How to develop phytogenic feed additives

*by **EW Nutrition Phytogenics** team*

Modern feed additives are now commonly used as a critical tool to improve animal health. Among these, phytogenic feed additives are increasingly widely adopted. Consequently, more and more products are entering the market, leaving producers to wonder how these products differ from one another and which product performs best. To better understand the benefits that phytogenic feed additives can bring to operations, one must understand the development process feed additives undergo.

Not all feed additives are born equal

Feed additives are products that are added into an animal feed to improve its value. They are typically used to improve animal performance and welfare and consequently to optimize profitability for livestock producers.

Their purpose should not be confused with that of veterinary drugs. Feed additives provide additional benefits *beyond* the physiological needs of the animals and should be combined with other measures to improve production efficiency. Those measures include improvements in management, selection of genetics, and a constant review of biosecurity measures.

Several categories of feed additives exist. They all have in common that they are mixed into the feed or premix or the drinking water in relatively low inclusion rates to serve a *specific* purpose. Examples of feed additives are organic acids, pre- and probiotics, short and medium chained fatty acids, functional yeast products, and phytogenic feed additives. Modern feed additives also blend those different additives into combination products, increasing the value of the final products.

Phytogenic feed additives are a sub-category of additives containing phytomolecules, active ingredients which originate from plants and provide a unique set of characteristics. These molecules are produced by plants to protect themselves from molds, yeasts, bacteria, and other harmful organisms. Depending on the type of molecule, phytomolecules have different properties, ranging from antimicrobial to antioxidant and anti-inflammatory.

EW Nutrition’s approach to developing Ventar D: 6 steps

The development of best-in-class phytogenic feed additives is a complex process. For Ventar D, EW Nutrition divided the process into the following steps, which can serve as a template for a successful development process:

1. Reviewing customer needs
2. Active ingredient selection
3. Technical formulation
4. Application development and scale-up
5. Performance tests
6. Safety and regulatory validation

Understanding customer needs

The most important point in developing a feed additive is customer-centricity. Understanding the challenges and needs of producers is crucial to developing feed additive solutions.

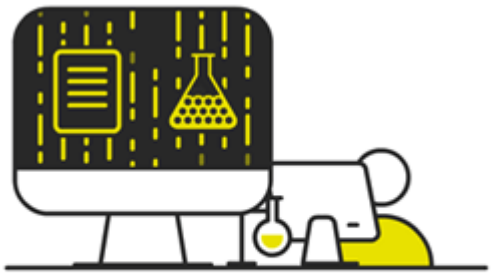
In a first step, additive producers need to evaluate and *quantify* customer needs wherever possible. This is achieved through communication and literature review: Producers, key opinion leaders, and research partners are interviewed, and their challenges are listed. In the next step, those challenges are further analyzed using scientific literature. In a final step, the customer needs are ranked according to their impact on the customer’s profitability.

Subsequently, the *minimum requirements* for the new feed additive are derived. For phytogenic feed additives, this might be, for instance, something like “Improving animal performance and reducing antibiotic use while increasing profitability”. The selected key performance parameters might be, for example, feed efficiency improvements in broilers.

Market research

Meeting unmet needs

Once the customer needs have been understood, the next phase of the development starts. Based on the intended mode of action, certain phytomolecules are chosen based on their described properties. In our example, this might be an antimicrobial mode of action that targets enteropathogenic bacteria in broilers, supporting gut health.



Laboratory research

In this *in-vitro* process, the selected individual compounds will be tested for their respective antimicrobial efficacy using MIC and MBC testing. Those tests are run using high-purity compounds.

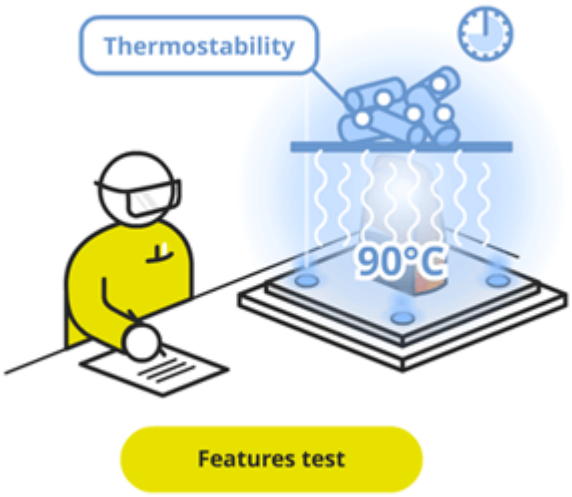
Features test

The tests will be conducted using various relevant field strains like *E. Coli, S. enterica* or *C. perfringens*. In the next step, the testing will be repeated with commercially available ingredients. The most promising compounds will be tested in more complex mixtures.

Modern phytogenic feed additives are based on the concept of combining different phytomolecules to attack bacteria in diverse ways, with their antimicrobial effects being multi-modal. This mode of action is crucial because it makes it very unlikely that bacteria can develop resistance to combinations of phytomolecules, as they do to antibiotics.

Selecting the right form of application

Feed processing is often a challenge for additives. Many phytomolecules are highly volatile and prone to volatilization and high temperatures. Especially non-protected phytogenic products are negatively affected by high pelleting temperatures and long retention times of the feed in the conditioner. The results are losses in activity.

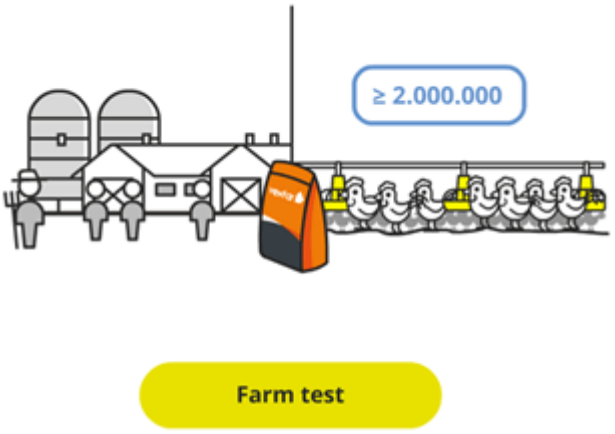


Therefore, the development of appropriate delivery systems is a preemptive method to ensure the release of the effective compounds where they should be released – in the gut of the animals. Those delivery systems can utilize emulsifiers when applying the additive via the water for drinking, or encapsulation technologies when the new additive is administered via feed.

Due to the importance of mixability, flowability, and pelleting stability for the performance of the feed additives, the exact types of emulsifiers, carrier, and technologies used in their production is often considered corporate intellectual property.

The importance of *in-vivo* evaluations

In one of the last steps of the development, the newly developed feed additive prototype needs to prove its safety and efficacy in the animal. Hence the need to run evaluation studies to confirm the mode of action chosen in the initial lab phase. Typically, the additive will be tested in the target species in in-house and external research institutes.



For a phytogenic feed additive, that might entail comparing its effect on body weight gain, feed efficacy, and gut health against different control groups. Additionally, the newly developed feed additive might be compared to existing additives to get a better understanding of its capabilities.

Dose-finding studies are conducted to verify the chosen dose recommendation and additional overdosing studies are conducted to prove the safety of the additive for both animals and consumers. In certain markets or regulatory environments, additional studies might be required. Those can contain environmental safety assessments or proof that the new additive does not create residues in animal products.

