

Maximising flock productivity from start to finish using eubiotics

Broiler flock performance depends upon a multitude of factors from chick and feed quality to flock health management. It is well known that a good chick start is essential for final flock performance. If chicks can achieve their target weight by day seven, final performance should be equal or above breed target.

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Achieving a good start depends upon a number of factors including optimum water quality, feed, temperature, ventilation and humidity. Development of the early gut microbiota is a key factor in ensuring all birds will achieve good performance throughout life.



Chicks need to be healthy and disease-free to be able to establish a healthy microflora. Chick quality starts in the breeder flocks and if chicks are immunocompromised from the outset, they will be poorly equipped to cope with bacterial, viral and parasitic challenges that are typically seen during production.

Eubiotics and the importance of eubiosis

Eubiosis is a term that refers to a healthy and diverse gut microbiota. Eubiosis has a profound impact on metabolic and immune homeostasis and therefore the gut microflora has a direct effect on animal health, well-being and consequently performance.

Eubiotics are products that support or help restore intestinal eubiosis. Eubiotics can be broad in their composition from β -glucans and probiotic bacterial strains through to short chain fatty acids (SCFA) and plant-based products. While their modes of action are diverse, they can all positively influence the intestinal microbiota to lesser or greater extents, helping birds to achieve an optimum eubiotic status.

Development of the microbiota – achieving eubiosis

Development of the microbiota is generally considered to begin upon hatching, where the majority of bacteria are acquired from the environment. One day post-hatch the ileum and caeca are both dominated by bacteria with densities up to 10^{10} bacteria/g digesta.

Within 14 days the typical adult small intestinal microbiota is well established and after 30 days the caecal flora has developed and ideally the intestine is in an eubiotic status. The diversity of bacterial populations of the intestinal microbiota increases with age, while nutritional influences are also apparent.

Bacterial numbers in the mature microbiota range from 10^8 CFU/g, predominantly *Lactobacillus* spp. in the foregut to 10^{11} CFU/g in the

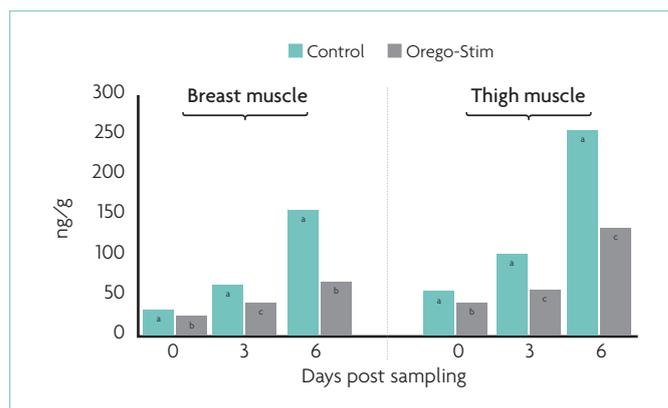


Fig. 1. Oregano essential oil improves the antioxidant status of broiler breast and thigh muscle. Within a time point, columns with different superscripts are significantly different ($p \leq 0.05$).

hindgut, mostly *Lactobacillus*, *Enterococcus*, and various *Clostridiaceae*.

Estimates suggest as much as 50-85% of the identity of bacteria in the gut are still unknown.

SCFA eubiotics, such as those based on propionic and formic acid on a mineral carrier (pHorce, Anpario plc), have a demonstrable beneficial effect upon the microbiota including the reduction of *E. coli* numbers and increasing levels of *Lactobacilli* with a detectable increase in levels of propionate and butyrate in situ.

Propionate and butyrate serve as energy sources for cells of the intestinal villi as well as other bacteria. In the first four days post

hatch, villus surface area/height increases substantially, while crypt depth increases until around 10 days of age.

At seven days, conventional chicks can have twice the number of proliferating enterocytes compared with chicks with minimal gut microbiota, demonstrating the importance of the microbiota and the production of localised nutrients and energy sources.

Managing health

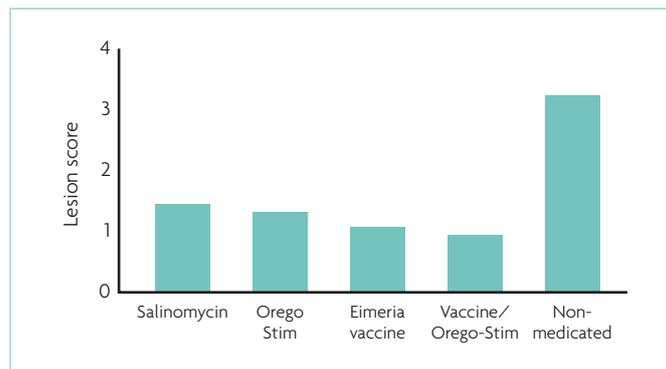
While SCFA eubiotics support the microbiota, eubiotics based on plant essential oils can have vastly different effects on the bird depending upon the plant origin.

Oregano essential oil (OEO) has been well studied and a number of eubiotics based on OEO are present in the market place. Once these OEO eubiotics have been carefully selected for composition and manufacture, they are powerful tools in the management of intestinal and overall health.

