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Escherichia coli trial

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Introduction

Over the last few years, post-weaning diarrhea caused by different enteropathogenic strains of *E. coli* has progressively become an important disease for the swine industry around the world. Many risk factors have been identified and linked to the condition, such as ration composition, genetics, number of pigs per pen, etc., but the correction or modification of any of those factors has given inconsistent results. Antibiotics have been widely used for prevention or for treatment but has lead most often to the development of resistance. In addition, the public awareness and concerns about the use of antibiotics in farm animals as well as the potential consequences of this practice on the resistance of the human bacterial strains over time is becoming increasingly important.

E. coli outbreaks

The disease took place in a multisite production system of 30,000 sows located in the province of Quebec. The age of pigs at weaning varied between 16-22 days, with an average of eighteen days. At the end of the 1990s, within four years, we experienced three episodes of post-weaning *E. coli* diarrhea (PWECD), where all pyramids of production were affected regardless of genetics or type of facilities.

The first episode took place in 1995, and piglets were affected three to four days after weaning. Morbidity was high, but mortality was low. The isolated strain was an *E. coli* F4 Sta Stb Lt. We were able to control the situation by the addition of zinc oxide at 2.5 kg per ton.

The second episode occurred in 1997, and the piglets from all pyramids were affected on day 17 after weaning, i.e., the third day after they were switched from phase two to phase three feed. Grossly, the differences between phase two and phase three feeds included the following:

- A 2% reduction of protein (from 22% to 20%)
- A 10% reduction of lacto serum content (from 25% to 15%)
- A complete removal of plasma
- A10% increase in soya (from 15% to 25%)

Again the morbidity was high and the mortality was low, but there was an increase in the number of runts, and the pigs weighed on average 1 kg less at the end of the nursery. An *E. coli* F4 Sta Stb strain was isolated, as in the first episode. We took a few months to realize that a change in the feeding program could be the solution, given no changes to the feeding program or management were made prior to the second episode. The solution chosen was to completely remove phase three feed (8 kg per pig), and to provide phase two feed for a longer period of time. This operation solved the problem completely, and the symptoms disappeared.

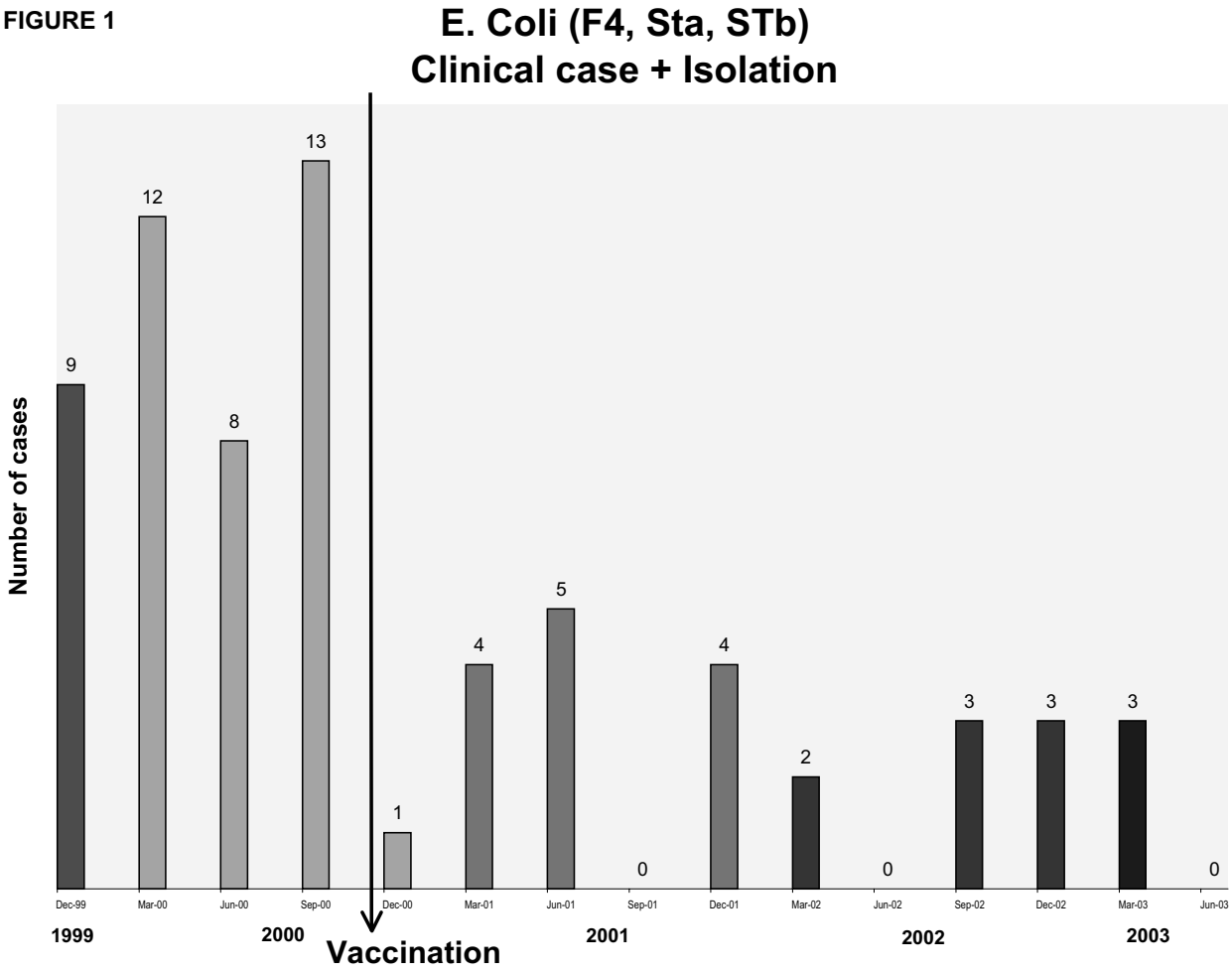
The third episode happened at the end of 1999, and this time the clinical symptoms appeared later, 4 to 7 days after the transfer to the finisher floors. These pigs were, on average, 55 to 60 days old. There were no feed changes, as they were receiving the same ration prior to and after their move in the finisher unit. The same *E. coli* F4 was isolated. Again all the pyramids were suddenly affected. While morbidity was lower, mortality was higher—sometimes up to 1% per day. In order to solve the problem, many different products and procedures were tried, including antibiotics, FOS, probiotics, and a change in protein source, etc. The only efficacious measure was to use mash instead of pelleted feed during the first three weeks following the transfer to the finishing unit. But performances were affected, and the feeding systems were not designed to handle this form of feed.