Case study: Ventar D

For Ventar D, the process followed these steps meticulously, in agile iterative development loops that went from the customer need to formulation, testing, scale-up, in-house and external trials, and finally production.

These steps ensured that the final product that reaches the customer’s doorstep delivers on the expectations – and more.

Choose your phytogenic products wisely

The plethora of (phytogenic) feed additives in the market leaves producers with many options to choose from. However, only scientifically developed feed additives can be relied upon to optimize both animal health and production profitability. It is important to select reliable feed additive producers who developed their phytogenic product with the customers' challenges in mind and went through all the steps necessary to create a high-performing and safe additive.

EW Nutrition achieves PCAS Certification in Australia

Singapore – November 1, 2021 – EW Nutrition has successfully passed an external audit conducted by the Cattle Council of Australia (CCA) and achieved Pasturefed Cattle Assurance System (PCAS) certification for three products: Activo Premium, Mastersorb Gold, and Prote-N.

The PCAS is a certification program that enables grassfed cattle producers to prove claims relating to pasturefed or grassfed production methods. EW Nutrition also achieved two optional modules under the PCAS Standards relating to the freedom from antibiotics and hormone growth promotants (HGPs). As a certified supplier, EW Nutrition is able to provide feed products to the industry to support pasturefed or grassfed production methods.

“We are pleased to receive the certification for our solution offerings in Australia. The qualification of these products is a testament of our commitment to work together with the industry to mitigate the impact of antimicrobial resistance. By pursuing our objectives in animal nutrition, our work contributes to increasing the efficacy of human healthcare.” said David Sherwood, Commercial Director Oceania with EW Nutrition.

The PCAS certified products are:

Activo Premium
Activo Premium contains standardized amounts of selected phytomolecules.

Mastersorb Gold
Mastersorb Gold is part of EW Nutrition’s Toxin Risk Management Program, which also includes services, on-site advice, and expert consultancy.

Prote-N
Prote-N is a slow-release source of nonprotein nitrogen (NPN).

About EW Nutrition

EW Nutrition offers animal nutrition solutions to the feed industry. The company’s focus is on gut health, supported by other product lines. EW Nutrition researches, develops, produces, sells and services most of the products it commercializes. In 50 countries, key accounts are served directly by EW Nutrition’s own

personnel.

For more information, please visit https://ew-nutrition.com.
For more information about PCAS, please visit https://pcaspasturefed.com.au/

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Phytogenic additives: An ROI calculation

*By **Ruturaj Patil**, Global Product Manager – Phytogenics, EW Nutrition*

Global trade in agricultural products has a direct impact on the added value in regional broiler production. Due to fluctuating meat and feed prices, a tight profit margin can melt away

quickly. Changes such as the use of cheaper raw materials, implemented to deal with reduced margins, may negatively affect flock health, creating a vicious cycle: If the flock also experiences increased disease pressure, the financially critical situation worsens.

What can the right phytogenic feed additive deliver for broiler producers?

It is essential to improve broiler gut health, as only healthy birds will perform and allow producers to be profitable. Producers can maintain flock performance through preventive management measures, a consistent hygiene concept, and the use of high-quality feed. For unproblematic flocks, the same measures also positively affect profit, generating a healthy return on investment (ROI).

What affects your return on investment?

In broiler production, the cost of feed is highest, with a share of 60 – 70 % of the total production costs. The proportion tends to be higher in markets that rely on importing feed raw materials (Tandoğan and Çiçek, 2016).

Let us take an example: With a compound feed price of 300 € / t as the basis, an increase of 10 € / t results in a profit reduction of 0.016 € / kg live weight. On the other hand, an improvement in feed conversion from 1.60 to 1.55 results in a financial advantage of 0.015 € / kg live weight. The best possible

feed efficiency is always desirable to keep production costs low.

Another risk factor for high-yield broiler production lives in the poultry intestines: the most significant “invisible” losses result from subclinical necrotic enteritis (*Clostridium perfringens*). This disease worsens the feed conversion on average by 11 % (Skinner et al., 2010). In the previous example, this would reduce feed efficiency from 1.60 to 1.78 points and reduce the contribution margin by 0.054 € / kg live weight. In addition, a live weight reduction of up to 12 % can be observed (Skinner et al., 2010). It is, therefore, critical to stabilizing gut health to reduce the risk of subclinical necrotic enteritis.

Practice prevention for a secure return on investment

The prophylactic use of antibiotics in compound feed was a well-known reality for decades. With the EU-wide ban on the use of antibiotic growth promoters, the occurrence of multi-resistant bacteria, and a globally increased demand for antibiotic-free chickens, producers now have had to cut down on antibiotic use.

For this reason, a lot of research has been conducted into alternative measures for maintaining good broiler health. Studies have confirmed that setting up a comprehensive hygiene concept to reduce the formation of biofilms on stable surfaces and reduce the recirculation of pathogens is a solid basis. At every production stage, irregularities can be detected through a meticulous control of performance parameters and illness symptom-centered health monitoring. Diseases can either be avoided or at least recognized earlier through targeted measures, and treatment can be carried out more efficiently.

A thorough hygiene concept and careful monitoring at every production stage are key to ensuring broiler performance.

Feed additives for intestinal stabilization

Hygienically impeccable compound feed is the wish of every animal producer to promote the development of a balanced intestinal flora. However, the quality of the available raw materials is subject to fluctuations and can therefore not be 100 % anticipated. Consequently, producers are now commonly balancing these uncertainties by using feed additives, which positively influence the intestinal flora. These products must prove their positive effects in scientific studies before they can be used in practice.

An effective solution: Encapsulated phytogenic feed additives

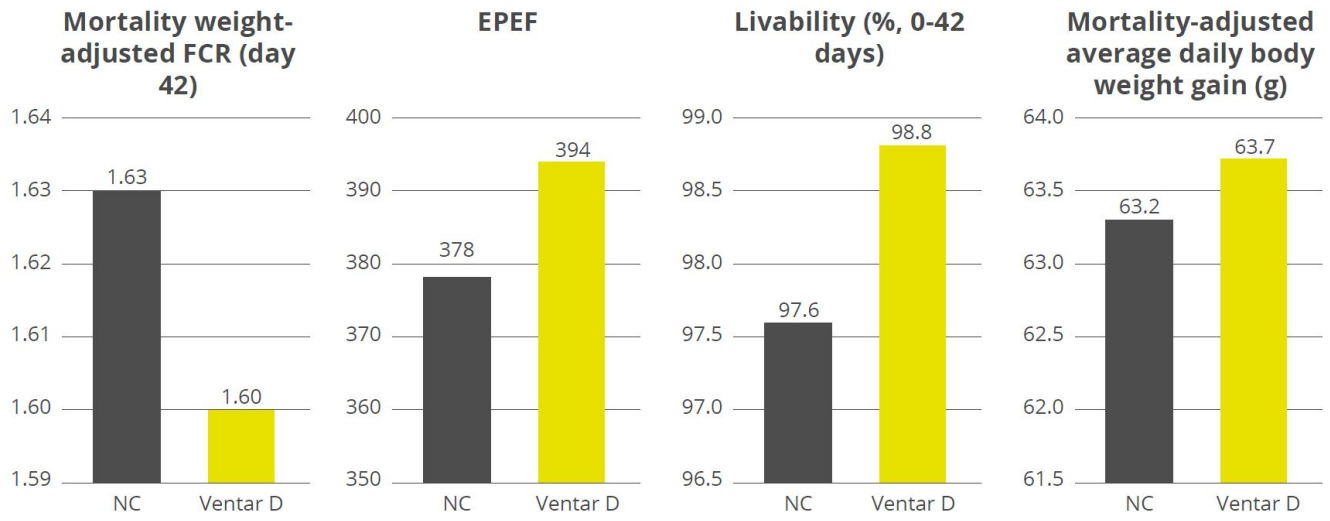
Studies have found that certain phytomolecules, which are secondary plant metabolites, can support broiler gut health. By stimulating digestive enzyme activities and stabilizing the gut microflora, feed utilization improves, and broilers are less prone to developing enteric disorders (Zhai et al., 2018).

