Eggshell quality: 3 solutions for older laying birds

by Ruturaj Patil, Product Manager Phytogenic Liquids, EW Nutrition

Older laying birds are still a valuable asset, as long as they are managed for performance and productivity. Eggshell quality is one of the elements that, without proper management, can quickly deteriorate. It is therefore essential that the egg producer takes into account all the necessary elements for the formation of high-quality eggs.

The eggshell, in a nutshell

The eggshell represents ten percent of the entire egg, by weight[i]. For instance, a 60-gram egg contains approximately 6 g of shell. Out of this particular shell, approximately 95% is $CaCO_3$[ii], with a total of 2.3 g of Calcium (Ca).

But where does the calcium in the eggshell come from?

The Ca required for the eggshell is obtained, in variable proportions, directly from the feed or water additives (absorbed from the gut and transported via the blood to the shell gland), or from the bone (resorbed by osteoclasts and the Ca transported to the blood to the shell gland).

Maintaining eggshell quality and bone calcium: Mission Impossible?

Eggshell quality is often negatively correlated to bone strength[iii], most probably because body calcium is redirected to the shell to the detriment of the bones and the other way around. This impacts the long-term health of the skeleton; however, modern laying hens can maintain shell quality while preserving bone mineralization[iv].

60 to 75% of shell Ca is derived from the diet on shell-forming days

Approximately 60 to 75% of shell Ca is derived directly from the diet on shell-forming days[v]. This means that the greater the proportion of Ca coming directly from the feed or water additives, the better the eggshell quality can be. Therefore, the factors that can improve shell quality will also reduce the need to mobilize bone Ca and can also help to maintain skeletal health.

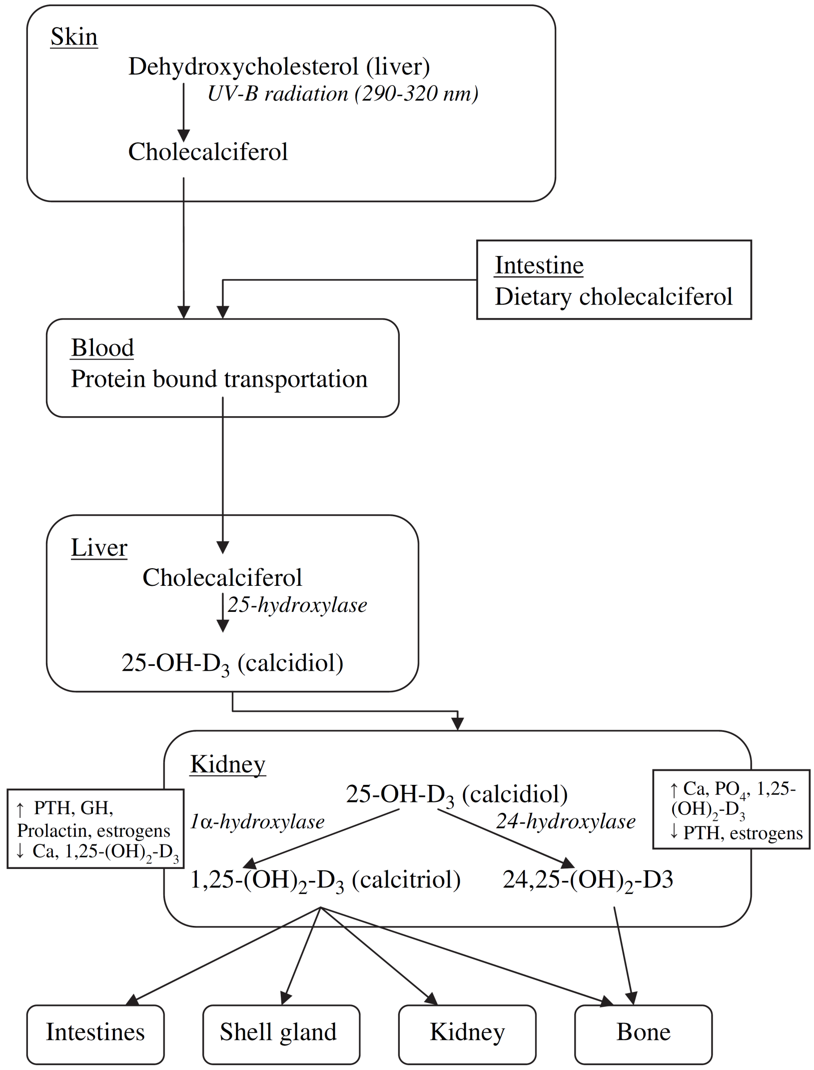
In old laying birds, generally after peak production, the ability to deposit Ca onto the shell remains relatively constant[vi], so an increase in egg size after peak production will tend to result in reduced shell quality. Dietary requirements for Ca tend to increase and those for phosphorus (P) tend to decrease as hens age.

Also, as hens age, the efficiency of Ca metabolism decreases[vii]. Increases in dietary Ca and a widening of the Ca:available P ratio are intended to counter this issue. Excess dietary P can also reduce shell quality[viii].

Because of its importance in Ca and P absorption from the gut, adequate dietary vitamin D activity must also be provided[ix]. Feeding of the vitamin D metabolite 25-OH vitamin D3 can help to maintain skeletal and shell quality in high-producing laying hens[x].