E. coli vaccination

The situation was becoming critical, and we had no choice but to consider the vaccination option. In collaboration with Dr. John Fairbrother and Montreal University, we selected a strain isolated from our facilities, which was F4-positive but Sta Stb Lt-negative. It is also important to mention that the endotoxin of the vaccine strain 08060 (cell wall) was different from the pathogenic strains (0147 or 0149). This cell wall has not been associated with any enterotoxin and is poorly endotoxic.

First we made a few controlled field trials under Federal Surveillance. Rapidly, the vaccination was spread to all pyramids of production. The efficacy was immediate and spectacular as illustrated in **Figure 1**.

FIGURE 1



Administration

The piglets were vaccinated three times: at weaning, at one week post-weaning, and four weeks post-weaning. Each time they received a solution containing 10^7 bacteria in the drinking water within a period of two to three hours. The repeated administration was done in order to make sure that each pig received the right dose at least once. We recommend avoiding any antibiotic in the water or in the feed for 24 hours prior to and 48 hours after the administration. This same recommendation applies to chlorine.

Quality control

We made two batches of vaccine per week (30,000 doses). Each batch was made fresh, using an *E. coli* strain provided by the Veterinary College Laboratory. We never used the final product to restart a new production. Every batch was controlled for purity and concentration by the Veterinary College Lab. If it did not meet the standards, it was destroyed.

Experiences

Over the years, we learned a number of important practice principles:

- Sterilize the broth before starting bacterial growth in order to help identify where the contamination, if present, takes place.
- Keep vaccination solution cool until the time of administration in order to avoid the growth of undesirable bacteria and to maintain the appropriate count.
- Avoid chlorine.
- Make sure your customers understand their own drinking water administration devices.
- Limit the transportation time or risk losing the pilis.

Safety

- The vaccine strain comes from the production system where it is used; we do not introduce new material.

- The cell wall of the strain used has not been related to enterotoxins, Sta, Stb, or any other.
- The cell wall of the strain used has not been identified to endotoxic shock.
- The F4 are species-specific.
- We always start with a new lyophilized strain.

Conclusion

For this production system, in this situation, the *E. coli* vaccine was very effective. It controlled the disease, reduced the antibiotic use, and allowed the control of feed cost. The safety level was considered acceptable, given the precautions which were taken.

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References

Fairbrother, J. M., Higgins, R., Desautel, C. 2000. Trends in pathotypes and antimicrobial resistance of Escherichia coli isolates from piglets with post weaning diarrhea in Quebec. In : *Proceedings 16th Int. pig Vet. Soc Congress,* Melbourne Australia, p. 17.

Madec, F., Josse, J., 1983. Influence of environmental factors on the onset of digestive disorders of the weaned piglet. *Ann. Rech. Vet.* 14, 456-462.

Ravel A. D'Allaire, S., Bigras-Poulin, M., Martineau, G.P., 1991. Évaluation de l'applicabilité au Québec d'un modèle écopathologique des troubles digestifs après le sevrage en élevage porcin. *Méd. Vét. Québec.* 21, 107-111.

Cardinal, F., D'Allaire, S., Fairbrother, J. M., Personal communication. Risk factors associated with post weaning *Escherichia coli* diarrhoea in early-weaned piglets.