Antibiotic stewardship: a key for sustainable pig production

Antibiotic treatments often lead to therapeutic failure, making bacterial infections difficult to combat in humans and animals. The pig industry is no exception. With increasing restrictions on the use of antibiotics for farm animals in the EU, alternative preventive solutions support reduced antibiotic use.

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New EU regulations give a boost to antibiotic stewardship

The pig industry has always faced many challenges, from disease outbreaks or zoonotic diseases to economic challenges. In 2006, when the EU banned antimicrobial growth promoters, producers and veterinarians were very concerned about maintaining performance and health.

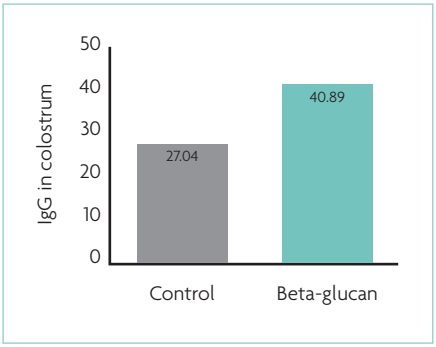
However, performance in Europe kept improving despite this ban thanks to interventions in management, genetic improvement, and health interventions including vaccines, prebiotics, probiotics and organic acids.

The pig industry has had to be adaptable and able to respond quickly to legislative changes in husbandry and management, including the ban on antibiotics, the ban on gestation crates, changes to castration, and the upcoming removal of zinc oxide and copper from the diets of weaning pigs.

This year has been no exception, with regulation EU 2019/6 coming into effect to further limit the use of antibiotics to control the spread of infection (metaphylaxis) or prevent infection (prophylaxis).

This law is designed to boost antibiotic stewardship, which is considered instrumental to ensure global human health, food security and sustainable development today.

Fig. 1. Effect of beta-glucan on the IgG content in colostrum (mg/ml).



Enteric challenges drive antibiotic use in pig production

The use of antibiotics varies from country to country and even from region to region. Up until a few years ago, reviews noted that, for instance, in Belgium 93% of total antibiotics were administered for prophylaxis, whereas metaphylaxis or treatments were much smaller at 7% of total antibiotic usage.

It was also found that antibiotics were commonly used during the suckling and post-weaning period, and that gastrointestinal infections were the most common reason for using antibiotics.

One of the frequent problems in suckling pigs that inevitably leads to the use of antibiotics is neonatal diarrhoea, often associated with Clostridia.

Clostridia are Gram-positive, spore forming bacteria – some oxygen tolerant, others obligately anaerobic – that are found in soil, water and in the intestinal contents of various mammals, birds and reptiles, which can cause disease in people and animals.

Enteric Clostridium perfringens is classified according to the toxins produced by the different strains, with disease being generally mediated by the production of these toxins.

The convention has been that C. perfringens type A produces α-toxin (cpa) and C. perfringens type C produces α-toxin (cpa) and β-toxin (cpb).

C. perfringens types A and C, as well as Clostridium difficile, are the main Clostridial species associated with disease in swine.

The major toxin produced by C. perfringens type A is α-toxin (cpa), but most C. perfringens type A strains from disease cases produce β-toxin (cpb).

Several studies have noted that the diagnosis of neonatal scours due to Clostridium species had become increasingly common.

Other important causes of antibiotic use in pig production are the enteric challenges associated with post-weaning diarrhoea.

Sustainable alternatives to antibiotic prophylaxis

Probiotics are a potential alternative to metaphylactic and prophylactic antimicrobial use. CLOSTAT is a patented probiotic that consists of spores of Bacillus sp. PB6 (ATCC PTA-6737), originally selected from the intestinal microflora of animals that resisted an enteritis outbreak in their flock.

In vitro studies have demonstrated the efficacy of a Bacillus sp. PB6 against pathogenic bacteria infecting pigs (for example C. perfringens, C. septicum, C. sordelli). Efficacy in vitro and in vivo of Bacillus sp. PB6 against Clostridium difficile has also been demonstrated, as well as the usefulness of this probiotic strain throughout post-weaning challenges.

As in vitro results do not always translate to the same results when tried in vivo, a trial was conducted to investigate the replacement of colistin with Bacillus sp. PB6 from weaning at four weeks of age to 11 weeks of age.

Landrace x Yorkshire x Duroc piglets were weaned and moved to nursery pens at four weeks of age with 120 pigs allocated to a control group (i.e. three pens of 40 pigs/pen with equal numbers of barrows and gilts/pen) and another 120 pigs to a treatment group (i.e. three pens of 40 pigs/pen with equal numbers of barrows and gilts/pen).

The feed offered to the control pigs contained 180ppm of colistin, 300ppm of amoxicillin, and 150ppm of tiamulin from five days of age through to weaning at four weeks, and also from weaning to nine weeks of age. From 9-11 weeks of age, the control feed contained 180ppm colistin and 40ppm florfenicol.

The treatment diet was the same as the control diet, except it did not contain colistin at any stage, but contained Bacillus sp. PB6 from weaning through to 11 weeks. Body weight, daily weight gain, feed conversion ratio, and pig deaths were recorded through to 11 weeks of age (Table 1). There were six deaths in the trial ascribed to complications from a live PRRS vaccine administered three days after weaning.

The removal of colistin and its replacement with Bacillus sp. PB6 in the treatment group did not result in decreased growth rate or feed conversion efficiency, but instead the 11 week body weight was significantly higher for the Bacillus sp. PB6 treatment group with pigs being 1.6kg heavier on average ($P<0.05$).

Furthermore, abrupt changes usually take place in piglet management and nutrition around the weaning period, leading to profound physiological changes. As these changes can be associated with issues of multifactorial origin, no single solution will guarantee the production of high quality animals. In this regard, piglet health and likelihood of antibiotic use also correlate with sow and young animal immunity.

Immune support and modulation

Aleta is a unique source of Beta-(1,3)-Glucans derived from an algae (Euglena gracilis), which is used for immune support and modulation to improve general health of the animals.

To assess its effect on the quality of colostrum, a study was carried out during the last third of pregnancy of sows in a commercial farm.

The sows' diet was supplemented with 200g algal beta-glucan (Aleta) per tonne of feed and led to a significant increase in the IgG content in sow colostrum resulting in mean levels of 40.89mg/mL 18 hours postpartum, an increase of more than 50% in IgG levels versus control.

This trial is an indication that the oral supplementation of Aleta can positively affect IgG content in the colostrum, and thus increased IgG intake by piglets.

Increased colostrum IgG intake in piglets has been linked to better immune status at weaning and to improved whole life health and performance.

Conclusion

Antibiotic stewardship is a must to support the global fight against antimicrobial resistance and to safeguard both human and animal health.

CLOSTAT (Bacillus sp. PB6, ATCC PTA-6737) and Aleta (algal Beta-(1,3)-Glucan) are preventive health solutions that reduce antibiotic use in pig production. ■

Table 1. Pig performance from weaning (four weeks) to 11 weeks of age. [a,b]means with different letters in rows differ significantly ($P<0.05$).

Measurement	Control (antibiotic regime)	Treatment (colistin replaced by Bacillus sp. PB6)
4-week average weaning weight (kg/piglet)	6.2	6.2
11-week average weight (kg/piglet)	33.4[a]	35.0[b]
Average daily weight gain (g/piglet)	486	514
Feed conversion ratio	1.530	1.507