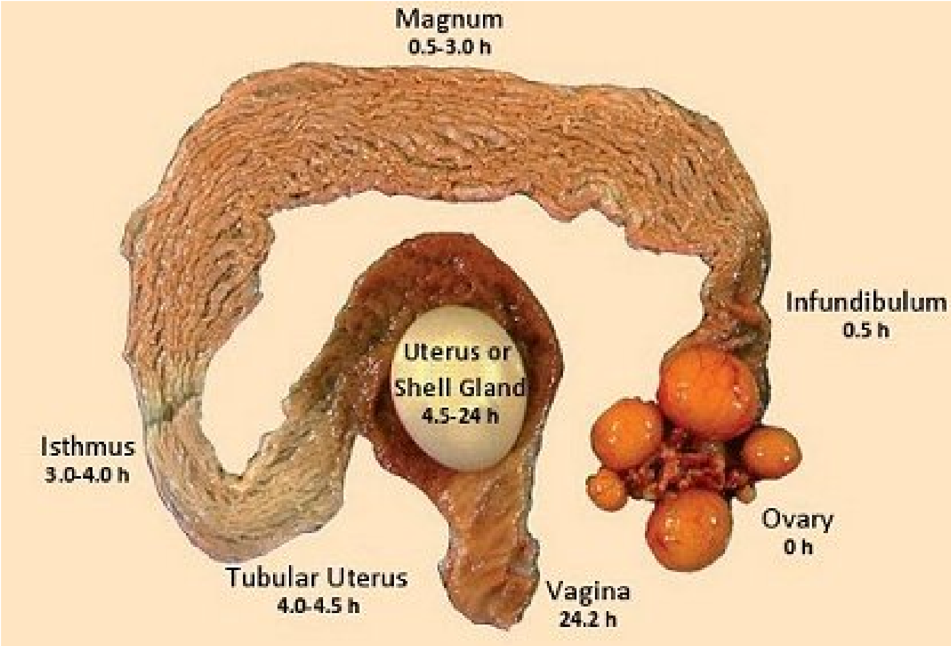
Ca metabolism is a complex game

Ca metabolism is regulated by various hormones such as calcitonin, 1,25-dihydroxyvitamin D3 (calcitriol), and parathyroid hormone. Estrogen, androgens, and prostaglandins also appear to have an important role in avian Ca metabolism.



Source: Ricardo (2008)

Egg formation and Ca requirements

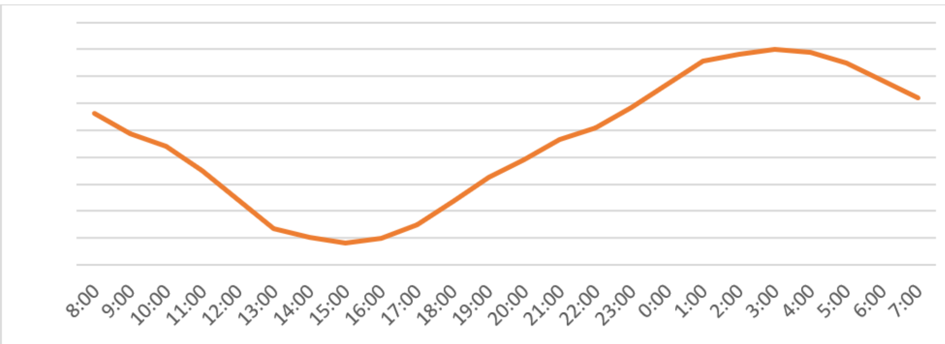


Source

A hen ovulates approximately 15 to 75 minutes following oviposition[xi], and the ovum takes approximately 4.25 hours to reach the shell gland[xii], at which point calcification takes approximately 17 hours[xiii]. Hens generally lay eggs in the morning and early in the afternoon[xiv]. The hen can use the Ca and P made available through diet to recover medullary bone losses during the next 5 hours after oviposition.

Once the ovum reaches the shell gland, the demand for calcium naturally increases greatly as eggshell formation progresses. The highest eggshell mineral accretion takes place 5 – 15 hours after the egg enters the shell gland[xv], which normally happens later in the afternoon and during the night preceding egg laying.

Hourly Ca requirements for eggshell calcification



Ca dietary requirements vary with species, age, breeding status, and dietary levels of vitamin D. Egg-laying birds and growing birds require more Ca than adult non-breeding birds.

Common eggshell quality problems and

causes

In many cases, the source of eggshell problems can be detected by recognizing the specific markers. For instance, cracked, soft-shelled or corrugated eggs can be caused by saline water, or the impact of mycotoxins; shell-les eggs can be caused by improper amounts of Ca, P, Mn or vitamin D3, as well as by infectious bronchitis or Newcastle disease IB. However, among the main causes of eggshell quality issues is heat stress.

In hot temperatures, increased respiration rates can cause an increase in CO_2 loss. The reduction of the pool of bicarbonate ions can result in respiratory alkalosis and an increase in blood pH[xvi]. A reduction in bicarbonate ions in the shell gland reduces the formation of $CaCO_3$ and decreases shell quality.