The encapsulation of these naturally volatile substances in a high-performance delivery system is critical for the success of a phytogenic feed additive. This protective cover, which is often a simple coating, provides good storage stability in many cases. However, in addition to the high temperatures, mechanical forces also act on these coatings during pelleting. The combination of pressure and temperature can break the protective coating of the product and lead to the loss of active substances.

A complete solution: How Ventar D maximizes your ROI

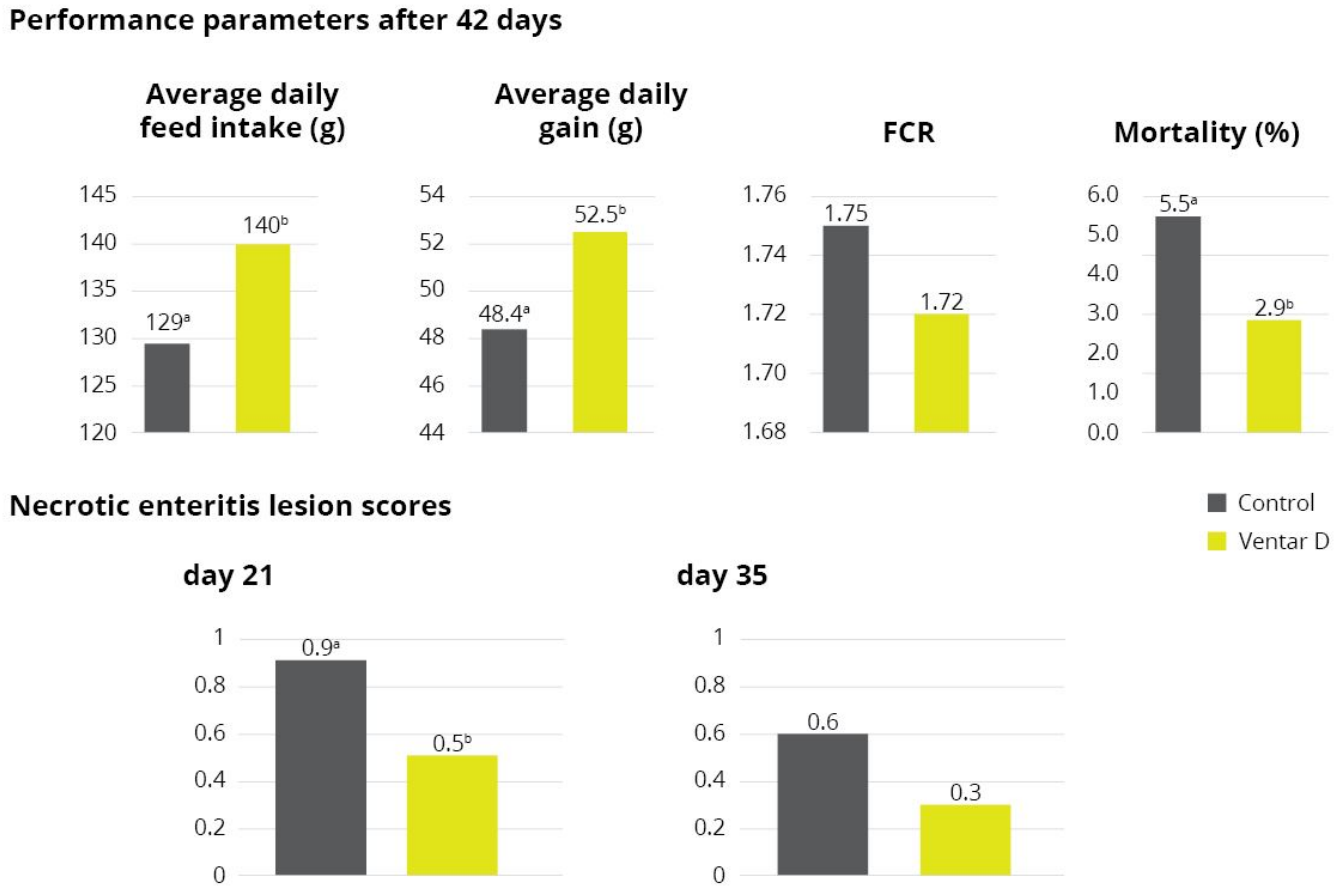
Because of the difficulties mentioned, the use of modern delivery system technologies is therefore necessary. EW Nutrition has many years of experience in the development of phytogenic products. Due to an original, innovative delivery system technology, Ventar D can offer high pelleting stability for optimal improvement of animal performance.

In particular, the positive influence of the phytogenic feed additive Ventar D on intestinal health under increased infection pressure was assessed in multiple studies. In two studies carried out in the United Kingdom, birds were challenged by being housed on used litter harvested from a previous trial. Moreover, increasing levels of rye were introduced into the diet, adding a nutritional challenge to provoke an increased risk of intestinal infections in the broilers. The use of 75 g of Ventar D per t compound feed increased the EPEF (European Production Efficiency Factor) by 4.1% and feed efficiency from 1.63 to 1.60.



With Ventar D use at 100 g / t compound feed under comparable conditions, EPEF increased by 8.9 %, and feed efficiency improved by 5 points (0.05), compared to a non-supplemented control group (NC).

Another study was carried out in the USA. In addition to performance parameters, data on intestinal health were also recorded. In the group fed with Ventar D (100 g / t compound feed), 50 % fewer necrotic enteritis-related lesions of the intestinal wall were found after 42 days. Compared to the group fed with Ventar D, the broilers of the control group showed a performance decrease of 11.8 % with an 8% lower final fattening weight and a 3 points poorer FCR.



Based on the results of the above studies, the ROI for Ventar D due to the improvement in feed efficiency by 3 and 5 points could be 1:3.5 and 1:6.5, respectively. Similarly, the net returns for using Ventar D could be 0.007 and 0.013 € / kg live weight, given the 3 and 5 points improvements in feed efficiency. The ROI for Ventar D use could be even higher thanks to additional benefits such as improvements in litter condition and foot pad lesions, reduced veterinary cost, etc., depending on the prevailing challenges.

The future of feeding is here

The first study results for Ventar D underscore that, if combined and delivered right, phytomolecules can transform broiler performance from inside the gut. Ventar D's stable delivery system ensures a constant amount of active molecules in targeted intestinal sites and, therefore, supports a favorable intestinal flora. With Ventar D supplementation, subclinical intestinal infections due to *C. perfringens* or other enteric bacteria can be very well kept in check, ensuring improved broiler productivity and production profitability.

