Issue 35 • Poultry
A magazine of Biomin®

Science & Solutions

AGP Replacement Tools: Ready for Action

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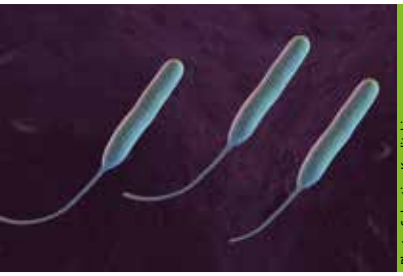

Photo: Sebastian Kaulitzki

Combining Tools to Counter *Campylobacter*

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What's Wrong with My Birds?

Part 8: Lameness Conditions (Nutrition)

Editorial

Change Is in the Air

As consumer and regulatory opinions have evolved over the last several years, poultry producers are looking to reduce or eliminate their usage of antibiotics while still reaching performance goals and managing bacterial populations. While dozens of countries have already banned the use of antibiotic growth promoters (AGPs), many places where their use is not illegal have seen a surge in demand for antibiotic-free or antibiotic-reduced products.

In this issue of **Science & Solutions**, Dr. Richard Markus and Franz Waxenecker look at the issue of AGP replacement and identify tools to help overcome challenges related to their removal such as impaired performance and intestinal health.

In the last few decades, *Campylobacter* has emerged as one of the most common causes of bacterial gastroenteritis in humans globally. Furthermore, *Campylobacter* spp. also have the potential to cause intestinal distress and significant reductions in feed efficiency in poultry. In the second article, Andrew Robertson delves into the issue of *Camplyobacter* contamination and addresses management and nutritional strategies to reduce colonization of this bacterium in poultry in order to help reduce the incidence of human infections.

Lastly, in the "What's Wrong with My Birds" section, we discuss nutritional factors which can contribute to increased incidence of lameness in poultry and offer solutions to help mitigate the consequences of these conditions.

We hope this issue provides you with valuable and timely information to help you overcome everyday issues and challenges you face in the field.

Enjoy!

Chasity PENDER
Poultry Technical Manager

Contents

Science & Solutions is a monthly publication of BIOMIN Holding GmbH, distributed free-of-charge to our customers and partners. Each issue of **Science & Solutions** presents topics on the most current scientific insights in animal nutrition and health with a focus on one species (aquaculture, poultry, swine or ruminant) per issue.
ISSN: 2309-5954

For a digital copy and details, visit: http://magazine.biomin.net
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AGP Replacement Tools Are Ready For Action

By **Richard Markus**, Assistant of Development Director & Global Technical Sales Coordinator, and **Franz Waxenecker**, Director of the Development Department

Results of over two dozen trials show that novel growth promoters can deliver real value to modern poultry production

Photo: donskarpo


GOOD
MAXIMUM

Organic acids, phytogenic feed additives, probiotics and prebiotics have all been identified as potential in-feed antibiotic replacements.

More intensive industrial production has placed greater demands on birds and given rise to several challenges related to gut health, including unspecific dysbiosis problems, reduced nutrient digestibility and impaired barrier function. These issues put pressure on farm profitability and explain, at least in part, the motivations for sub-therapeutic application of antibiotics for disease prevention and growth promotion.

A recent scientific study notes that the poultry industry's global consumption of antibiotic growth promoters (AGPs) is three times higher than that of cattle: 45 mg/kg vs 148 mg/kg (Van Boeckel *et. al.* 2015). Without indicating any relationship between resistance level and antibiotic usage, Teillant and Laxminarayan (2015) point out that recommended dosage of sub-therapeutic antibiotics has increased over last 60 years, from 10–20 g/ton in the early 1950s to 40–50 g/ton in the 1970s, to 30–110 g/ton nowadays.

New ways to promote growth

The experiences in countries that were early to adopt AGP bans, such as Sweden in 1986 and Denmark in 1998, demonstrate that while a move to antibiotic-free production is not without short-term challenges, these can be overcome and flock performance can reach even higher levels. Replacing AGPs relies upon a holistic approach to improve animal health status and performance through better management, biosecurity measures, vaccination programs, diagnostics and feeding strategy.

In general, novel growth promoters (NGPs) should perform roughly equally as well under practical conditions in order to gain acceptance.