Under heat stress, birds will also tend to decrease their feed intake during the day to reduce diet-induced thermogenesis. Calcium intake is therefore also reduced, and shell quality decreases as a consequence.

3 solutions for eggshell quality in older layers

Midnight feeding in hot climates

At midnight, when temperatures are typically cooler, the addition of one to two hours of light can help the birds increase feed consumption[xvii]. Midnight feeding can also have the benefit of providing a dietary source of Ca to support eggshell formation during the night and reduce reliance on bone reserves[xviii].

Nutrition supplements

Along with Calcium, some micro-minerals can also influence eggshell quality. Zinc, Manganese and Copper act as cofactors of enzymes involved in the mineralization process during eggshell formation. Although European Union legislation restricts the use of high levels of these minerals, several studies in layers indicate increased egg shell resistance by increasing the dietary concentrations of microminerals. Using organic forms of Zinc, Manganese and Copper appears to be an alternative way to increase the absorption of these minerals, as organic forms appear to be more digestible than inorganic forms. Considering the high cost of organic minerals, a mix of organic and inorganic forms of critical minerals could be a better option.

Liquid Ca supplements

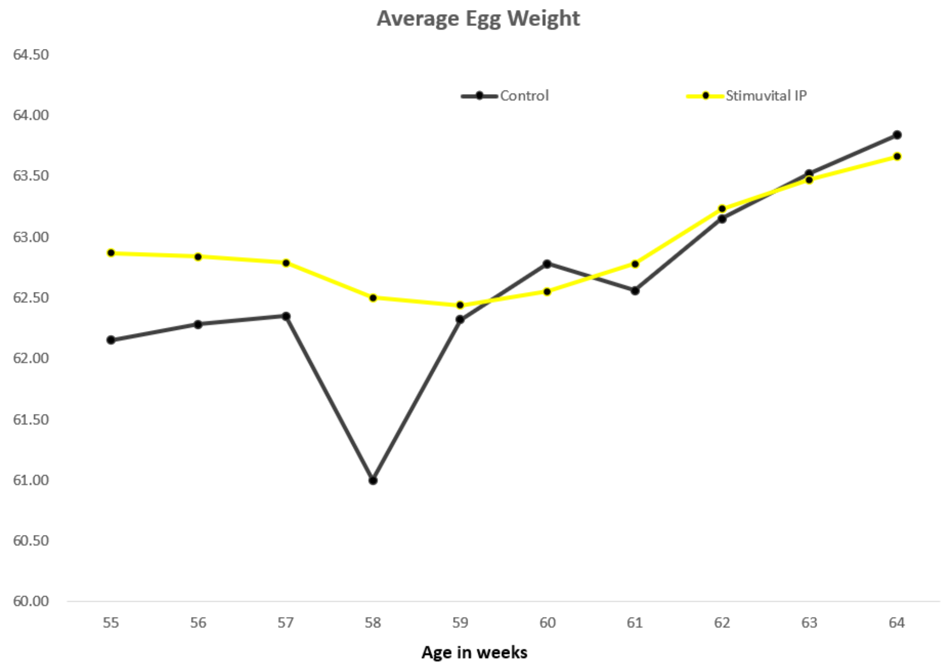
If a hen is fed a diet containing only a small-particle Ca sources, such as finely ground limestone, the intestine will be deprived of a source of Ca during the night, when demand for Ca is highest. At that point, the hen will be entirely reliant on bone Ca to support eggshell formation. A combination of Ca supplementation through water additives can be a good alternative as readily available Ca to the hen to support high Ca requirements during the late afternoon and through the night. Liquid Ca additives also offer further precise and user-friendly application.

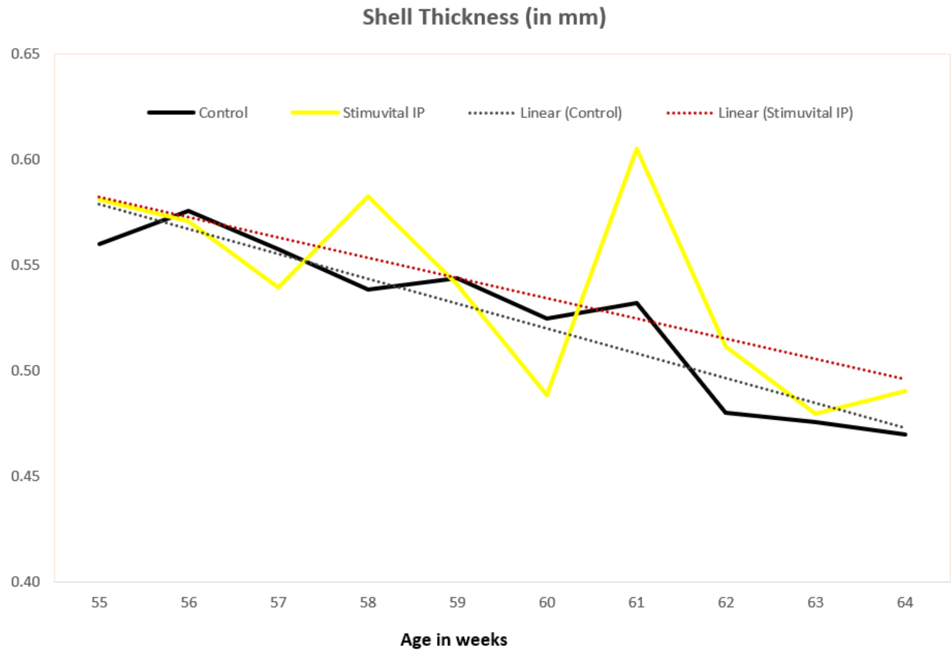
Stimuvital IP: a liquid solution from EW Nutrition

Stimuvital IP (formerly Shellimprover) is a liquid nutritional additive for laying hens, supporting the quality of eggshells and bone health. It contains a cocktail of Ca and vitamins whose benefits in laying birds are well proven through field studies, existing literature, and years of market experience.