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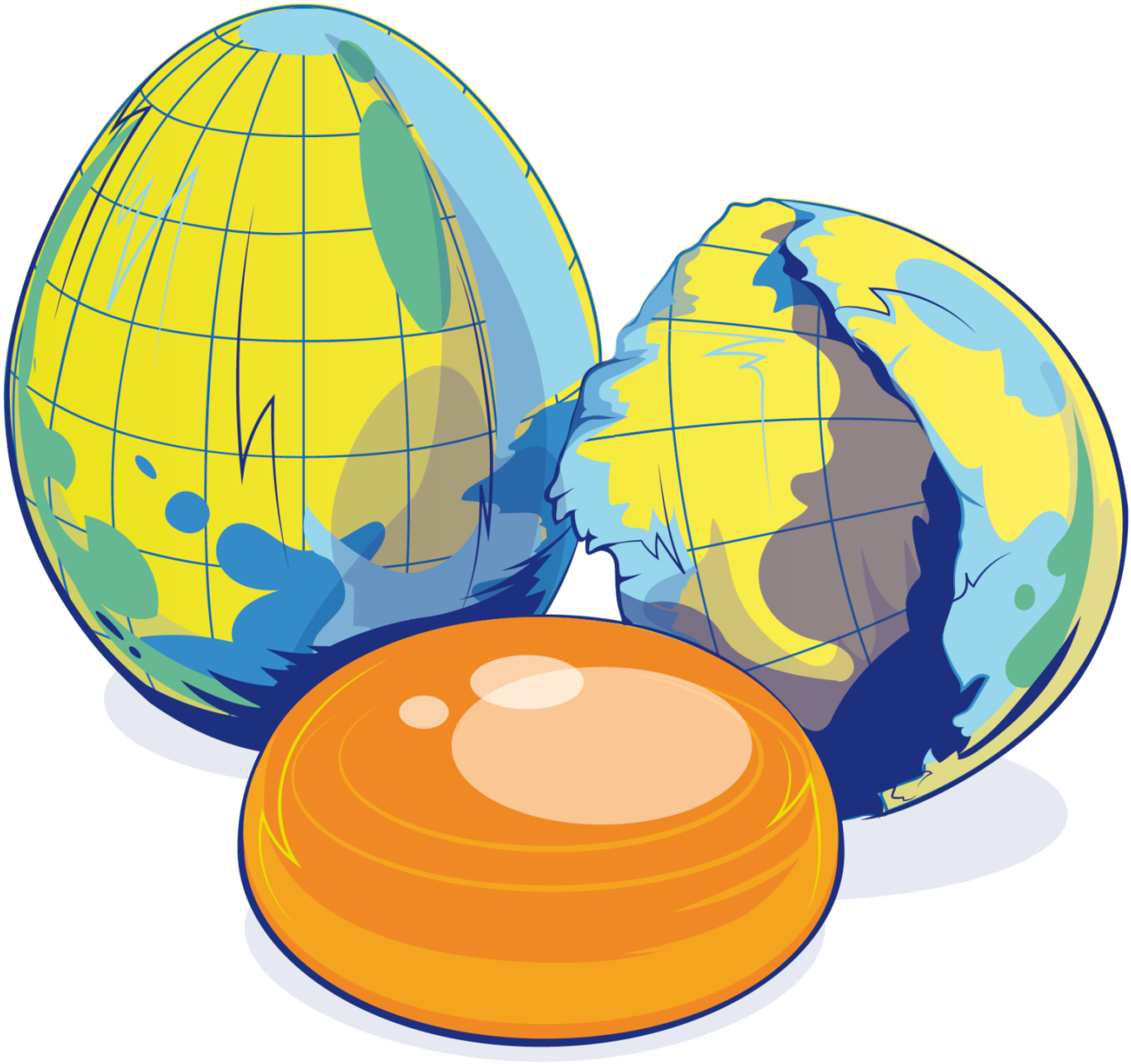
Reducing apo-esters: What are the alternatives?



By Technical Team, EW Nutrition

A year ago, the European Commission announced regulation (EU) 2020/1400 – restricting the use of ethyl ester of β-apo-8'-carotenoic acid (generally known as 'apo-ester'). Starting on 26 October 2021, this legislation restricts the use of apo-ester in poultry feed to 5 mg/kg for laying hens and 15 mg/kg for broilers.

As apo-esters is a synthetic pigment – not naturally occurring in nature – this measure was taken because the authorities could not guarantee safety upon exposure to the user. Limiting the concentration in feed would reduce this risk to acceptable levels, according to the legislators' decision.

Why use apo-esters in the first place?

Apo-ester is a synthetic yellow colorant, with good stability in premixtures and complete feed. It also has a high deposition rate in the yolk, making it an effective egg yolk colorant.

Its ability to be applied through premix facilitates the proper dispersion in the final feed, which is relevant if micro-dosing systems are lacking in the feed mill.

Why was the legislative change necessary?

The legislative change which limits the use of synthetic apo-ester is based on the precautionary principle and in line with a broader market trend: away from synthetic (non-natural) components, towards the use of naturally occurring alternatives.

The alternative to apo-ester

Natural yellow pigments, typically based on lutein and zeaxanthin produced from marigold oleoresin, are available in the market and can be used to reach the egg yolk pigmentation desired by the consumer. In contrast to apo-ester, these natural solutions are functional antioxidants, further contributing to the egg's nutritious composition.

Challenges for natural alternatives

However, stability in premixtures and complete feed can be a challenge, with inconsistent yolk coloration as a risk. Safety can also be an issue, so it is important to ask for Quality Control measures routinely applied to avoid contamination with undesired substances (e.g., dioxins). To limit the risk of producing eggs with insufficient yolk coloration, it is important to select natural pigments with excellent stability and deposition efficiency.

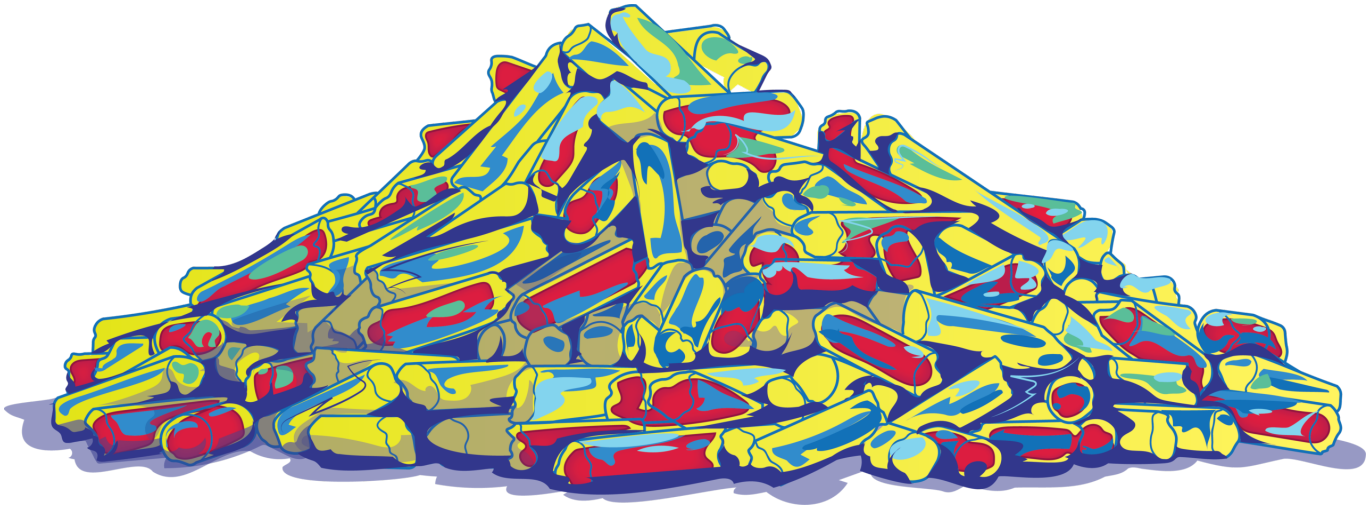
What is the best natural alternative to apo-ester?

