ANITOX®
SECURITY THROUGH SCIENCE™

The importance of enteritis control in layers

An Anitox Advice Guide

Contents

The importance of enteritis control in layers

The bulk of this guide covers topics which are relevant for layers kept in cages (most of the world) or colonies (Europe). There is increasing pressure on several markets, derived from consumers and local regulations, to have at least a proportion of the production derived from cage-free animals. Maintaining birds in direct contact with litter generates increased challenges due to several reasons. From the intestinal health perspective, layers will be potentially ingesting high loads of bacteria on a regular basis due to their pecking behavior and the large fecal component the litter may have.

The economic impact of enteritis is most quantifiable in broilers, where the rapid lifecycle allows for precise calculations of body weight gain and feed conversion rate. In layers, where fine measurement of feed conversion is difficult to achieve, the cost of mild cases of enteritis can remain hidden. But the impact is there, and it's estimated to be costing up to six eggs per layer's lifetime.

Enteritis is simply defined as inflammation of the intestinal tract. Viruses, pathogenic bacteria and protozoa are all potential infective causes of inflammation. However, the most likely cause of enteritis in layers is ingestion of feed containing excessive levels of mold, mycotoxins, rancid fatty acids, anti-nutritional factors, or excessive loads of bacteria.

For a layer operation, the implications of enteritis can be huge. As well as animal-welfare issues, outbreaks of enteritis within layer populations impact in two key ways: reducing flock uniformity prior to point-of-lay and decreasing productivity post-18 weeks of age.

It is well accepted that bringing birds into lay without optimum body weight limits lifetime performance. Flocks cannot be managed by exceptions; the average condition of the birds will dictate the flock management as a whole. Nutrition and the management of environmental factors will reflect the needs of the majority of the population. The more animals deviate from the average, the less able we are to meet requirements for optimal production (Bell, 2012).

A flock with good uniformity will be easier to manage as most of the birds are at the same physiological stage. The body weight at sexual maturity will also influence egg weight and the egg mass produced by layers. (Dumoulin, Successful layer production begins in rearing).

As a general rule we can expect birds in a flock that have been managed under acceptable conditions to reach body weights that are within the target for their genetic line (Bell, 2012). Space allowances (cage or colony and feeder space), environmental temperature, lighting, nutrient intake, feed and water quality, immunization program, sustained enteritis and other diseases can have an important effect.

Enteritis can have an economic impact; a mild impact in some cases, a much larger impact in extreme cases. For example, a reduction in nutrient utilization by an inflamed intestine can lead to an increase in feed conversion which will be difficult to detect by most producers.

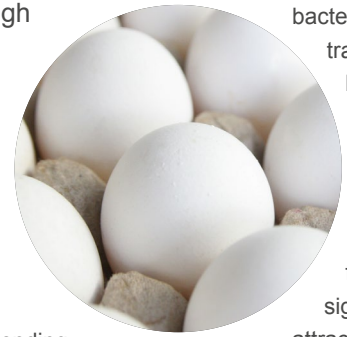
Severe enteritis, such as focal duodenal necrosis, can reduce production up to 10% below the standards for a genetic line. As well as impacting egg numbers, egg weight is also affected by up to 2.5g per egg (Hy-Line technical update, 2013).

Economic impact as a result of reduced productivity can bring massive losses and mean a period of economic instability for an average egg producing company.

Common sources of enteritis

Feed

Feed is commonly linked to enteritis in poultry. High and varying levels of pathogen load in feed is a major source of challenge, with raw materials being contaminated even before manufacture. Wet harvests, for example, are associated with moldy grains which can lead to high mycotoxin content.



Some types of feed materials are more associated with high and varying bacterial load. For example, animal by-products such as fish meal and rendering meal, DDGS and soya can all be heavily contaminated with bacteria depending upon source, handling and time of year.

As well as the direct impact of pathogen load in feed, bacteria present in some raw materials will digest amino acids to produce biogenic amides which have been linked to proventriculitis in poultry.

Clostrida can also be present in high concentrations of feed. Even though clostridial diseases are largely dependent upon the intestinal environment, large amounts of these bacteria in feed certainly facilitate incidence of the disease.

Environment

Poor husbandry and management of the layers' environment can lead to enteritis.

Feed bins and feed lines can accumulate large amounts of very high pathogen load material over time. If not properly cleaned, this material steadily detaches with the vibration of the feeding line, resulting in continuous contamination of each batch of feed.

Dust, with its large surface area, is a mechanical vector for large numbers of bacteria. It's a problem in mills, in transit, in silos and in poultry houses, where bacteria-loaded dust can find its way into feed trays to be ingested by layers.

Vermin, such as rodents, flies and wild birds, carry significant bacteria and are attracted to feed. As well as carrying pathogens from feces to the feed, vermin are also capable of short to large distance migration. For example, Clostridium perfringens is a common sporulated organism found in soil and feces. A large population of flies commuting from feces to feed will increase the consumption of these bacteria by poultry.