Benefits proven in Australia field trial

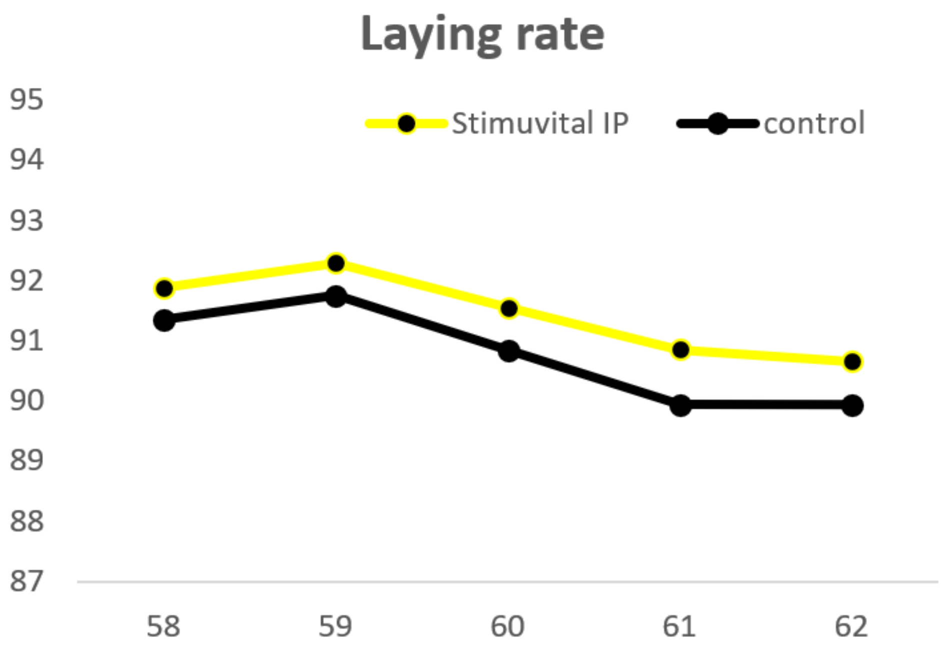
22,500 layer birds were split into two equal-size groups, one of which (11250 birds) was supplemented with Stimuvital IP for 3 days every two weeks, starting from age 53rd to 63rd week. Improvements in eggshell thickness and strength could be noticed after the application of Shellimprover. Egg weight was consistent in Stimuvital IP -supplemented birds.3 days every fortnight by using the Easy@ system. In total, the 11250 birds received (2 (feed lines) x 3 (times per days) x 265ml x 3 (days) x 6 (week 53, 55, 57, 59, 61, 63) 28620mll of Stimuvital IP.

