Managing the gut microbiota to optimise productivity

A dramatic increase in antibiotic resistance worldwide has led to a ban in their use as growth promoters in many countries. This situation led to a higher risk of an overgrowth of pathogenic microflora in the intestine, associated with diarrhoea symptoms, leading to a strong reduction of growth and feed intake.

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Consequently, variations in performance between groups on farm can be altered. In this context, a specific and patented Copper Exchanged Clay (CeC) was developed as such an alternative and aims to modulate the microbiota to improve swine performance.

Intenssive breeding generates critical periods

Intensive breeding generates critical periods where the gut microflora is modified and this leads to a higher risk of an overgrowth of pathogenic bacteria in the gut, especially during the post-weaning period.

At this stage, the piglets have several challenges for successful weaning:

- **Adaptation to feed intake:**
One of the main targets for the farmer is to ensure that the piglets eat properly after weaning. The longer they go without eating at weaning, the higher the risk of diarrhoea.

- **Adaptation to feed distribution:**
From milk suckled at the sow to a solid feed.

- **Feed composition changes:**
From milk containing lactose to a prestarter feed containing mainly plant-based raw-materials (with new nutrients, such as starch for example).

- **Adaptation to a new environment:**
From farrowing crate to post-weaning pen, with possible variation of the microflora present in the environment.

All these changes require an adaptation of the digestive microflora. It will lead to a higher digestive risk via a gut microbiota imbalance involving diarrhoea and a loss of performance. Colibacillosis infection is one of the most frequent in piglets and is caused by an over multiplication of Escherichia coli in the gut.

Diarrhoeic E. coli can be split into several categories based on their virulence properties. Strains O141K85, O138 and O139 belong to the E. coli category of 'Attaching and Effacing' (AEEC) and more specifically to the group producing Verotoxin (VTEC).

Those toxins involve lesions of endothelium vessels, modify vascular permeability, leading to post-weaning diarrhoea and development of oedema.

E. coli strains O157K88 and K99 belong to the group of Enterotoxigenic E. coli (ETEC). This bacterial strain involves severe neonatal and post-weaning diarrhoea.

CeC mode of action

To support piglets' microbiota and growth during the challenging weaning period but also to ensure a well-balanced and secure microflora during the whole life of the animals, a unique and patented Copper Exchanged Clay has been developed by Wisium.

This solution is a combination of copper ions at a very low level and a synthetic zeolite having antimicrobial properties and able to specifically target pathogenic bacteria and have a limited action against beneficial bacteria.

Several in vitro trials results are available and highlight the benefits of CeC over different strains of bacteria found on farms involving infection, clinical consequences, such as diarrhoea, mortality and leading to economic loss. CeC is efficient on pathogenic bacteria independently if they are Gram negative (Escherichia coli) or Gram positive (Clostridium perfringens, Streptococcus suis).

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Fig. 1. Inhibition curves with the application of CeC.

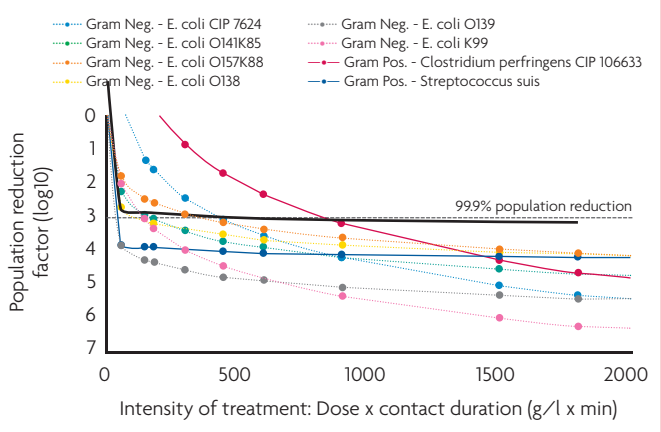

Fig. 2. Synthesis of 35 trials with CeC supplemented feed.