The mobility of bacteria-carrying rodents, insects and birds increases the risk of pathogens being transported from farm-to-farm across vast regions. Ensuring feed is free of pathogens at the point of manufacture, therefore, offers little protection. **Residual protection is essential, to ensure feed is protected right up to the point of consumption.**

Water

Water quality is now widely recognized as impacting poultry health, safety and productivity. Water sources can become contaminated by fecal material, so regular checks on levels of coliforms are essential to determine if a water source is suitable for poultry consumption.

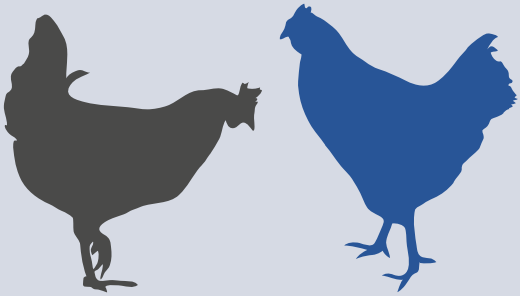
Maintenance of the water system is also important to ensure bacteriological quality. If not properly cleaned, biofilms develop in water tanks, filters and water lines. Biofilms can be a breeding ground, harboring bacteria that would survive for relatively short periods of time without the protection offered by this organic structure. Due to the nature of biofilm, it can be hard to remove, especially if the cleaning is not conducted on a regular basis. The ingestion of large amounts of bacteria released by biofilms will increase the risk of enteritis and likely have an adverse impact on the performance of flocks.

Layer mash is particularly vulnerable to pathogen contamination…

Unlike most broiler feeds, layer mash does not undergo even the low levels of heat treatment associated with pelleting.

The absence of heat in the layer mash production process means contaminants that stem back to the field and to harvesting practice can find their way into finished feeds.

Mash feed with high levels of contamination can lead to enteritis. Even mash with lower levels of contamination can help perpetuate enteritis established via other agents.



Implications of gut health

A healthy gut is essential for the efficient conversion of feed into its basic components for optimal nutrient absorption. If gut health is compromised, digestion and nutrient absorption will be affected and bird performance and welfare compromised. Economic losses will follow, commonly as a result of poor flock performance and mortality.

Feed represents the largest investment for egg producers. Enteritis, impacting the intestine's ability to absorb and digest nutrients from feed, compromises that investment.

Villi, the finger-like projections that line the intestine, facilitate nutrient absorption. Enteritis impacts villi growth, causing a reduction in the length of the villi leading to a reduction in absorptive capacity.

"After 12 hours of infection (with enteritis) a bird can lose from 20.9% to 35% of absorptive gut villi surface."

(Borsoi et al, 2011)

Although villi can regrow, dependent upon the extent of initial damage, the reduction in villi length will have already affected feed conversion rate, limiting body weight gain. Not all animals within a flock respond equally to a similar challenge. Some animals will be more affected (some may die) and some will be almost unaffected. This phenomenon is typical of large populations and in layers it has an impact on flock uniformity.

Effect of enteritis on the intestine

Under normal conditions food passes through the intestine and some nutrients are digested by the epithelial cells in the intestinal wall.

When increased loads of harmful bacteria enter the intestines and multiply, the intestine inflames and villi damage occurs.

Inflammation of the intestine will lead to increasing numbers of lymphocytes and other immune cells within the intestinal mucosa.

These white cells are loaded with antimicrobial molecules, however, most of these molecules also have the ability to damage tissue.

Tissue that has been damaged in response to the immune reaction will release pro-inflammatory signals leading to higher levels of inflammation.

Consumption of feed with high bacterial loads will sustain the inflammation over time.

Flock uniformity is affected and mortality may have occurred. Feed conversion rate is increased and production negatively impacted.

Feed source pathogens linked to enteritis

Streptococcus

+ Endocarditis
+ Septicemia
+ Diarrhea
+ Enteritis

Clostridia

+ Ulcerative Enteritis
+ Necrotic Enteritis

Pseudomonas

+ Diarrhea
+ Enteritis

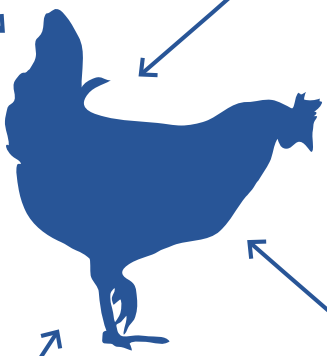
Eschericia coli

+ Air Sacculitis
+ Pericarditis
+ Septicemia
+ Diarrhea
+ Enteritis

Salmonella

+ Salmonellosis

Impact on productivity



Reduction in egg numbers

Focal Duodenal Necrosis may cause from 1-10% drop in egg production in addition to a 2g drop in egg weight.

Brash and Petrik, 2014

Reduction in uniformity

Poor uniformity prolongs the transition period and may result in low peak and poor persistency of egg production.