EW Nutrition's natural pigment Colortek® Yellow B, produced with a proprietary technology, withstands the harsh conditions in premixtures, while the unique saponification process provides unparalleled deposition rates.

Moreover, Colortek® Yellow B is the most concentrated natural pigment on the market, making it the perfect premix-delivered colorant in the egg industry. If you want to produce all-natural eggs without worrying about the stability of the product or the reliability of your egg coloration, please contact your local EW Nutrition person.

Encapsulation: How a modern phytogenic feed additive makes

all the difference



By Technical Team, EW Nutrition

Secondary plant extracts have been shown to improve digestion, have positive effects on intestinal health, and offer protection against oxidative stress in various scientific studies in recent years. Their use as a feed additive has become established and various mixtures, adapted to the various objectives, are widely available.

However, their use in pelleted feed has been criticized for some time. In particular, an unsatisfactory reproducibility of the positive influences on performance parameters is the focus of criticism. The causes invoked for the loss of quantifiable benefits are inadequately standardized raw materials, as well as uncontrollable and uneven losses of the valuable phytomolecules contained during compound feed production.

Delivery mechanisms influence product benefits

The animal production industry has long attempted to reduce its need for antibiotic drugs to an indispensable minimum. As a result, more natural and nature-identical feed additives have been used for preventive health maintenance. These categories include numerous substances that are known in human nutrition in the field of aromatic plants and herbs, or in traditional medicine as medicinal herbs.

The first available products of these phytogenic additives were simply added to compound feed. The desired parts of the plant were, like spices and herbs in human nutrition, crushed or ground into the premix. Alternatively, liquid plant extracts were placed on a suitable carrier (e.g. diatomaceous earth) beforehand in order to then incorporate them into the premix. These procedures are usually less than precise and may be responsible for the difficult reproducibility of positive results mentioned at the beginning.

Another negative factor that should not be underestimated is the varying concentration and composition of the active substances in the plant. This composition is essentially dependent on the site conditions, such as weather, soil, community and harvest time [Ehrlinger, 2007]. In an oil obtained from thyme, the content of the relevant phenol thymol can therefore vary between 30% and 70% [Lindner, 1987]. These extreme fluctuations are avoided with modern phytogenic additives through the use of nature-identical ingredients.

Effective encapsulation is key to stability

The loss of valuable phytomolecules under discussion can also be traced back to the natural origin of the raw materials. Some phytomolecules (e.g. cineole) are volatile even at low temperatures. In regular medicinal use, this effect is mainly employed with cold products. Thus essential oils, such as of mint and eucalyptus, can be added to hot water and inhaled via the resultant steam.

In the process of pelleting in compound feed production, temperatures between 60°C and 90°C are common, depending on the type of production. The process can last for several minutes until the cooling process is over. Sensitive additives can be easily inactivated or volatilized during this step.

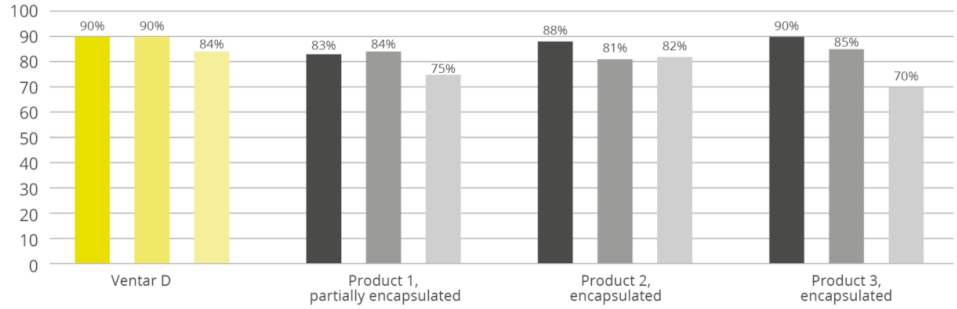
A technical solution for the preservation of temperature-sensitive additives is using a protective cover. This is, for instance, an already established practice for enzymes. Such so-called encapsulation is already used successfully in high-quality products with phytogenic additives. The volatile substances should be protected by a coating with fat or starch so that the majority (>70%) of the ingredients can also be found after pelleting.

Unfortunately, complete protection is not possible with this capsule, as this simple protective cover can be broken open by mechanical pressure during grinding and pelletizing. New types of microencapsulation further reduce losses. In a sponge-like type of microencapsulation, if a capsule is destroyed, only a small proportion of the chambers filled with volatile phytomolecules are damaged.

High protection and recovery with Ventar D

A new type of encapsulation, developed by EW Nutrition for use in feed, delivers further optimization. Results show that the technology implemented in Ventar D ensures very high recovery rates of the sensitive phytomolecules even under demanding pelleting conditions.

In a comparative study with encapsulated products established on the market, Ventar D was able to achieve the highest recovery rates in all three tested scenarios (70°C, 45 sec; 80°C, 90 sec; 90°C, 180 sec). In the stress test at a temperature of 90°C for 180 seconds, at least 84% of the valuable phytomolecules were recovered, while the comparison products varied between 70% and 82%. A constant recovery rate of 90% was achieved for Ventar D under simpler conditions.



Phytomolecule recovery rates under processing conditions, relative to mash baseline (100%)

Site-specific release of active ingredients

The major gastrointestinal pathogens (like *Clostridia* spp., *Salmonella* spp., *E. coli,* etc.) are present across the gastrointestinal tract after the proventriculus. This leads to infection or lesions at different sites of preference, reaching up to ceca. Any feed-based solution should have a profound antimicrobial effect. It is, however, also crucial that active ingredients are released across the gastrointestinal tract, for a better contribution to intestinal health.

The unique, innovative delivery system used for Ventar D specifically addresses this point, which many traditional coating technologies do not. Other encapsulation technologies tend to release the active ingredient either too early or too late (depending on the coating composition). The active ingredients in Ventar D reach across sites in the gastrointestinal tract and exert antimicrobial effects, supporting optimal gut health and improving performance.

Economically and ecologically sustainable

In the past, the losses mentioned in compound feed production and especially in pelleting were described as largely unavoidable. To obtain the desired effect of the valuable phytomolecules in the finished product, higher use of products was recommended and thus increased costs to the end-users and the associated CO_2 footprint, lowering sustainability overall.

The modern encapsulation technology used in Ventar D now offers significantly better protection for the valuable phytomolecules and, in addition to the economic advantage, also offers more efficient use of the resources required for production.