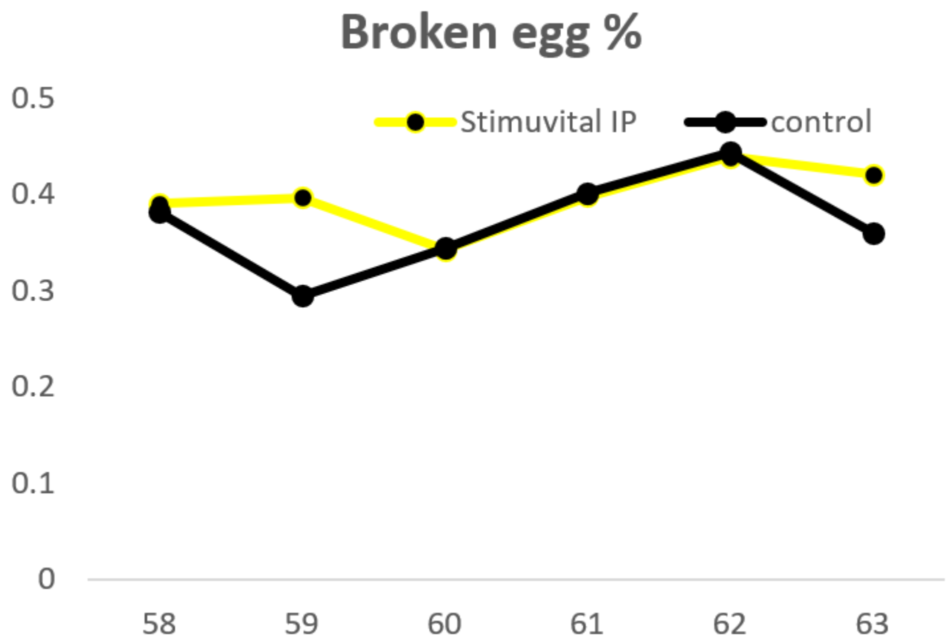


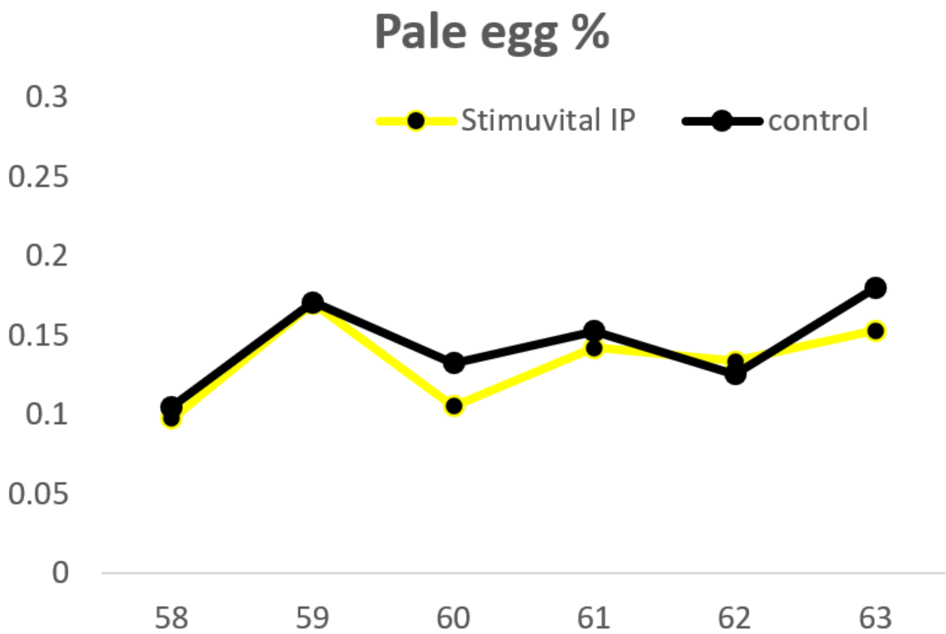


Benefits proven in China field trial

The field trial was carried out on a commercial layer farm. A control group and Stimuvital IP (Shellimprover) group had 50,000 birds each. Stimuvital IP was supplemented for 3 days every two weeks, starting from age 57th to 62nd week. The Stimuvital IP supplementation improved eggshell quality, including eggshell thickness, laying rate, and number of saleable eggs during the trial period.







Optimizing quantity, quality, and overall profitability for layer producers

Ca concentration in the blood is controlled by many interacting feedback loops that involve Ca, phosphate, PTH, vitamin D_3, and calcitonin. Supplementation of Vitamin D_3 can help maintain skeletal and shell quality in high-producing laying hens[xxiv].

Stimuvital IP offers an essential cocktail that caters to the additional requirements of Ca and vitamins in older laying birds. It thus supports Ca metabolism and eggshell quality. And, in the end, better eggshell quality reduces broken egg percentage and optimizes the number of salable eggs and profitability for layer producers.

Notes

[i] Pelicia *et al*., 2009; Bello and Korver, 2019

[ii] Nys *et al*., 2004

[iii] Orban and Roland Sr, 1990

[iv] Bello and Korver, 2019

[v] Driggers and Comar, 1949

[vi] Roland Sr et al., 1975

[vii] Wistedt *et al*., 2019

[viii] Miles *et al*., 1983

[ix] Wen *et al*., 2019

[x] Silva, 2017; Akbari Moghaddam Kakhki *et al*., 2019

[xi] Beuving and Vonder, 1981

[xii] Roberts, 2004

[xiii] Hincke *et al*., 2012

[xiv] Samiullah *et al*., 2016; Hunniford *et al*., 2017

[xv] Hincke *et al*., 2012

[xvi] Franco-Jimenez *et al*., 2007

[xvii] van Staaveren *et al*., 2018

[xviii] Harms *et al*., 1996

[xix] Chowdhury, 1990

[xx] Leach and Gross, 1983

[xxi] Zhang *et al*., 2017

[xxii] Atteh and Leeson, 1983

[xxiii] Atteh and Leeson, 1985

[xxiv] Silva, 2017; Akbari Moghaddam Kakhki et al., 2019

Full references are available upon request.

Moisture optimization: How to safeguard feed quality and feed mill efficiency

by Technical Team, EW Nutrition

In light of climatic challenges, variability in raw material quality and technical constraints, it can be challenging for feed manufacturers to optimize the water content in compound feed.

In combination with high temperatures, too much moisture in feed can favor the growth of mold. Molds spoil feed by depleting energy and nutrients and rendering the feed unpalatable. Even worse, some molds release toxins harm animals' health and performance. On the other hand, too little moisture in feed has a negative impact on feed digestibility and pellet durability, increasing the level of fines, process loss and energy consumption, while decreasing press yield (Moritz et al., 2002).

In this article, we look at how the right choice of processing aid is key to sustainably boosting feed mill efficiency. A concerted focus on moisture management when preconditioning the mash feed prior to pelleting allows feed producers to reap both economic and feed quality benefits.