Hy-Line Management Guide

Increased veterinary costs

Antibacterial drugs are commonly used to prevent or control enteritis. Globally, the economical impact of the disease is estimated at US $2 billion a year through mortalities, poor performance and the costs of prevention and treatment.

Bahram et al, 2012

Increased production costs

Loss of 6.5g daily live weight gain after 28 days of infection.

Cao et al, 2013

Increased concomitant diseases

Healthy animals have a higher tolerance to performance-limiting pathogens than stressed animals.

Reduction in egg weight and quality

The lighter the birds at first egg, the smaller the eggs for the whole life of the flock

Dumoulin, Successful layer production begins in rearing

Reduction in profitability

Birds that suffer enteritis usually have a reduced ability to digest and absorb nutrients due to extensive damage to the mucosal lining, which ultimately results in reduced profitability.

The Poultry Site, 2016

Increased mortality

Nectrotic enteritis may cause up to 6% flock mortality/month.

Sawale 2010. Dhillion 2004

Anitox pathogen control solutions can help to improve productivity through feed.
See page 8

Performance protection starts here

Anitox pathogen control solutions offer the **highest level of pathogen control in feed**, controlling contaminations caused by:

- *Salmonella spp., E.coli*
- *Clostridium spp.*
- *Staphylococcus spp.*
- *Molds*

Feeding layer mash free from pathogens can maximize the nutritional value of the diet, which results in:

- Improved flock uniformity
- Improved feed conversion rates/egg numbers
- Reduced mortality especially in early life stages

Treating feed with Termin-8 reduces the incidence of pathogens in the food chain and can lead to a reduction in antibiotic use. It is particularly effective in reducing contamination caused by Salmonella spp.

Support services

Anitox offers extensive support through laboratory analyses and engineering knowledge, this ensures an effective pathogen control program and safe use of both Termin-8 and Finio. Anitox pathogen control solutions are applied evenly using Anitox patented application equipment installed, monitored, serviced and supported by Anitox engineers and feed milling technologists.

Regulations vary by country; please consult local regulations for specific applications.

Product description

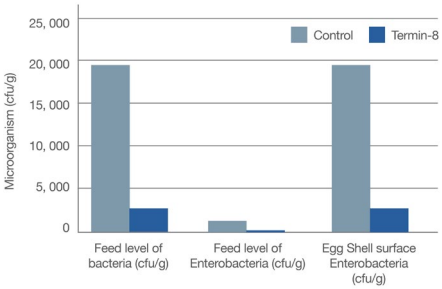
Effective synergistic blend of formaldehyde, propionic acid, terpenes and surfactants. Termin-8 can be applied in feed as either a powder or a liquid, and has a residual protection against contamination.

Why formaldehyde?

Formaldehyde, a naturally occurring chemical which is produced by most animals' metabolic processes, is used in the production of hundreds of everyday products. Formaldehyde inactivates microorganisms by cross linking proteins in their cellular cytoplasm therefore conferring its **antimicrobial properties.**

Effect of Termin-8 in Layers – Piedmont Research Station, Salisbury, North Carolina, USA

Anitox R&D Conclusions: Treating feed with Termin-8 provides residual protection against Salmonella recontamination



Conclusion: Treating the feeds with Termin-8 improved feed quality and egg hygiene.

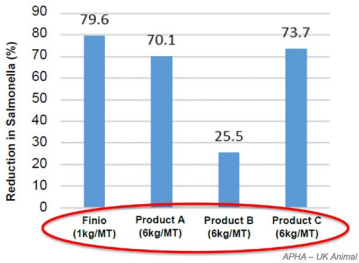
Product description

Novel formula consisting of phytochemicals and naturally occurring carboxycilic acids. Finio is the first **next generation formaldehyde-free** form of pathogen control from Anitox.

Performance

Finio outperformed three leading organic acid blends in trials, delivering 3x greater control of pathogenic contaminants. Finio controls a broad spectrum of pathogens that have been tracked info the human food chain and offers a residual effect, protecting feed from recontamination post-application.

Figure 1. Efficacy of Commercial Products on Salmonella in Feed



APHA – UK Animal & Plant Health Agency

Anitox proprietary products and technologies protect the health and welfare of livestock and companion animals, and promote clean fermentation of biofuels. We improve production efficiency and sustainability by maximizing value from precious resources including land, water, feed and energy crops.

We are proud that our authority and value is recognized by regulatory agencies around the world, by the scientific community and, most of all, by our customers.

You can find out more about our work, together with details of your local Anitox branch or distributor, at www.anitox.com.

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Anitox is dedicated to the control of microbes and pathogens in feed, food and fermentation applications worldwide. We understand how microbes and pathogens occur, survive and thrive, and we deliver practical, reliable and commercially viable systems to safely remove them from the human food chain to protect public health. For further information on any of our products please visit www.anitox.com

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