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Water Hygiene: The missing ingredient for successful ABF poultry

By T.J. Gaydos

Water quality is a frequently overlooked part of animal production and it becomes even more important when producing animals in an antibiotic-free (ABF) system. Chickens drink almost twice as much water as they consume feed, and water hygiene is often a second-level priority. Microbes present in water can be primary or secondary pathogens or non-pathogenic. Consuming impure water can add a challenge to the immune system, negatively impacting performance.

Water hygiene is essential for achieving antibiotic-free poultry production

Significant resources are spent on the correct nutrients in the diet and the correct additives for bird health. Water quality should be a priority, and a water quality monitoring program is essential for success in an ABF program. All things being equal, animals will perform better if they have access to high-quality water.

The variability of water quality in the grow-out region should determine how many water quality samples are taken. In highly variable areas, water quality should be measured at every season change on enough farms in every region to know if the solutes are changing. If the water quality is good and consistent, monitoring may be reduced significantly. Water quality should be a part of a “problem farm” work up or related to otherwise unexplained poor performance.

Water-soluble additives: Prevent biofilm

The use of water-soluble products is common in ABF production systems and their frequent use may provide a carbon source for bacteria. This, along with warm temperatures and slow water flow in enclosed water systems, makes the perfect environment for biofilm development.

It is important to frequently flush lines, give birds access to fresh water between additives, and sanitize

water lines after using a product that can provide nutrients to bacteria in the line. The biofilm is a perfect location to harbor and protect pathogens from acids and mild or under-dosed disinfectants.

Designing a water quality program

Sample collection

The first step to building a water quality program is to understand the challenge on every farm. Correct sample collection is critical to achieving good results. Take a water sample from as close to the well as possible and submit for water quality analysis: pH, hardness, and minerals. This sample should also be submitted for bacterial load: total aerobic plate count (CFU) per mL and total coliforms per mL.

Monitor bacterial load

A drip sample should be collected from the end of the line for bacterial load analysis as well. This will help determine if the bacterial challenge begins at the source or is limited to the house. Additionally, a swab from the inside of the end of the water line should be taken to determine the level of biofilm. The total bacterial count should be less than 1,000 CFU/mL without fecal coliforms in a free-flowing sample, and total bacteria should be less than 10,000 CFU/mL on a biofilm swab.

Monitor water pH

Water should have a pH between 5 and 8. Water with a pH consistently lower than 5 can be damaging to equipment, while a pH over 8 reduces the efficacy of many disinfectants and can have a bitter taste to birds. Hard water can increase scaling of lines and equipment, leading to leaking seals. Scale also provides a matrix for biofilm formation, making cleaning and disinfection more difficult.

Clean and disinfect water lines

Cleaning water lines between flocks is the minimum program for ABF production. Stabilized hydrogen peroxide products are excellent for disinfecting water lines between flocks. The levels needed for proper disinfection of lines are generally too strong for birds, and the lines must be flushed prior to bird placement.

Water lines are often only cleaned in the house; it is important to periodically clean the lines that transport water from the well or water source to the poultry house as this may be a significant reservoir for bacteria. If the well is identified as a source of contamination, it is essential to seek the help of a qualified technician before adding any sanitizing product to a wellhead.

Continuous disinfection

Ideally, water should be continuously disinfected with a product that is approved for poultry consumption. One of the best products for continuous disinfection is chlorine dioxide, which is effective at reducing bacteria and also reducing the concentrations of some mineral components. High levels of iron in the water can create a favorable environment for *E. coli* and other bacteria such as *C. perfringens*.

In addition to disinfection, chlorine dioxide is an effective treatment to reduce soluble iron levels. High sodium and chloride levels can lead to flushing and promote the growth of some bacteria. If high levels of sodium and chloride are consistent across a grow-out region, it may be possible to decrease the levels in the feed to reduce flushing. If the levels of sodium and chloride are considerably high, reverse osmosis should be considered to improve water quality.

Bottom line: invest in high-quality water

Another effective product is stabilized hydrogen peroxide at an appropriate residual level for bird consumption. There are other options for water line sanitation that can be explored on a case-by-case basis.

There are excellent online resources [link] for poultry water quality. The important message remains, in any case, that investment in high-quality water is a critical step for success in ABF poultry production.

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Why ABF poultry producers need to invest in pullet rearing

By T.J. Gaydos

There is no more efficient place to invest than in pullets. Pullets are the future of an integrated company. Successful pullet rearing is simply attention to detail, management, serology, biosecurity, vaccination, and worming. Decisions, both good and bad, made during rearing will follow that company for a year. This is especially true related to the introduction of pathogens such as mycoplasmas, *Salmonella*, and reoviruses, which are persistent and can be vertically transmitted. The importance of biosecurity in any pullet program cannot be overstated, but it is even more critical in an antibiotic-free (ABF) program.

The 4 pillars of rearing pullets without antibiotics

1. Effective management

It is imperative to properly manage flock uniformity, weight, and frame size. For details on how to manage and feed pullets, it is always advised to use the technical support of the primary breeder company because no one knows their bird better than them. Pullet uniformity is critical to the success of the flock in the breeder house. Uniform and healthy pullets are easier to manage to peak and easier to feed for persistency of lay.

Uniform and consistent feed distribution is crucial to managing pullets: people must monitor feeding on a regular and consistent basis. Simply because the feed disappears before the next feeding does not mean it was distributed in an effective way to all birds. Non-uniform feed distribution is not only bad for uniformity but may train other undesirable behaviors such as race tracking, foraging, and roosting on lines to feed. These behaviors increase the risk for trauma and picking up pathogens in the litter.

There are multiple stressful transition periods in the life of a pullet. It is advised to spread the stressors apart as much as possible. Do not make major management changes, such as turning birds out, changing their lighting or feed program, all at the same time. The more gradual the transitions are, the easier it will be on the birds, and the more likely they will perform as desired.

2. Heightened biosecurity

It is recommended to have dedicated inside and outside boots for all growers, service technicians, and regular visitors. A divided entrance (i.e., Danish entry) is ideal to further limit the risk of bringing pathogens in from the outside. Rodent and insect control is another important facet of pullet biosecurity and must be closely monitored. Vehicles entering the farm must be consistently cleaned and disinfected.

Managing the risk of pathogen introduction via feed is important and feed hygiene should not be ignored. Visitors are almost always the cause of biosecurity breaks and pullets receive a lot of visitors including vaccination crews that travel between farms with equipment. Ensure that vaccination equipment is properly sanitized between farms and crews always use appropriate personal protective equipment.

3. Focus on intestinal health

One of the most difficult challenges to raising pullets is conferring early and uniform immunity to coccidia. These parasites can be managed successfully with chemicals, ionophores, or vaccine programs, although every program has pros and cons. A fundamental problem with an ionophore program is accidentally feeding ionophores (technically considered antibiotics) to ABF flocks due to logistic errors at the feed mill.

Chemical programs can be very effective at managing *Eimeria spp.* cycling. Most of the time they work a little too well and birds do not develop adequate immunity; consequently, putting flocks at risk of breaking with *Eimeria necatrix* after chemicals are removed from the diets. A coccidiosis vaccine program is the most sustainable for rearing pullets.

The relative low density of birds, compared to broilers, and the lower feed consumption and thus lower consumption of water can result in dry litter early. The reduced density can also make it difficult for birds to pick up oocysts early in the coccidiosis cycle. Several techniques may be used to increase the chance of success. Birds can be spray-vaccinated at the hatchery and again when placed in the house. Brooding the birds in a portion (e.g., ¼) of the house for the first 7 to 8 days before turning them out to half house, and then to full house can improve early cycling.

