



discoveries

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- **Vaccination is one of the key approaches to control of porcine reproductive and respiratory syndrome (PRRS).**
- **To be effective, a PRRS vaccine does not have to be from the same lineage group as circulating PRRS virus strains.**
- **A recent study demonstrates that Foster[®] PRRS, a lineage 8 vaccine, is just as effective as a lineage 1 vaccine in pigs challenged with a lineage 1 field strain of the PRRS virus.**

Foster[®] PRRS protects against diverse PRRS virus field strains

Porcine reproductive and respiratory syndrome (PRRS) has been described as one of the most important swine diseases of the last half-century.¹ One report estimates the syndrome costs producers US \$45.20 per weaned pig.² Annual PRRS productivity losses are reportedly \$580 million. An estimated 20% to 25% of herds are still affected, and the syndrome remains the US swine industry's most costly disease.³

Vaccination is one of the key approaches to PRRS control. Although the widely used modified-live vaccines (MLVs) may not provide sterilizing immunity — immunity that prevents infection — they can reduce clinical signs and improve performance.⁴

There are several effective PRRS vaccines available, says Eva Jablonski, DVM, senior technical services veterinarian, Zoetis. She cautions, however, that it's a misconception to assume a PRRS vaccine has to be from the same lineage group as circulating field strains to be effective.

"The PRRS virus is genetically diverse, and it has a relatively high rate of mutation and recombination.⁵ That's why it's important to select a vaccine that cross-protects against different strains of the PRRS virus,"⁶ says Jablonski, formerly a regional veterinarian for a major North American pork producer.

Recent challenge study

As evidence, Jablonski cites a recent study comparing the effectiveness of a lineage 8 and a lineage 1 PRRS vaccine (2018) against PRRS 1-7-4, a lineage 1 strain that first emerged in North Carolina, reportedly causing up to 50% mortality in growers.⁷

In the study, pigs were vaccinated at 2 weeks of age with Foster[®] PRRS, the lineage 8 MLV, or a lineage 1 PRRS MLV vaccine.⁸ Pigs were challenged 4 weeks later with the 1-7-4 strain, says Kimberly Vonnahme, PhD, associate director of outcomes research, Zoetis, and project leader for the study.

Pigs in both vaccine groups had fewer lung lesions and higher average daily gain (Figure 1) compared to unvaccinated, challenged controls. However, pigs in the lineage 8 vaccine group (Foster PRRS) had less viremia than pigs that received the lineage 1 vaccine, and at times, the difference was significant (Figure 2), she says, noting that viremia reflects the severity and advancement of PRRS virus infection.⁹

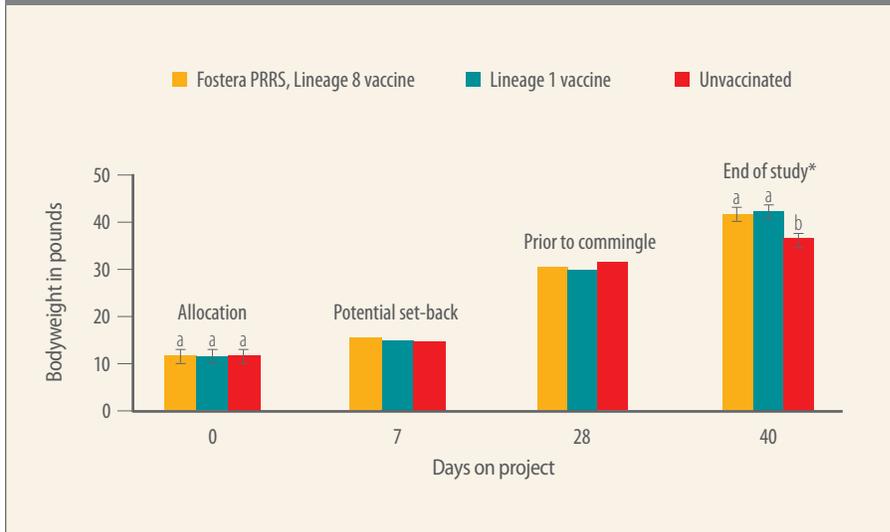
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EVA JABLONSKI, DVM
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“We’ve known for over a decade that a PRRS vaccine does not have to be homologous to wild strains to be effective...”

Figure 1. Means for weight throughout the study



Notes: Arithmetic means are presented for 7 and 28 as treatments were not yet commingled.

*These data were statistically analyzed: ^abLSMeans ≠ SEM within a day with different superscripts differ. $P \leq 0.005$

“Foster PRRS was just as effective against a lineage 1 PRRS virus challenge as the lineage 1 vaccine,” says Vonnahme, formerly a professor at North Dakota State University.

