductive performance we observed in the neg herds was within normal reported ranges.[22] The replacement and culling rates were also within suggested ranges for progressive swine herds.[22]

Implications

- Reproductive performance decreased in PRRSV-positive herds where the producer was unaware of problems.
- Careful record analysis may be required before stating that PRRSV has had no negative reproductive impact on a herd.
- Vaccinating PRRSV-negative herds did not appear to cause identifiable reductions in reproductive performance in this study; the impact of a vaccination protocol for breeding swine will vary according to conditions prevailing in a given herd.

Acknowledgments

The authors thank Barb Cox for technical assistance and dedication to the initial data collection. The authors also thank all of the veterinarians, producers, and PigCHAMP® bureaus throughout the Midwest that took the time and effort to assist in this study. The efforts of Delora Hahn, Kim Christian, Renee Fitzke, and Debbie George deserve much praise and appreciation.

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