For reasons that are still not fully understood, the intestinal microbiota responds positively to OEO, despite the oil's well known antimicrobial properties. Shifts in *Lactobacilli* have been credited with increased antioxidant activity in other monogastric species and this

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Fig. 2. Oregano lowers the average lesion score in birds challenged with eimeria.



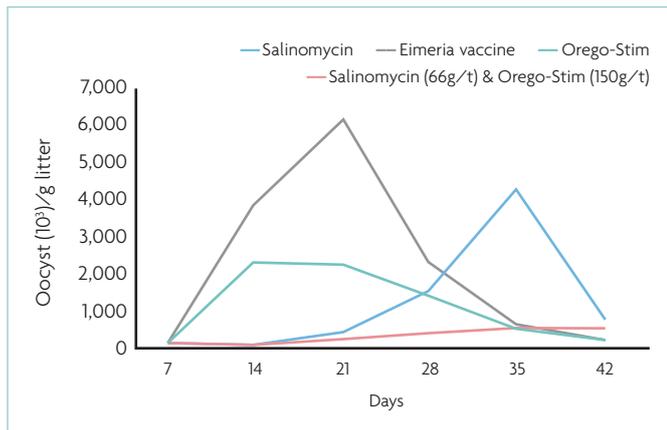


Fig. 3. Oregano reduces levels of circulating oocysts in the litter following eimeria vaccine application.

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 may well be a factor in the improved antioxidant status measured in birds fed a mineral based OEO eubiotic (Orego-Stim, Anpario, plc) (Fig. 1).
 Improving the antioxidant status supports cells under metabolic stress, such as an immune response to an infection or thermal stress. Cellular processes lead to the production of free radicals which are highly reactive and can damage the cells; the harder cells work, the greater the production of free radicals.

Antioxidants neutralise with these free radicals, thereby preventing damage to the cells. Birds fed OEO have been shown to have significantly lower levels of malondialdehyde (a by-product of oxidation) in thigh and breast muscles (Fig. 1).

An additional benefit of this improved antioxidant status is the potential for improved meat quality. Rancidity is due in part to lipid oxidation in the meat. By lowering the rate of oxidation, OEOs can improve meat shelf life.

Other reported benefits of OEO eubiotics include regulation of immune responses, for example inflammation and stimulation of enterocyte proliferation, leading to a

quicker replacement of damaged intestinal cells.

This holistic activity is likely a significant contributing factor to the amelioration of the detrimental performance impact of parasites such as eimeria.

Research would suggest the supplementation of feed with an OEO eubiotic in birds infected with either attenuated or non-attenuated eimeria strains leads to less intestinal damage (Fig. 2) and lower levels of eimeria oocysts circulating in the litter (Fig. 3).

Reducing the disruption to enteric health helps the bird to maintain its eubiotic status and improve performance.

Eubiotics in breeders: providing chicks with an early start

It is well known that the age of the parent flock influences chick quality; chicks from younger parent flocks tend to be lighter. Similarly, hygiene and health management in the breeder flock is essential to avoid the risk of vertically transmitted diseases, such as salmonella or mycoplasma, and to ensure the chick has some degree of passive

immunity, through absorption of the yolk sac, on hatch.

Development of the eubiotic status in broiler breeders is extremely important to support the birds' natural defences against enteric pathogens while supporting immunity, particularly as birds in lay are under high metabolic stress.

Recent research suggests that crude protein and energy levels of breeder diets in both the rearing and laying phase can influence not only fertility, hatchability and embryonic viability but also progeny performance.

Improvements observed include better chick quality, lower mortality, improved immune responses and higher chick weight. The effect of maternal diet also appears more pronounced in male versus female progeny.

Since breeder nutrition appears to be such an important factor in the performance of progeny, it follows that eubiotics fed to breeders could also have a significant impact upon progeny.

SCFA eubiotics have been shown to improve feed digestibility; an increase in total metabolisable energy of feed was shown to increase by 112kcal/kg. In broiler breeders fed a SCFA eubiotic

(propionic and formic acid on a mineral carrier (Salkil, Anpario plc)) birds were shown to produce more fertile eggs leading to a 5% increase in the number of day-old chicks versus birds given unsupplemented feed.

Furthermore, those progeny from eubiotic-fed birds went on to have improved performance (Table 1).

Summary

Maximising flock productivity requires a multifactorial approach. Good flock management from the very start is essential. Eubiotics such as mineral carrier based SCFA blends can improve flock productivity before chicks are even placed by supporting breeders and their progeny. These SCFA eubiotics bring benefits to the newly placed chicks by promoting development of the microbiota.

Essential oil based eubiotics support the bird during periods of stress and intestinal challenge.

While there is no 'one size fits all' approach, it is clear that eubiotics with their broad modes of action are important to help maintain intestinal health and maximise flock productivity. ■

Table 1. Improvement in 45 week old broiler breeder and progeny performance when fed Salkil.

	Control	Salkil
Production (%)	71.27	71.85
Fertility (%)	94.32	96.64
Hatch of fertiles (%)	86.04	86.26
Number DOC		+2%
Progeny performance		
Feed intake (g)	5,127	5,118
Weight gain (g)	2,842	2,934
FCR	1.80	1.74