



discoveries

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- **Swine disease specialists speculated that a PCV2 vaccine containing two genotypes — PCV2a and PCV2b — would significantly improve the coverage provided against PCV2 viruses, including the prevalent PCV2d genotype.**
- **An analysis that predicts immune responses indicates Fosterera® Gold PCV MH, the only commercial PCV2 vaccine with the 2a and 2b genotypes, will provide the broadest coverage available against PCV2 viruses.**

Epitope-comparison study illustrates broad coverage of Fosterera® Gold PCV MH against PCV2 viruses

Immunologists at Zoetis were confident that a porcine circovirus type 2 (PCV2) vaccine with two circulating genotypes — PCV2a and 2b — would provide the broadest range of coverage against evolving PCV2 viruses in US swine herds, including cross protection against the leading 2d genotype.

How much more coverage was purely speculative, however. To see if they were on the right track, they collaborated with EpiVax, an informatics and immunology biotechnology company, that develops computational immunology tools.

An epitope is part of an antigen that is recognized by the immune system, specifically by immune cells — including lymphocytes known as T cells. T cells are essential for killing infected host cells (including PCV2-infected cells) and for the development of an effective antibody response. Using a process called EpiCC to analyze T-cell epitopes, EpiVax and Zoetis scientists could predict immune response and plot the coverage of different vaccines against PCV2a, 2b and 2d, the most prevalent genotypes affecting US herds, as well as genotypes 2c, 2e and 2f, which are rare or absent in the US.

Evolving field strains

“Through this computer model, we determined that putting PCV2a and PCV2b in one vaccine could provide considerably more coverage against the evolving field strains of the virus than traditional PCV2 vaccines with only one genotype,” explained Meggan Bandrick, DVM, PhD, senior manager, Global Biologics Research, Zoetis.¹

“With this technology, we could predict what the pig’s immune system would identify and how that might influence vaccine performance against various strains of the virus.”

continued



“The broader coverage of Foster Gold PCV MH is important — not just for swine herds today, but also as the PCV2 virus continues to evolve.”

MEGGAN BANDRICK, DVM, PHD
ZOETIS

To make this work, Zoetis obtained sequences for 161 field strains of PCV2 from GenBank, a voluntary repository of global sequences, and provided them to EpiVax for the analysis.

The strains were selected to broadly represent the different PCV2 types found globally. “We looked at 161 strains because there’s a lot of diversity in PCV2 and it continues to evolve,” Bandrick added.

Predicting responses

EpiVax used the EpiCC computational method to predict how swine T cells recognize and bind T-cell epitopes — in this case, about 800,000 different ones — and develop an immune response to either a pathogen or vaccine antigen.

“EpiCC takes the antigen-binding regions of swine T cells, predicted from the swine-genome sequence, and compares that to the same predicted binding regions or complementary regions on vaccine strains and on field strains,” Bandrick explained.

“Based on this, we can determine how the vaccine is going to convey information to the pig’s immune system so that the vaccine confers protection not only to the vaccine strain but also to field strains.”

Radar plot

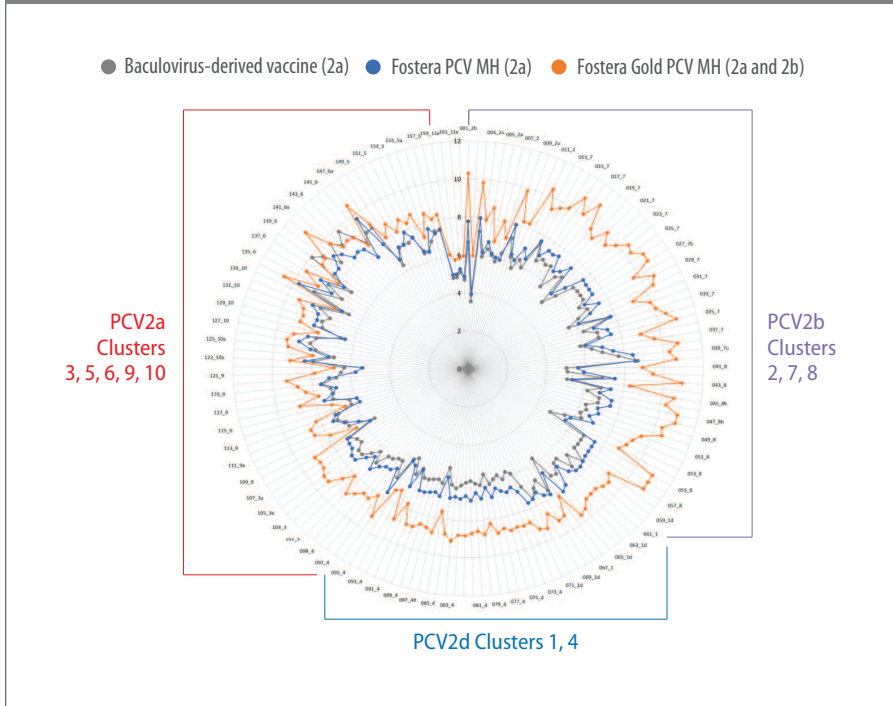
PCV2 vaccine antigens or antigen combinations from three commercial vaccines were used in the analysis: Foster Gold PCV MH (PCV2a plus PCV2b); Foster Gold PCV MH (PCV2a only); and a vaccine made with a baculovirus-derived PCV2a antigen. All are used in combination with *Mycoplasma hyopneumoniae*.

A radar plot (Figure 1) shows the results. The field strains are grouped together by genotype and identified on the perimeter. Each of the 161 PCV2 field strains in the analysis is represented by a single line running from the perimeter to the center. The three jagged starburst patterns inside the radar plot represent each vaccine’s T-cell epitopes compared to that specific field strain in the analysis.

“Note that the amount of T-cell epitope overlap indicating immune coverage increases going from the center of the circle to the perimeter,” Bandrick said, pointing to the chart. “The bigger the circle, the greater the coverage of the vaccine.”

The orange line representing Foster Gold PCV MH covers a considerably broader range than either the gray (baculovirus-derived PCV2a) or the blue (Foster Gold PCV MH) lines, she added.

Figure 1. Coverage of three PCV2 vaccines against 161 field strains



“Targeting the b-d clusters with a PCV2b vaccine makes sense and is supported by the EpiCC analysis.”

DENNIS L. FOSS, DVM, PHD
ZOETIS

“In the vast majority of the cases, we found a significant improvement in coverage from having both PCV2a and PCV2b in the vaccine compared to just having 2a,” reported Dennis L. Foss, DVM, PhD, research director, Zoetis. “The 2b and 2d viruses are more closely related to each other than to the 2a viruses. Targeting the b-d clusters with a PCV2b vaccine makes sense and is supported by the EpiCC analysis.”

The scientists cautioned that the vaccine coverage shown in a computer model predicts rather than proves protection. That would have to be demonstrated by conducting multiple studies challenging pigs with different strains.

“Nonetheless, we would expect a strong correlation between pig response to these field-circulating strains and the coverage of the vaccine used,” Bandrick added. “The broader coverage of Fostera Gold PCV MH is important — not just for swine herds today, but also as the PCV2 virus continues to evolve.”

For more information on the study, contact Dr. Bandrick (meggan.bandrick@zoetis.com) or Dr. Foss (dennis.l.foss@zoetis.com).

¹ Data on file, Study Report Zoetis W01, EpiCC PCV2 Analysis, Zoetis LLC.



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