Since feed costs account for a significant part (up to 70%) of total production costs, feeding strategy is a crucial point. Organic acids, phytogenic feed additives (botanicals, or PFAs), probiotics (direct-fed microbials, or DFMs) and prebiotics have all been identified as potential in-feed antibiotic replacements. They work in different ways (various modes of action) in order to prevent the proliferation of harmful bacteria, to promote health and immune status, and to enhance animal performance, e.g. by influencing a bird's anti-inflammatory response.

Comparable or better results

Significant effort has been paid to identifying which additives will be able to reduce usage of AGPs. In general, novel growth promoters (NGPs) should perform roughly equally as well under practical conditions in order to gain acceptance.

Looking across 25 broiler trials performed in various countries worldwide and testing both AGPs and NGPs (phytogenics, organic acid-based products or microbials) at a variety of production stages, each NGP group performed similar on average in terms of FCR and ADG compared to the AGP group (*Figures 1 and 2*).

The feed conversion ratio (FCR) showed an average improvement of 0.05 in the phytogenic supplemented group versus the AGP (control) group in 14 trials. This may be due to the fact that phytogenic feed additives (PFAs) tend to improve digestion and an animal's anti-inflammatory and anti-oxidative status, directing more energy towards growth. The organic acid-based additive delivered a 0.01 FCR improvement versus AGP groups averaged over 5 trials. One potential explanation relates to the additive's antimicrobial effect that supports feed and water hygiene, the control of gram-negative bacteria, and overall reducing the total bacterial load. Microbials (probiotics) delivered an FCR 0.02 higher than the AGP supplemented group across 6 non-challenge trials. The mode of action of direct-fed microbials (DFMs) serve to reinforce a healthy gut microbiota, and improving gut

Richard Markus, Assistant of Development Director & Global Technical Sales Coordinator
Franz Waxenecker, Director of the Development Department

immune function, having an effect on growth mostly in challenging production conditions.

In terms of average daily gain (ADG) of birds, the grams per day figures of the acidifier and microbial groups were similar to the AGP groups (*Figure 2*). The phytogenic supplemented group recorded a slight improvement (1.5%) compared to the AGP group. Average daily gain (ADG) can positively influence the final weight of the animals and number of rotations, resulting in higher income.

Absolute mortality in NGP groups were lower on average compared to the AGP groups (*Figure 3*). The greatest improvement was observed in the microbial supplemented groups in 6 trials where mortality was reduced more than 30% versus AGP groups. Mortality in phytogenic and organic acid based product groups were 12.3% and 1.3% lowered compared to AGP groups, respectively.

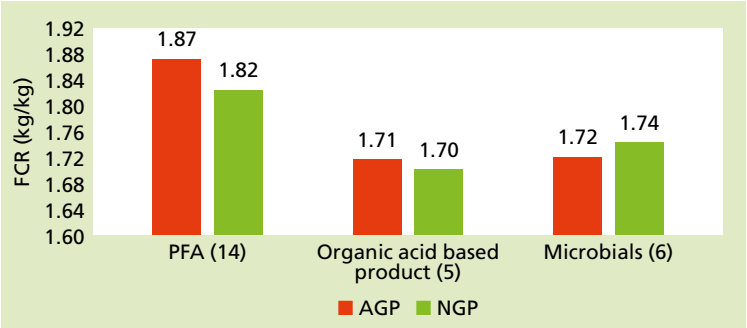
Identifying the right tool

These results suggest that flock performance can be maintained with natural growth promoters and that these can be considered an important tool in antibiotic reduction strategies. However, it appears obvious that various NGPs have differing modes of action, needing to be supplemented at the right time and/or in the correct combination, depending on the specific challenge the animals encounter throughout production.

The aim of NGPs should always focus on disease prevention, not treatment. Species, production phase, farm conditions, product dosage and ROI considerations all influence the choice of feed additive.