In contrast to other PRRS vaccines, Foster PRRS is produced with a unique attenuation method that utilizes a recombinant pig kidney-cell line.¹⁰ The vaccine virus is able to replicate well when administered. Most other PRRS vaccines are attenuated using a monkey kidney-cell line, and it can take several generations of viral replication to adapt and grow on pig macrophages, which are the primary cells that PRRS viruses infect, she says.^{11,12}

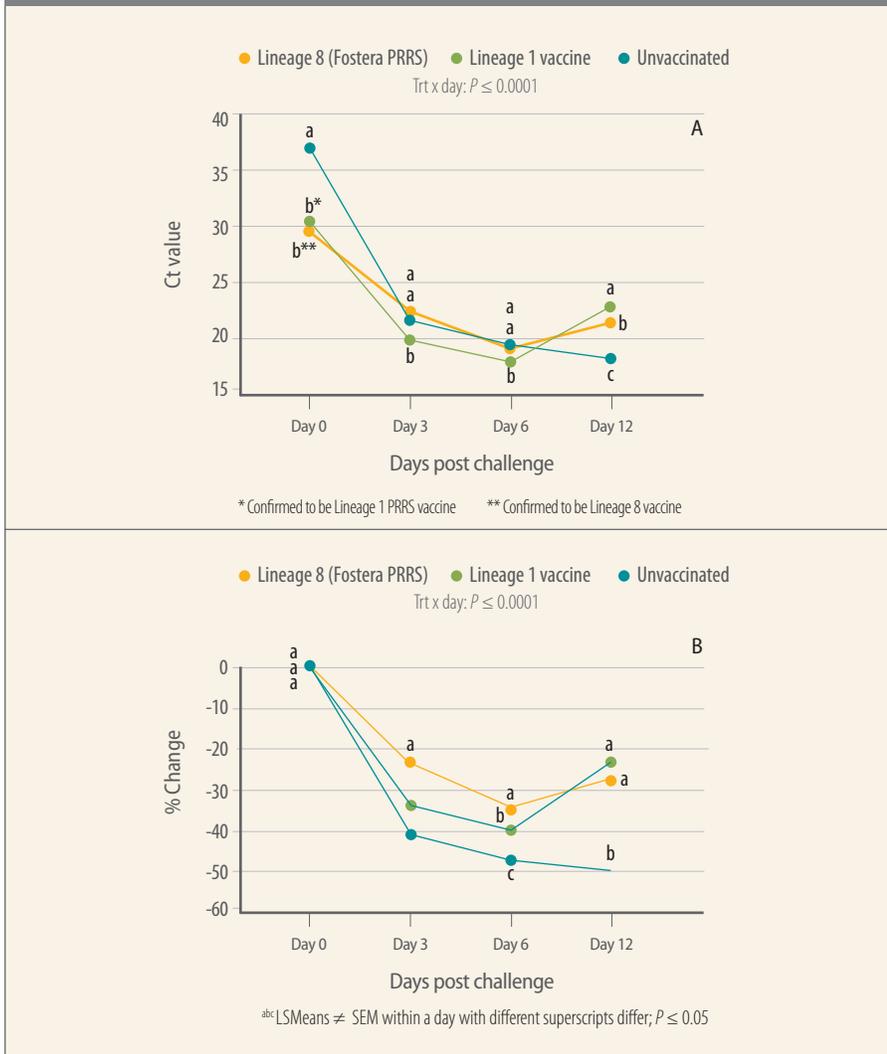
Different but effective

Jablonski explains that the PRRS virus is classified into 9 lineages. A PRRS vaccine that’s based on the same lineage group as a PRRS wild strain is said to be homologous, or similar, to the circulating strain. When the lineage of a PRRS vaccine and wild strain differ, the vaccine is said to be heterologous to the circulating strain.

“We’ve known for over a decade that a PRRS vaccine does not have to be homologous to wild strains to be effective and that homology is no guarantee that a vaccine will be effective against a circulating PRRS strain,” she says.

The veterinarian points to a 2005 study conducted at Iowa State University. Pigs were immunized with a MLV for PRRS, then challenged with PRRS virus isolates that were only

Figure 2. Viremia expressed as the average cycle threshold (Ct) value in serum (Panel A) or as a percentage change from day 0 (Panel B). Lower Ct values indicate greater viremia.



“Fostera PRRS was just as effective against a lineage 1 PRRS virus challenge as the lineage 1 vaccine.”

KIMBERLY VONNAHME, PhD
ZOETIS

from 76% to 89% similar to the vaccine strain — a similarity the researchers describe as “quite different.”¹³

The vaccine was highly effective in reducing the severity of PRRS virus associated disease and lesions. In fact, the greatest reduction in lung lesions occurred in pigs vaccinated with strains that had less similarity, or less homology, with the vaccine strain.¹³

“The degree of genetic homology between MLV PRRS virus vaccine and the infecting strain is not a good predictor of vaccine efficacy,”¹³ the investigators concluded.

continued



¹ Iowa State University. Porcine reproductive and respiratory syndrome (PRRS).

² Valdes-Donoso P, et al. Production losses from an endemic animal disease: porcine reproductive and respiratory syndrome (PRRS) in selected Midwest US sow farms. *Front Vet Sci.* 2018;5:102.