Carefully using built-up litter may improve exposure to beneficial microflora; thereby, improving gut health. Managing intestinal health with the correct non-antibiotic feed additives such as saponins, essential oils, and pre and probiotics can significantly improve pullet health.

A well-designed deworming program is important for bird health and uniformity. It is also essential to help reduce the risk of Blackhead disease, which is caused by *Histomonas meleagridis*, while its intermediate host is *Heterakis gallinarum* (cecal worms).

4. Tailored vaccination program

Building a vaccination program for pullets has two critical functions: protect the health of the pullets/breeders and protect the health of the offspring by conferring maternal immunity. The exact constituents of the program depend heavily on regional disease challenges. Matching the program to disease pressure is best accomplished with a combination of a rigorous serology program for hens as well as periodically checking the blood of processing-age broilers.

Serology combined with open communication between the breeder and broiler departments about disease challenges can greatly improve the antigen choices of the vaccination program. Pullet rearing is attention to detail – managing the small details will help the long-term success of the poultry company.

Necrotic Enteritis control for ABF poultry production

By T.J. Gaydos

Control of Necrotic Enteritis (NE) can be one of the most difficult challenges in a system without the availability of antibiotics. In addition, NE is a costly disease because of mortality and loss of performance. Necrotic enteritis is a multifactorial disease that requires damage to the intestinal mucosa, disruption of the intestinal microflora, and a toxin-producing strain of

***Clostridium perfringens*. If any one of these three items is removed or lessened, the severity or incidence of NE will be reduced.**

The 3 must-haves for antibiotic-free necrotic enteritis control in poultry

1. Prevent mucosal damage

The most common cause of damage to intestinal mucosa in broilers is excessive cycling of *Eimeria maxima*. The ubiquitous nature of this parasite in poultry production makes it one of the most important contributors to NE. This species of coccidia is most relevant with respect to NE because its life cycle invades deeper into tissues than other species leading to more damage to the intestinal mucosa.

The life cycle of coccidiosis lasts roughly seven days, with each cycle producing exponentially higher numbers of the parasite. Three consecutive replication cycles are needed to produce immunity. The biology of *E. maxima* is a significant reason why NE commonly occurs around 18-21 days. However, many other things may damage the intestinal mucosa, including mycotoxins, worms, and rancid fat. Managing all sources of mucosal disruption are critical to preventing and controlling NE.

2. Support the microflora

The importance of the microbiome on health is well known; the ability to modify the microbiome to a more appropriate or healthy status is a more difficult challenge. There is a tremendous volume of research in all species about the impact and importance of intestinal microflora on immunity, health, and disease. The microflora is not static but rather a dynamic community of microorganisms that change with bird age, time of day, composition of the diet, and treatment with antibiotics or other additives. Management of intestinal microflora is a very difficult process because its development and manipulation are not fully understood.

Any significant feed formulation or feed form change is a stress event for intestinal microflora. Feed changes are thus high-risk periods for the development of NE. It is a best practice to avoid feed changes when birds are in the NE risk window. It is important to support the intestinal microflora with either in-feed or in-water products to improve intestinal health during feed changes.

It is important to avoid feed outages. After a feed outage, the disruption to the microflora and the increase in mucus production increases the likelihood of an NE outbreak in the following days. Preemptively adding a water additive to improve intestinal health directly after a feed outage can reduce the risk of NE in the flock.

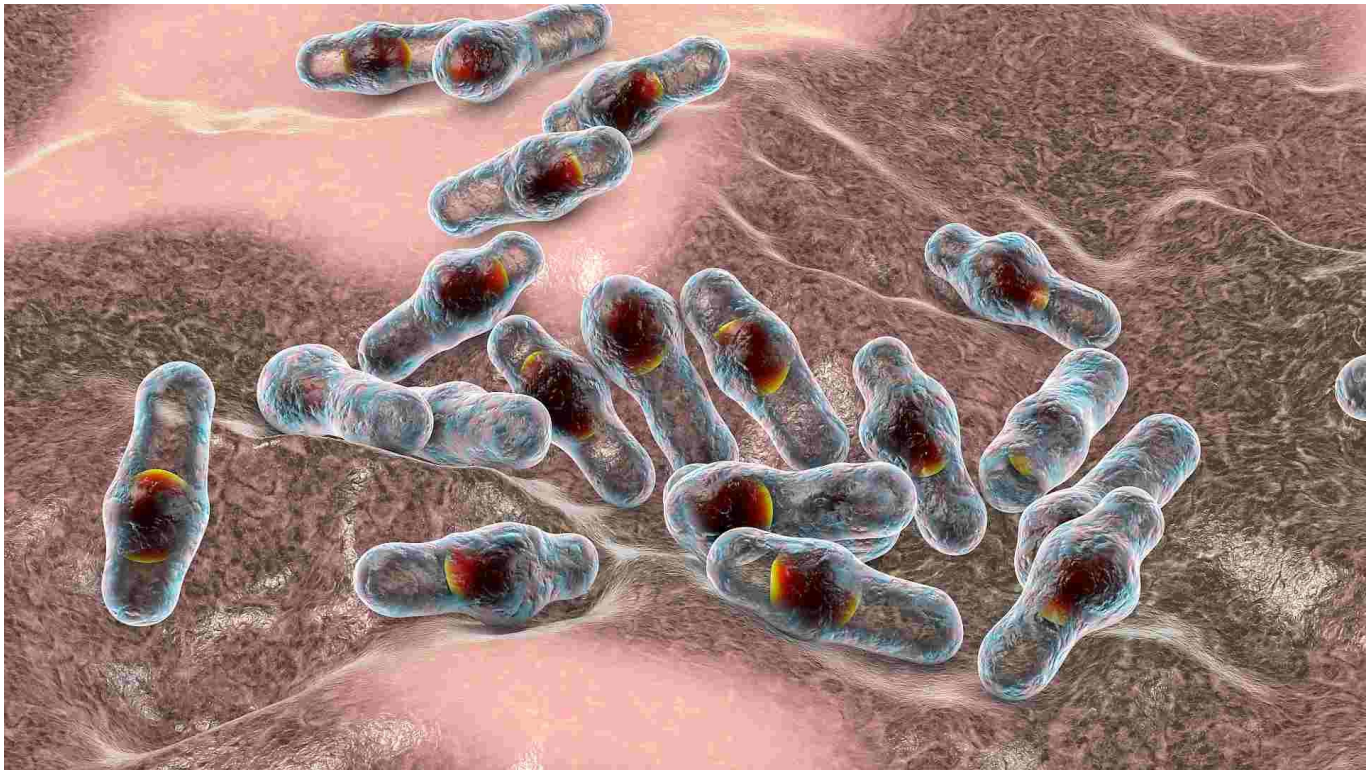
When managing intestinal microflora: probiotics, prebiotics, plant extracts, enzymes, and organic acids are the most commonly used tools. Each of these product classes interacts with the bird and its flora in a different way and selecting additives with complimentary modes of action is critical to the success of the program. Direct colonizing organisms like *Lactobacillus* spp. can help to directly change the microflora, providing a more mature and healthier microbiome.