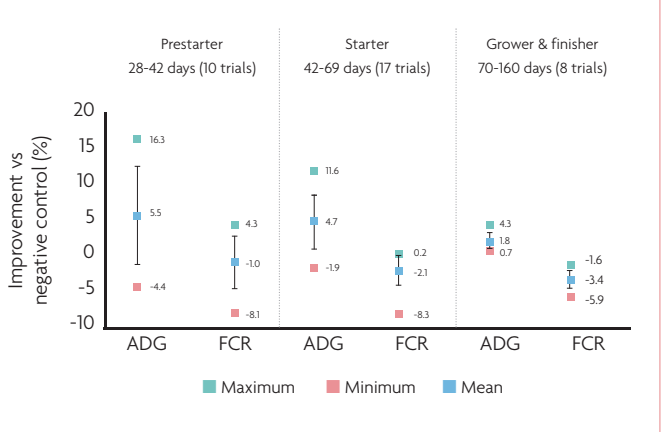

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Fig. 1. demonstrates the efficiency of CeC on several Escherichia coli strains (O141K85, O157K88, O138, O139 and K99) responsible for diarrhoea in swine farms and resistant to antibiotics.

The two E. coli strains O141K85 and O157K88 come from the national strains bank and strains O138, O139 and K99 are isolated from the farm. Clostridium perfringens and Streptococcus suis were also tested.

With CeC, bacteria population was decreased from 4 log10 to 6.2 log10. It is commonly considered that 1 log reduction is equivalent to a reduction of 90% of the bacterial population, 4 log corresponds to 99.99% of reduction, and 5 log to 99.999%.

Consequently, CeC is able to reduce the microbial population of all the strains tested and responsible for swine diseases.

This selective modulation of the gut microflora thanks to Cec has also been proved through a published in vivo trial.

Optimisation of productivity

The link between the necessity to have a well-balanced microbiota and productivity is not new but more and more recent scientific information highlights the strong role that microbiota can also play on other physiological roles.

CeC is backed up by scientific evidence: A synthesis of 35 trial results is presented in Fig. 2. The first part of the synthesis compares control pre-starter and starter diets with CeC supplemented feed. The trials were performed in R&D conditions and in farm conditions.

- In an average of 10 trials run during the prestarter period (28-42 days), the weight gain increased by +5.5% and the feed conversion ratio (FCR) decreased by -1.0%. The results in the prestarter period are more heterogeneous than in the starter period due to the difficulty for some animals to eat.

- Then in the starter period, in a synthesis of 17 trials run between 42-69 days, CeC was able to increase the weight gain by +4.7% and reduce the FCR by -2.1%.

CeC, by acting as a microflora modulator in the gut, helps piglets to face the challenging post-weaning period and consequently, to improve their performance.

CeC is not only efficient for piglets after weaning but good results have been obtained during the whole breeding period: in growers and finishers.

In an average of eight trials run between 70-160 days, CeC was able to improve average daily gain by +1.8% and contributed actively to the improvement of the feed efficiency by a reduction of the feed conversion ratio by -3.4%.

Consequently, CeC is an efficient solution in swine production to improve performance thanks to better control of the microbiota.

CeC: an efficient solution

The in vitro inhibition trials on several pathogenic strains commonly found on swine farms and especially E. coli strains showed that CeC is able to inhibit both the Gram-negative and Gram-positive bacteria strains tested.

Based on these in vitro trials, CeC can be considered an efficient solution to help in reducing the main pathological bacterial population in the gut.

Obviously, in vitro trials alone are not sufficient to validate the efficiency of a feed additive. That is why the synthesis of the results confirmed those in vitro results and the importance of modulating the microbiota to ensure gut health and performance.

By helping to ensure a well-balanced gut microflora on swine from the most critical period – weaning – to the finisher phase, CeC involves a regular and reliable improvement of performance, specifically for the average daily gain and feed conversion ratio. ■