Why moisture management requires both surfactants and organic acids

Moisture management starts with monitoring certain indicators. The moisture content measures the total amount of water contained in a substance, usually expressed as a percentage of the total weight. Feed manufacturers track the moisture contents of raw materials, mash feed, and pellets during all processing stages to optimize quality, yields, and profitability.

For the purpose of preventing mold growth, however, another indicator is even more critical: water activity (a_w) is technically defined as the ratio of partial vapor pressure of water in a substance to the partial vapor pressure of pure water under the same temperature and pressure conditions. What this captures is the energy state of water in a substance, i.e. its potential for (bio)chemical activity, including the growth of bacteria, yeasts, and molds. Simply put, microorganisms will usually not grow below a certain water activity level, and the higher the water activity, the higher the chance of microbial growth (Roos, 2003).

Minimum water activity (a_w) for growth and toxin production of toxigenic fungi affecting grains

		Minimum a_w	
Fungal species	**Mycotoxin**	**Growth**	**Toxin production**
Aspergillus flavus	Aflatoxin	0.78 – 0.84	0.84
Aspergillus parasiticus		0.84	0.87
Aspergillus ochraceus	Ochratoxin	0.77	0.85
Penicillium aurantiogriseum		0.82 – 0.85	0.87 – 0.90
Penicillium viridicatum		0.80 – 0.81	0.83 – 0.86

Aspergillus ochraceus	Penicillic acid	0.77	0.88
Penicillium aurantiogriseum		0.82 – 0.85	0.97
Penicillium patulum	Patulin	0.81	0.95
Penicillium expansum		0.82 – 0.84	0.99
Aspergillus clavatus		–	0.99
Fusarium verticillioides	Fumonisins	0.88	0.93
Fusarium proliferatum		0.88	0.93

Adapted from Magan, Aldred, and Sanchis (2004)

Can we condition feed with pure water?

Why does this matter? The intense friction during grinding and mixing results in heat; subsequently, moisture from the mash feed is lost in the form of vapor. These losses need to be mitigated, when the feed is too dry, the milling equipment cannot function optimally and the pellet quality deteriorates. However, simply adding water does not work well: Pure water does not readily bind to the feed; it effectively “sits on top” of the feed surface, increases the feed’s water activity and thus becomes a perfect substrate for microbial growth. Plus, pure water steam largely evaporates again when the feed is cooled.

Surfactants

Hence, at the conditioning phase, it is critical to add surfactants to the hydrating solution. Surfactants change the way water behaves: by reducing the surface tension of water, they enable the feed particles to absorb the water and ensure that it is evenly distributed throughout the feed. There are numerous beneficial effects as improved moisture retention

- facilitates the starch gelatinization during conditioning (important for pellet digestibility and durability),
- minimizes feed shrinkage at the cooling stage,
- reduces friction and hence the energy required for the pellet die (improving milling efficiency), and
- curbs microbial growth by reducing water activity.

While surfactants contribute to mold control, feed manufacturers also require the help of organic acids to optimize the moisture content in feed while reliably preventing mold (re)contamination hazards along the distribution chain.

Organic acids

Let us consider how the most effective one, propionic acid, works: In its non-dissociated state, propionic acid has all its hydrogen ions attached to the molecule. Once it enters a mold cell, the propionic acid dissociates, meaning the hydrogen ions separate from the molecule. They reduce the intracellular pH in the mold cell and inhibit its metabolic pathways, ultimately leading to cell death (Smith et al., 1983).

Common feed ingredients such as soybean meal, maize, wheat, barley, and dehulled oats are often stored for several months. Given variable and likely challenging temperature, oxygen, and moisture conditions, their water activity levels can easily escalate (Mannaa and Kim, 2017) – rendering the long-lasting anti-fungal activity of targeted organic acid preconditioning even more important.

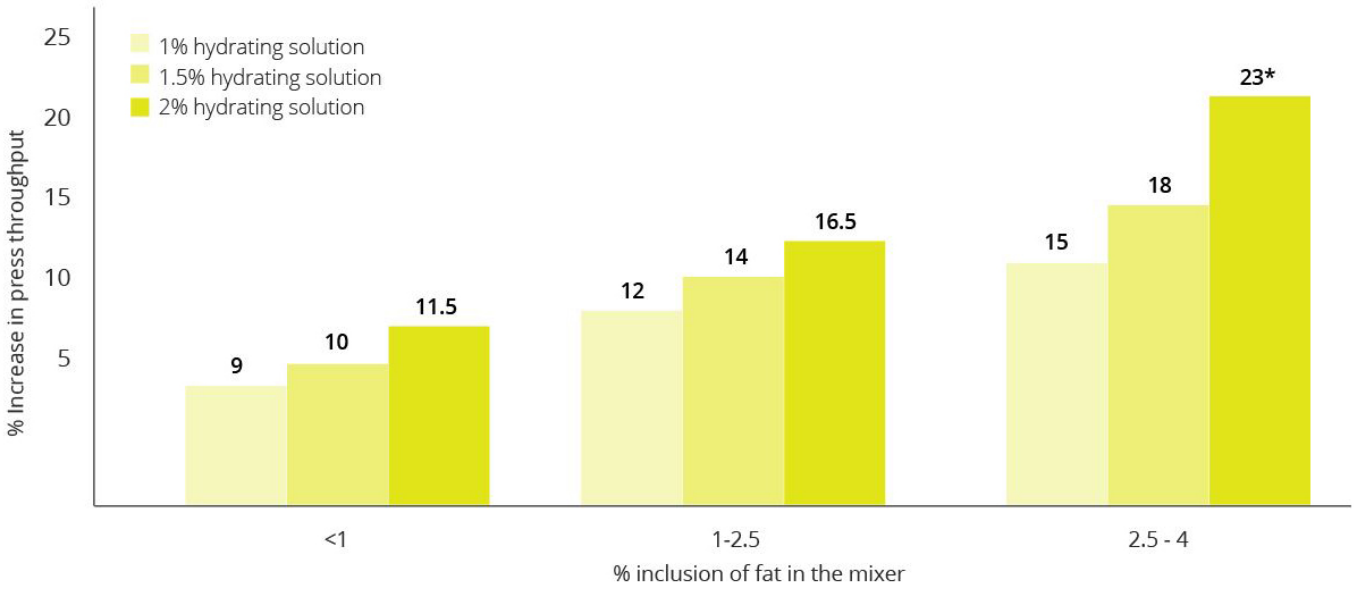
SURF•ACE: Improve mill performance and pellet quality