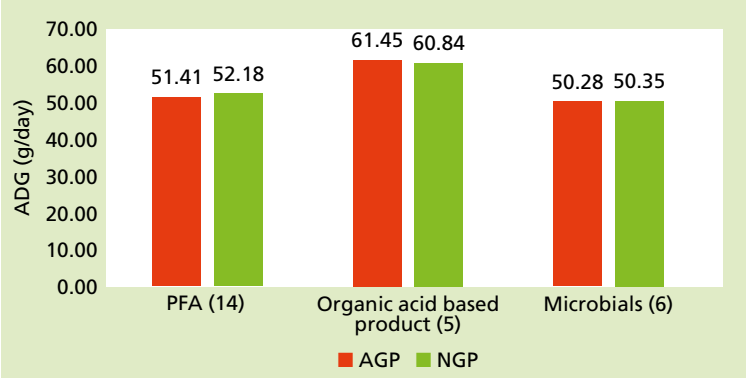
Furthermore, combinations of additives have been demonstrated to work successfully in particular situations to achieve specific objectives or to counter challenges such as mycotoxins or pathogenic bacteria. This means that organic acid-based products, microbials and phytogenic feed additives may each play a role in future production as part of a tailor-made solution to help producers achieve bird health and performance goals.

Figure 1. Feed conversion ratio comparison (number of trials).



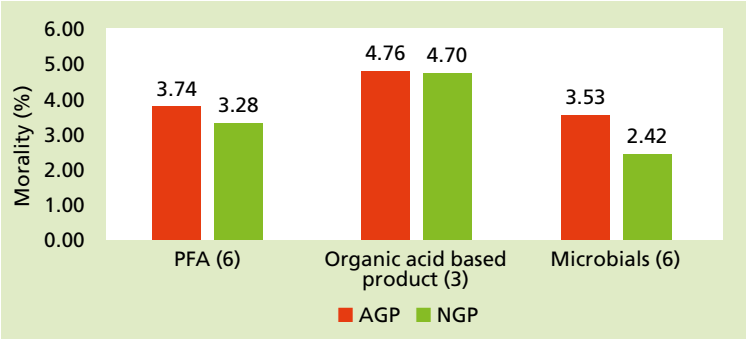
Source: BIOMIN 2016

Figure 2. Average daily gain comparison (number of trials).



Source: BIOMIN 2016

Figure 3. Relative mortality comparison (number of trials).



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Combining Tools to Counter

By **Andrew Robertson**, Poultry Technical Manager

Combined strategies may be the best approach to minimizing *Campylobacter* levels in broiler flocks.

Photo: Sebastian Kaulitzki

Campylobacter

***Campylobacter* spp have the potential to cause disease in poultry, diarrhea and reductions in feed efficiency.**

Table 1. Management strategies to counteract *Campylobacter* contamination in broilers.

Measure	Success and implementation status
Vaccine	Does not exist
Extreme temperature intervention	Claims to reduces rate of carcass contamination by up to 90%. Does not eliminate risk to humans.
Chlorine wash	Not permitted in the EU due to concerns over carcinogenic residues.
Stringent biosecurity	May reduce rate of carcass contamination by 50% to 70%, though difficult to attain under commercial conditions.
Stop thinning	Single out-loading of flocks can reduce contamination by 80%. Puts pressure on production and introduces short-term challenges.
Slaughter at 28 days	Dramatic reduction in contamination levels. Impractical due to market requirements.

Source: BIOMIN

Table 2. Nutritional strategies to counteract *Campylobacter* contamination in broilers.

Measure	Success and implementation status
Bacteriocins	Some effect in scientific trials showing reductions of contamination in the caeca. More investigative work required.
Bacteriophages	*In vivo* use tends to be therapeutic. Considered for in slaughterhouse treatment of carcasses but problems may occur in registration.
Organic acids	Mixture of acids needed. The pH of drinking water has to be lowered to between 4.0 and 4.5 for optimum results. Varied results obtained.
Phytogenic feed additives	*In vitro* trials not replicated *in vivo* to date. More work required.
Probiotics	Several trials show significant reduction of *Campylobacter* colonization. Perhaps the most promising for commercial purposes.

Source: BIOMIN

There are an estimated 9 million cases of campylobacteriosis in the EU alone each year, costing US$2.72 billion. There is still no definitive solution to control *Campylobacter* in poultry flocks. Yet, there are several strategies that can reduce its incidence, so improving food safety and enhancing farm profits.

Broiler producers need to apply a series of measures to reduce *Campylobacter* contamination levels. A mixed approach starts with improved biosecurity, changes to management practices, proven feed or water intervention with additives and, finally, intervention measures during slaughter.

Table 1 provides an overview of management strategies to counter *Campylobacter*. These management methods, however, are not all applicable universally, for example within the EU there are restrictions due either to availability legislation or consumer demand for carcass size.