³ Pork Checkoff Report. Annual PRRS Costs Fall \$83.3 million. 2017 Summer;38-39.

⁴ Vansickle J. How to manage PRRS-negative pigs. *National Hog Farmer.* 2011 June 16.

⁵ Brar MS, et al. Genomic evolution of porcine reproductive and respiratory syndrome virus (PRRSV) isolates revealed by deep sequencing. *PLoS One.* 2014;9(4):e88807.

⁶ Murtaugh M, et al. Immunological solutions for treatment and prevention of porcine reproductive and respiratory syndrome (PRRS). *Vaccine* 2011;29: 8192-8204.

⁷ USDA/Pork Checkoff. PRRS RFLP 1-7-4 Summary. 2015 April 24.

⁸ Data on file. Study No. 19PRGBIO-01-04. Zoetis, LLC.

⁹ Islam ZU, et al. Quantitative analysis of porcine reproductive and respiratory syndrome (PRRS) viremia profiles from experimental infection: a statistical modelling approach. *PLoS One.* 2013 Dec 17;8(12):e83567.

¹⁰ Calvert J, et al. Attenuation of a virulent North American porcine reproductive and respiratory syndrome (PRRS) virus isolate on CD163-expressing cell lines, and demonstration of efficacy against a heterologous challenge. 2012 Am Assoc Swine Vet annual meeting.

¹¹ Renukaradhya GJ, et al. Live porcine reproductive and respiratory syndrome virus vaccines: Current status and future direction. *Vaccine.* 2015;33:4069-4080.

¹² Calvert JG, et al. CD163 expression confers susceptibility to porcine reproductive and respiratory syndrome viruses. *J Virol.* 2007;81(14):7371-7379.

¹³ Opriessnig T, et al. Genomic homology of ORF 5 gene sequence between modified live vaccine virus and porcine reproductive and respiratory syndrome virus challenge isolates is not predictive of vaccine efficacy. *J Swine Health Prod* 13(5):246-253.

¹⁴ Prieto C, et al. Similarity of European porcine reproductive and respiratory syndrome virus strains to vaccine strain is not necessarily predictive of the degree of protective immunity conferred. *Vet J.* 2008;175:356-363.

¹⁵ Angulo J, et al. Efficacy of a PRRSV MLV vaccine against a genetically diverse range of PRRSV isolates. 2015 Allen D. Leman Swine Conference.

¹⁶ Aljets K, et al. Field evaluation of vaccination of piglets at processing using Fostera PRRS. 2017 Am Assoc Swine Vet annual meeting.

¹⁷ O'Brien B, et al. Safety, efficacy, and duration of immunity of a PRRSV MLV vaccine in 1 day-of-age pigs. 2014 Am Assoc Swine Vet annual meeting.

Close but ineffective

There are similar reports from other countries. Researchers in Spain vaccinated pigs with a European-type PRRS MLV, then challenged them with the wild-type, virulent Spanish PRRS isolate 5710. Unlike the study at Iowa State, the vaccine and wild strain were closely related. Compared to unvaccinated, challenged controls, immunized pigs still showed moderate clinical signs and were viremic at least once. In addition, PRRS virus was found in at least one tissue sample from the majority of vaccinated pigs.¹⁴

“These findings strongly suggest that the degree of genetic homology...between the MLV-PRRS vaccine used in this study and the challenge isolate was not a good predictor of vaccine efficacy,” the researchers reported.¹⁴

Fostera PRRS has been shown to provide significant protection against a highly diverse range of PRRS virus isolates. Besides lineage 1 isolates, strains used in challenge studies have included lineage 8/9 and lineage 9 isolates as well as isolates from abroad,¹⁵ Jablonski says.

Field experience

More importantly, the efficacy of the vaccine has been demonstrated in the field, in a commercial setting. “That’s important because results from challenge studies conducted in a research setting don’t always pan out in the real world. I want to see the results substantiated in a commercial environment,” she continues.

As one example, Jablonski referred to a study where Fostera PRRS was used on a commercial farm in the Midwest with 2,800 sows that sent weaned pigs to 10 nursery sites. The herd initially tested positive for wild-type PRRS virus 1-26-2, then later contracted PRRS 1-7-4, both lineage 1 strains. Pigs were vaccinated at 3 to 5 days of age, immediately after sows were vaccinated.

A 16-month analysis demonstrated a 4% greater reduction in nursery mortality in the Fostera PRRS group compared to unvaccinated controls — a statistically significant difference.¹⁶ The positive results prompted the client to request pigs continue to receive Fostera PRRS, Jablonski reports.

Challenge studies in the field also provide a good way to evaluate a vaccine’s safety, which has been established for Fostera PRRS under field conditions in young pigs,¹⁷ she says.

“In the end, it’s all about pig performance — that’s what affects a producer’s return on investment,” she says. “Challenge studies are still the gold standard for determining a vaccine’s value.”

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