A synergistic blend of organic acids and surfactants can achieve the objective of adding moisture without risking either the subsequent loss of moisture during cooling or the development of mold. This is the working principle behind SURF•ACE™ feed mill processing aid, carefully formulated to best achieve the dual objective of higher feed quality and higher production efficiency. This objective is achieved in concordance with optimal resource use and lower energy requirements, thus also contributing to the feed industry's environmental commitments.

Improved press yield

The effect of adding SURF•ACE to diets with increasing levels of fat were evaluated at more than 40 feed mills, with production capacities ranging from 5 to 20 tons per hour, under identical electricity consumption conditions. The results show that the addition of SURF•ACE to the preconditioning solution increases press throughout (t/h), relative to pure water preconditioning, by between 9 and 23 %, depending on how much preconditioning solution is applied and the level of fat in the diet:

Addition of SURF•ACE increases press throughput



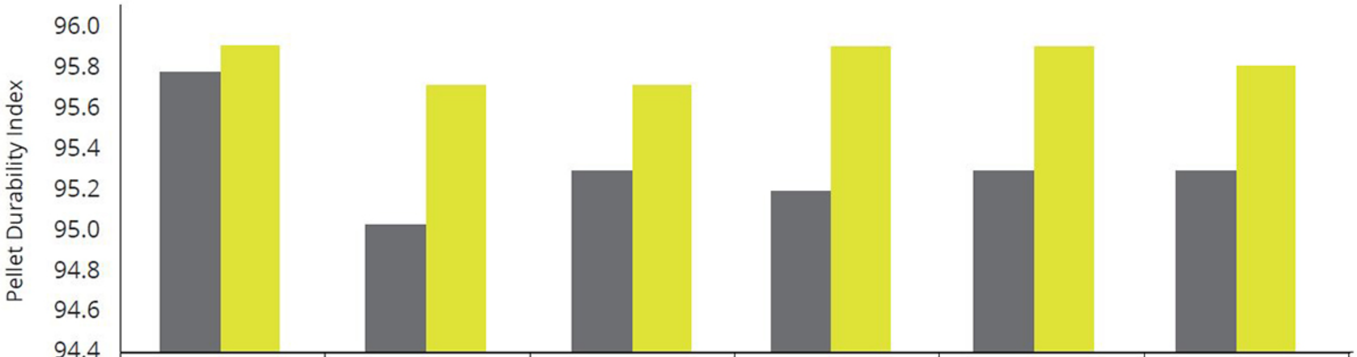
Including large volumes of hydrating solution in high-fat diets might adversely affect the durability values of the feed

What is the role of fat in this scenario? Dietary fat acts as a lubricant between the feed and the pellet die, reducing the pressure within the die. The higher the percentage of fat included in the mixer, the lower the energy required to process the mash (Pope, Brake, und Fahrenholz, 2018). The surfactants contained in SURF•ACE have an emulsifying effect; they help bind water to the fat element of the feed. The emulsion of water and fat "behaves" like fat, improving the lubrication of press and generating a higher throughput for the same electricity consumption.

Higher pellet quality

Importantly, adding SURF•ACE does not negatively affect pellet durability, a common issue in high-fat diets (Moritz et al., 2003). On the contrary, it enhances pellet durability as more crystal starch becomes gelatinized. This translates into improved results for Holmen pellet durability testing:

Addition of SURF•ACE improves pellet durability



	1	2	3	4	5	6
Holmen T0 Control	95.8	95.0	95.3	95.2	95.3	95.3
Holmen T1 SURF-ACE	95.9	95.7	95.7	95.9	95.9	95.8

Holmen T0 Control
Holmen T1 SURF-ACE

Pellets need to withstand significant pneumatic handling, for example, during bagging and transport, and in the feed lines. The Holmen durability tester simulates this handling, and calculates the percentage of fine generated, expressed as a pellet durability index (PDI). Across six different poultry compound feed types, SURF•ACE improves pellet quality and thus the PDI. Fewer fines equate to less reprocessing for feed manufacturers and higher palatability for animals.