In addition to management strategies, there is also the option to use feed additives or water treatments, which can further reduce the level of *Campylobacter* contamination, as shown in *Table 2*. Of these, probiotics may be the most promising approach for controlling *Campylobacter* through nutritional interventions.

Multi-approach, multi-benefit

Each of the interventions listed above will help to reduce overall contamination. Combined, they may possibly give the required reduction of *Campylobacter* contamination in finished broiler meat.

The impact of campylobacteriosis in humans is well known. It usually results in severe abdominal pains and diarrhea, which can lead to hospitalization. But it is worth remembering that it can lead to death and, in some cases, lead to serious complications, such as Guillain-Barre syndrome, reactive arthritis, bacteremia, inflammatory bowel disease and irritable bowel syndrome.

A genuine, costly challenge

It is also important to remember that *Campylobacter* spp are not necessarily commensal bacteria but have been shown to have the potential to cause disease in poultry: diarrhea and reductions in feed efficiency.

In the UK, for example, estimates suggest that the costs to the industry are up to US$29.16 per thousand broilers. Controlling the situation on farm is of benefit to poultry producers, and not just meeting contamination levels for poultry leaving the processing plant.

Cut & Keep Checklist

What's wrong with my birds? Part 8: Lameness Conditions (Nutrition)

Chickens raised for commercial meat production are selectively bred to reach market weight quickly. This rapid growth, however, can place increasing demands on the bird's skeletal system resulting in impaired locomotion.
Lameness and gait abnormalities in poultry are conditions of high significance not only because of their implications in terms of animal welfare, but also due to the financial losses caused by increased mortality, reduced feed utilization and growth rate, and downgrading in the processing plant.
Nutrition plays a significant role in skeletal health and development, thus there are a multitude of nutritional factors can lead to musculoskeletal diseases which are commonly characterized by lameness. It is important to identify and understand these risk factors in order to develop a prevention or mitigation strategy to reduce incidence of lameness in poultry flocks.
The purpose of this table is to outline several nutritional factors that can contribute to increased incidence of lameness in poultry and offer approaches to help mitigate the damage caused by these conditions.

Nutritional Factors

Condition	Causation	Symptoms	Lesions	Solution
Rickets	• Vitamin D3 deficiency - Ca/P imbalance	• Enlargement of the ends of Tibia & Femur, with widened epiphyseal plate	• Disorganized cartilage matrix • Irregular vascular penetration	• Feed vitamin D3 with balanced calcium and phosphorus
Perosis/ Chondrodystrophy	• Manganese deficiency	• Thickened and shortened legs • Shortened wings	• Enlargement and malformation of the tibio-metatarsal joint • Twisting, bending of tibial distal end and proximal end of tarso-metatarsus • Slippage of the gastrocnemius tendon from its chondyles	• Feed appropriate Manganese as per the production stage • Maintaining Mn-Ca-P balance
Osteoporosis/ Cage layer fatigue	• Impaired calcium flux in laying hens	• Soft and rubbery bones • Birds on their sides in the back of the cage	• Vertebral fracture affecting spinal cord	• Feed appropriate calcium as per the production stage • Care must be taken to feed ~50% of the dietary calcium in the form of coarse limestone, with remaining half as fine particle limestone
Ionophore toxicity	• Monensin	• Legs extended backward	• No specific lesions	• Mix feed properly • Withdraw the ionophore
Pododermatitis/ Footpad dermatitis/ Foot burn/ Ammonia burn	• Biotin deficiency • Poor quality of litter	• Ulceration of the metatarsal and digital footpads	• Necrotic lesions on the plantar surface of the footpads	• Improve gut integrity by feeding poultry-specific, live probiotics • Supplement biotin in the feed • Lower litter moisture with proper ventilation and avoid water spillage
Tibial Dyschondroplasia/ Osteochondrosis	• Calcium-Phosphorus ratio • Excess chloride in feed → Metabolic acidosis • Acid/base balance • Mycotoxins	• Swelling and bowing in the region of the knee joints • Angulations of legs • Typically in birds >35 days	• Plug of cartilage in proximal end of tibia, distal tibia, and proximal metatarsus, in decreasing order of frequency	• Correct the nutritional imbalances • Add an effective mycotoxin deactivator in the feed.

References are available on request

For more information, visit **www.mycotoxins.info**

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