Prebiotics such as mannan- and fructo-oligosaccharides provide a food source for beneficial microorganisms and can interact directly with the immune system of the bird. Plant extracts can have antimicrobial or anti-inflammatory properties that can also modulate the microflora by impacting the growth and metabolism of different species of microorganisms in the intestine.

3. Limit *Clostridium perfringens* growth

It is not possible to eliminate toxin-producing *C. perfringens* from the environment. Clostridia are spore-forming microorganisms that are very resistant to disinfectants. However, it is possible to manage the abundance of these microorganisms in a system through proper litter management, sanitation, and disposal of mortality.

A house that has a history of NE should have the litter completely removed and the environment cleaned and disinfected as much as the facility will allow. New clean shavings should be brought into the house at a sufficient depth to limit access to the floor. Several non-antimicrobial feed and water additives have shown promise in reducing numbers of *C. perfringens* in feces of infected birds. Feed and water additives are an essential tool to reduce the impact of NE.



Conclusion: the more you prevent, the less you have to treat

Even with the best management practices, outbreaks of NE will happen. In order to successfully treat a flock with NE, it is critical to catch the mortality early. Once a flock is experiencing high mortality from NE, it is very difficult to treat because the sickest birds will not be drinking enough water to receive a significant amount of water additives. Treating or managing an outbreak is as much art as science, but it is a combination of reducing the inciting causes.

Manage microflora and clostridial growth with organic acids, copper sulfate, phytogenics, or probiotics. Reduce coccidiosis cycling with amprolium, saponins, or other phytogenics. With excellent husbandry, the impact of NE can be reduced drastically even without using antibiotics. Managing NE incidence in poultry is a mixture of animal husbandry, managing coccidiosis cycling, feed and water additive selection, and high-quality nutrition.

Nutrition and feeding in ABF poultry production

By T.J. Gaydos

Management practices and feed additive selection are often discussed when working in antibiotic-free (ABF) poultry production. Nutrition is another critical component of any agricultural animal system. Working with a qualified nutritionist will help ensure that the diet is correctly formulated with high-quality ingredients.

5 nutrition tips for antibiotic-free poultry production

1. Consider feed form and delivery

Feed form and delivery are nearly as important as the nutrient content of the formulation. If feed form or handling is improper and feed separates, is improperly mixed, or oxidized, the birds will not appreciate the effort that went to develop a balanced diet. A durable pellet or crumble is important to allow all birds to have equal access to a nutritionally complete diet with every bite.

Additionally, if the finished feed or individual ingredients are not stored properly, they may not have the same value that is attributed to them in the formulation process. Other than correct nutrient formulation, three parts of the diet that should be considered are feed additives, mycotoxin contamination, and lipid oxidation.

2. Prevent oxidative stress

The impact of oxidative stress on the intestinal mucosa, immune system, and performance is well-documented across species. Oxidized fat sources reduce the available energy, but equally significant to bird health is the reduction in vitamin availability, resulting in increased oxidative stress for the animal. Protecting the sources of fat and the finished feed is important to spare fat-soluble vitamins, specifically vitamin E.

Oxidized fat can also irritate the intestinal mucosa leading to decreased absorption of nutrients. The process of breaking down macromolecules during digestion and converting them to forms useful for further metabolism is a significant contributor to oxidative stress. The immune system is also a great contributor to oxidative stress. Immune cells use reactive oxygen species to kill pathogens that are phagocytosed.

A large portion of the immune system is located in the GI tract in order to protect the animal from pathogens crossing from the gut into the animal. In addition to being a contributor to oxidative stress, the immune system can be negatively impacted by oxidized feed (Liang et al., 2015). The combination of metabolic and immune activity in the intestines puts it at a high risk of damage from oxidative stress. It is vital to protect fat sources with synthetic or natural antioxidants; reducing the incoming stress from oxidized fat should be a priority to improve poultry health.

3. Mitigate mycotoxin risks

Another risk to bird health and mucosal integrity is mycotoxins. Diets containing mycotoxins may damage the mucosa of the GI tract directly or may damage other organs leading to significant health challenges and decreases in performance. Some mycotoxins or compounds created by fungi can disrupt the intestinal microflora by acting on bacterial cells, as many fungal metabolites are antimicrobial.

The best approach to managing mycotoxins is eliminating them from the system by purchasing high-quality grain and storing it appropriately. It is impossible to completely eliminate all risks of receiving ingredients contaminated with mycotoxins. An internal program should be developed to test the incoming ingredients and finished feed regularly for mycotoxins.

Knowing the challenging ingredient sources may help reduce the risk to highly susceptible birds like Breeders or chicks through dilution in formulation or the addition of toxin binders and/or enzymes. Several toxins may be found in a feed stuff and many of the mycotoxins are synergistic in their deleterious effects (Murugesan et al., 2015). Different binders have varying affinity for different mycotoxins; closely examining the product literature can help to choose the correct product to mitigate risk.

4. Choose optimal additives

Choosing the correct feed additive program for intestinal health, food safety, and growth performance depends on the specific challenges in the complex. When selecting a feed additive that is not FDA approved, it is important to base the decision as much as possible on scientific evidence through peer-reviewed research.

In addition to published data, internal testing within the production system is also helpful to ensure the product matches the local challenge. In a market saturated with “natural” products, it is essential to find a supplier that is trustworthy and is engaged in the success of the complex and health of the birds, not only in selling products. A partnership will be much more successful in the long term than only a buy/sell arrangement.

5. Manage expectations

When considering removing antibiotics from a program, the temptation is to expect natural products to completely replace the efficacy of antibiotics. This is an unreasonable expectation. The success of a transition to ABF production relies on modifying management practices as well. The vast majority of program success is related to attention to the details of husbandry, biosecurity, and sanitation. The remaining opportunity to improve health rests on the additive program.

References

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EW Nutrition launches Pretect D to support poultry gut health during challenging periods

VISBEK, 28 September – EW Nutrition announces the launch of a novel gut health solution for poultry. Pretect D, a proprietary blend of phytomolecules, helps maintain bird performance and farm profitability.

Trials indicate that Pretect D offers natural support even during *Eimeria*-related challenges, making it an effective addition to programs focused on gut health issues.

“EW Nutrition is a front runner when it comes to innovations driving lower use of antibiotics and harmful chemicals in the animal production industry,” says Michael Gerrits, Managing Director. “The introduction of Pretect D signifies our commitment to helping customers make livestock production more sustainable through best-in-class natural solutions.”

Research with Pretect D conducted around the globe, in research institutes and under commercial conditions, evidenced improved body weight and lower feed conversion rate. EW Nutrition is also following up on initial results indicating significant oocyst count reduction.

“Poultry producers are affected by reduced animal performance and high costs for preventive and therapeutic control,” says Madalina Diaconu, Product Manager for Pretect D. “What our product brings to the market is an ability to support the natural defenses of birds. We’re also investigating our product’s ability to impair the growth cycle of the *Eimeria* population.” Pretect D is developed to be used in combination with vaccines, ionophores and chemicals, as part of the shuttle or rotation program.

About EW Nutrition

For the global animal production and feed industries, EW Nutrition offers innovative, comprehensive solutions for gut health, feed quality, pigmentation, digestibility, on-farm performance and more.

Headquartered in Germany, with R&D and manufacturing facilities around the world, EW Nutrition owns the entire value chain, from development and scale-up to production, distribution, and support in 90+ markets.