



discoveries

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- Shifts in the genotypes of PCV2 circulating in swine herds have led to a genetic gap between field viruses and commercial PCV2a vaccines.
- Scientific evidence indicates a PCV2 vaccine with more than one genotype is needed due to the rapid evolution and continued emergence of new strains.
- Foster[®] Gold PCV MH, the first and only PCV2 vaccine with two genotypes, offers broader protection against PCV2 viruses affecting US herds.

Evolution of PCV2 virus, need for broader coverage spurred development of Foster[®] Gold PCV MH

Compelling scientific evidence indicating the need for an updated porcine circovirus type 2 (PCV2) vaccine was the driving force behind the development of Foster[®] Gold PCV MH, a new vaccine from Zoetis, according to Meggan Bandrick, DVM, PhD.

PCV2 viruses evolve rapidly and a genetic gap has developed between commercial PCV2 vaccines and field viruses,¹ indicating the need for an updated PCV2 vaccine, explained Bandrick, senior manager, Global Biologics Research, Zoetis.

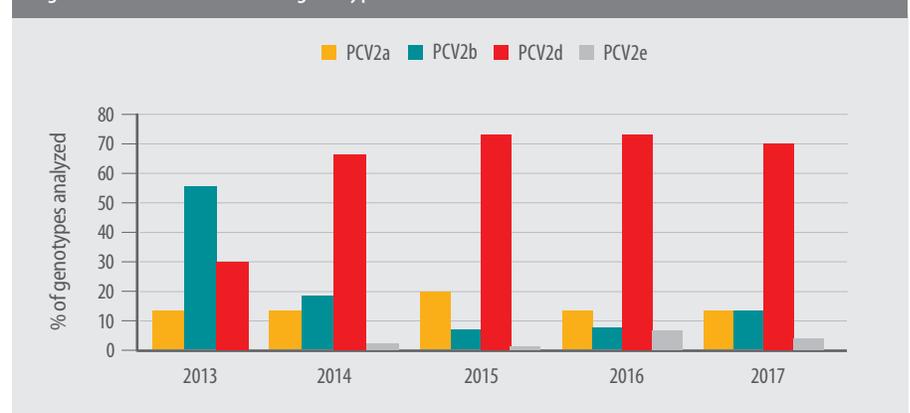
Shifts in the genotypes of PCV2 circulating among swine herds are a global phenomenon.² PCV2a, 2b and 2d are seen worldwide. In the US, 2017 genetic-sequencing data from Iowa State University's Veterinary Diagnostic Laboratory (Figure 1)³ show that:

- PCV2d was the most prevalent, accounting for 70% of genotypes sequenced. In 2013, its prevalence was only 30%.
- The 2b genotype is on the rise and accounted for 13.08% of genotypes sequenced — more than twice as many as the 5.98% seen in 2015, yet down from 56.18% in 2013.
- The prevalence of PCV2a was 13.08% and has changed less. For the most part, 2a has remained in the 13% range over the past 5 years.

But PCV2 incidence figures don't tell the whole story, Bandrick cautioned.

continued

Figure 1. Prevalence of PCV2 genotypes in US swine herds





“Infection with more than one genotype also allows the 2a and 2b genotypes to recombine, and then we’ve got a new PCV2 virus.”

MEGGAN BANDRICK, DVM, PHD

¹ Franco G, et al. Porcine circovirus type 2 (PCV2) evolution before and after the vaccination introduction: A large scale epidemiological study. *Sci Rep*. 2016;6:39458.

² Ibid.

³ PCV2: What pig farmers should know about this evolving virus. *National Hog Farmer*, May 16, 2018.

⁴ Ibid.

⁵ Franco G, et al. Porcine circovirus type 2 (PCV2) evolution.

⁶ Bao F, et al. Retrospective study of porcine circovirus type 2 infection reveals a novel genotype PCV2f. *Transbound Emerg Dis*. 2017;1-9.

⁷ Beach, NM, et al. Novel chimeric porcine circovirus (PCV) with the capsid gene of the emerging PCV2b subtype cloned in the genomic backbone of the non-pathogenic PCV1 is attenuated in vivo and induces protective and cross-protective immunity against PCV2b and PCV2a subtypes in pigs. *Vaccine*. 2010;29:221-232.

⁸ Lekcharoensuk P, et al. Epitope mapping of the major capsid protein of type 2 porcine circovirus (PCV2) by using chimeric PCV1 and PCV2. *J Virol*. 2004 Aug;78(15):8135-8145.

⁹ Data on file, Study Report No. 16PRGBIO-01-01, Zoetis LLC.

¹⁰ Data on file, Study Report Zoetis W01, EpiCC PCV2 Analysis, Zoetis LLC.

For more information on *Fostera Gold PCV MH*, contact meggan.bandrick@zoetis.com or your Zoetis representative.

“PCV2 gets more complicated. Herds are often infected with more than one PCV2 genotype. They can have 2a with 2b, for example, and oftentimes these mixed infections that lead to PCV2 associated disease are more severe and persistent. Infection with more than one genotype also allows the 2a and 2b genotypes to recombine, and then we’ve got a new PCV2 virus.”⁴

Selective pressure

Another important contributor to PCV2 evolution is selection pressure from vaccination. Most commercial PCV2 vaccines contain only 2a, and while they have helped decrease the prevalence of this genotype, they’ve helped give rise to an increase in 2b and 2d, further contributing to the genetic gap between most current PCV2 vaccines and circulating field viruses, the immunologist said.⁵

“You can have very good protection from existing commercial vaccines, but PCV2 viruses can change so rapidly that some of them escape the pig’s immune response to vaccination. Those are the viruses we need to protect against,” Bandrick added.

Rationale behind 2b

The new vaccine from Zoetis, *Fostera Gold PCV MH*, contains PCV2b in addition to 2a for several reasons. Virus sequencing demonstrates there are two main clusters of PCV2. One is the PCV2a group and the other is the 2b/d group — and there are multiple strains within each genotype, she said.

PCV2b and 2d are more closely related than 2a and 2d. Based on genetic sequencing and phylogenetics — the evolutionary history of PCV2 — 2a and 2b are from 88.9% to 94.4% identical while 2b and 2d are from 93.2% to 96.2% identical.⁶

PCV2b provides coverage against 2a,⁷ but it also has unique immune-cell epitopes (targets) apart from 2a. Epitopes, Bandrick continued, are specific sites recognized by antibodies and T cells.

“There’s some epitope overlap with 2a and 2b, but there are also distinct differences. PCV2b and 2d share more similar epitopes than 2a and 2d.⁸ This is why the inclusion of 2b in a PCV2 vaccine should help broaden coverage to not only 2b but to 2d,” she said.

‘Ahead of the curve’

Fostera Gold PCV MH protects against 2a and 2b. In a large field trial, it was efficacious against the 2d genotype.⁹ Evidence the vaccine should provide even broader coverage also comes from an epitope analysis made possible with EpiCC, a sophisticated computer model used to predict immune response and plot the coverage of different PCV2 vaccines against 161 PCV2 field strains.¹⁰

EpiCC predicted that a vaccine with both PCV2a and PCV2b would provide more antigenic coverage against evolving field strains, Bandrick said.

“*Fostera Gold PCV MH* is a response to the growing drift of field viruses away from currently available vaccines. By increasing the antigenic coverage of a PCV2 vaccine, pork producers should have more security against field viruses that escape PCV2a vaccine coverage.

“A vaccine with two genotypes that broadens herd immunity against further evolutionary changes should, in short, help us to stay ahead of the curve,” she said.