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Production and Performance

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AMINO ACIDS
VITAMINS
MINERALS
ENZYMES
ACIDIFIERS
ESSENTIAL OILS

Whether industry is willing and able to make the adjustment remains to be seen. Clearly, it will require farms to be more efficient, but if the dairy industry is any indication, sexed sperm is a technology that pork producers should milk for all its worth.

Part three: Editing the genome for PRRSV resistance – where can we go from here?

As visitors go, Porcine Reproductive and Respiratory Syndrome Virus (PRRSV) is akin to a mother-in-law at a stag party: unwelcome and potentially fatal. With vaccines largely ineffective, losses from the disease continue to mount. In exploring alternative countermeasures, Dr. Randall Prather with the Division of Animal Science at the University of Missouri described the use of a simple genetic editing technology to delete a protein from the pig that is responsible for infection. These gene edited pigs are completely resistant to challenges from PRRSV and represent one example of a genetic change that has a profound effect on the health and wellbeing of pigs.

Fortunately, vaccines provide control for many swine pathogens. Unfortunately, it has been more difficult to develop an effective vaccine for PRRSV, resulting in costs to producers of over \$660 million in North America and over €1.5 billion in Europe. And the financial damage is only part of the picture. There is also a price to be paid in terms of animal welfare, sustainability, food security and psychological and emotional costs. The starting point for a genetic editing approach to PRRSV prevention was a belief by some that the virus gained entry into, and infected, the white blood cells in the lungs. Two can-

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didate molecules on the surface of the white blood cell were implicated: sialoadhesin and CD163.

To test which molecule is really important for infection, it was necessary to remove the sialoadhesin or CD163, or both sialoadhesin and CD163, and then determine if the animals could still become infected. Researchers began by testing sialoadhesin. By using some rather complicated genetic engineering technology, they were able to delete the DNA sequence that prompts the production of sialoadhesin. Removing these sequences resulted in "knocking out" the gene and in making pigs that didn't produce the protein.

PRRSV Resistance

Unfortunately, the animals that did not make sialoadhesin still contracted PRRSV, but experiments with CD163 clearly identified it as a gatekeeper for infection. Moreover, the pigs with CD163 removed appeared to grow at usual rates, reproduce normally and be no more susceptible to other infections than regular pigs.

Since these CD163 edited pigs have been raised and maintained in a research setting, it remains to be seen if they perform well in a production environment. Additionally, the same or similar edits need to be introduced into pigs with elite genetics to determine if there is any effect on production characteristics.

Other Genetic Editing Opportunities

Editing CD163 to knock it out is just one example of what might be done. Other possibilities include replacing individual amino acids in a protein, replacing domains and adding transgenes. These approaches could support introducing resistance to other diseases, addressing other animal welfare issues, improving productivity and altering the carcass composition.

Genetic engineering, whether it's gene editing or transgenesis, offers an incredible opportunity to address basic questions of biology. In addition to producing a pig that is

resistant to PRRSV infection, a better understanding of the mechanisms of biology in the case of how a virus infects the cell by using CD163 may also lead to better treatments to prevent PRRSV infection.

The types of genetic engineering available are limited only by biology and our imagination. Applications that benefit production agriculture by improving animal welfare, boosting productivity and creating safer, healthier food will continue to be developed. Now if we can just find a gene to keep your mother-in-law in check, our work will be done. ■

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