The next level in compound feed production

Achieving optimal moisture levels in compound feed is a complex balancing act involving technical constraints, raw material variability, microbial challenges, and the price pressures of competitive feed markets. Feed mills generally operate within a particular comfort zone, a throughput and quality level at which they minimize production problems. Thanks to its dual surfactant and preservative effects, SURF•ACE feed mill processing aid expands the comfort zone in two dimensions: From an economic point of view, the improved lubrication gives mills the choice of either pushing their performance levels closer to their equipment’s potential capacity or achieving the same results at lower electricity use. From a feed quality angle, effective mold prevention and improved pellet quality allow for safer, more palatable feed – and from there we come full circle, to safe, nutritious food for all of us.

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How phytomolecules support antibiotic reduction in pig production

by Merideth Parke, Regional Technical Manager, EW Nutrition

To contain and reverse antimicrobial resistance, consumers and government regulators expect changes in pork production with the clear goal to reduce antibiotic use. For healthy, profitable pig production with simultaneous antibiotic reduction, a holistic strategy is required: refocusing human attitudes and habits, optimal pig health and welfare, and applying potential antibiotic alternatives.

Corn is often contaminated with Aspergillus fungi that can produce poisonous mycotoxins

Pig producers need to manage pathogenic pressure while reducing antibiotics

Intensive pig production has stress points associated with essential husbandry procedures such as weaning, health interventions, and dietary modifications. Stress is widely accepted to have a negative impact on immune system effectiveness, enhancing opportunities for pathogenic bacteria to invade at a local or systemic level. The gastrointestinal and respiratory systems are highly susceptible to developing disease as a result of these combined factors. Interventions such as antibiotics are commonly implemented to reduce the impact of pathogens and manage pig health. Processes that minimize the number of pathogens in the environment are the foundation for a successful antibiotic reduction plan. The challenge is to smartly combine strategies to keep the gastrointestinal and respiratory tract intact and robust.

Phytomolecules, the specific active defense compounds found in plants, have been identified as capable of enhancing pig health through antimicrobial (Cimanga et al., 2002, Franz et al., 2010), antioxidative (Katalinic et al., 2006, Damjanovic-Vratnica et al., 2007, Lee et al., 2011), digestion-stimulating and immune-supportive functions. As many thousands of phytomolecules exist, laboratory research has focused on identifying those with the capability of microbial management, facilitating the end goal of reducing the reliance on antibiotics for pig health and welfare and the production of safe pork (Zhai et al., 2018).

Which roles can phytomolecules play in reducing antibiotics?

The gastrointestinal tract benefits from applying phytomolecules such as capsaicin, carvacrol, and cinnamaldehyde, as they:

- support a balanced and stable biome,
- prevent dysbiosis, maintain tight junction integrity (Liu et al., 2018),
- increase secretion of digestive enzymes, and
- enhance gut contractility (Zhai et al., 2018).

Pigs most susceptible and in need of phytomolecule gastrointestinal supportive actions are piglets at weaning and pigs of all ages undergoing stress, pathogen challenges, and/or dietary changes.

Porcine respiratory disease is a complex multifactorial disorder. It frequently requires antibiotics to manage infection pressure and clinical disease to maintain pig health, welfare, and production performance. Causal pathogens may be transmitted by direct contact between pigs in saliva (Murase et al., 2018) or bioaerosols (LeBel et al., 2019), via the nasal or oral cavities (inhalation directly into the airways and lungs), or via an unhealthy gut. Phytomolecules such as carvacrol and cinnamaldehyde have antimicrobial properties. Hence, they may help contain respiratory pathogens in their natural habitat (the upper respiratory tract) or during transit through the oronasal cavity and gastrointestinal tract (Swildens et al., 2004, Lee et al., 2001).

In addition to supporting the gastrointestinal and respiratory systems, phytomolecules such as menthol and 1,8-cineole have been shown to enhance the physical and adaptive immune systems in multiple species (Brown et al., 2017, Barbour et al., 2013). When applied via drinking water, adherence to the oronasal mucosa facilitates the inhalation of the active phytomolecule compounds into the respiratory tract. There, they act as mucolytics, muscle relaxants, and enhancers of the mucociliary clearance mechanism (Başer and Buchbauer, 2020). Phytomolecules have also been documented to positively influence the adaptive immune system, promoting both humoral and cell-mediated immune responses (Awaad et al., 2010, Gopi et al., 2014, Serafino et al., 2008).

How phytomolecules feature in the holistic approach to antibiotic reduction

Antibiotic reduction programs positively enact social responsibility by reducing the risk to farmworkers of exposure to antimicrobial-resistant bacteria. They also help maintain or increase efficiency in safe pork production – pork with minimal risk of antibiotic residues.

Implementation of a successful health program with reduced antibiotic use will require:

- application of strict internal and external biosecurity processes;
- evaluation and monitoring of AMR bacteria;
- partnerships with specialist nutritionists to target a lifetime healthy gut biome; and
- phytomolecule-assisted health management (Figure 1).

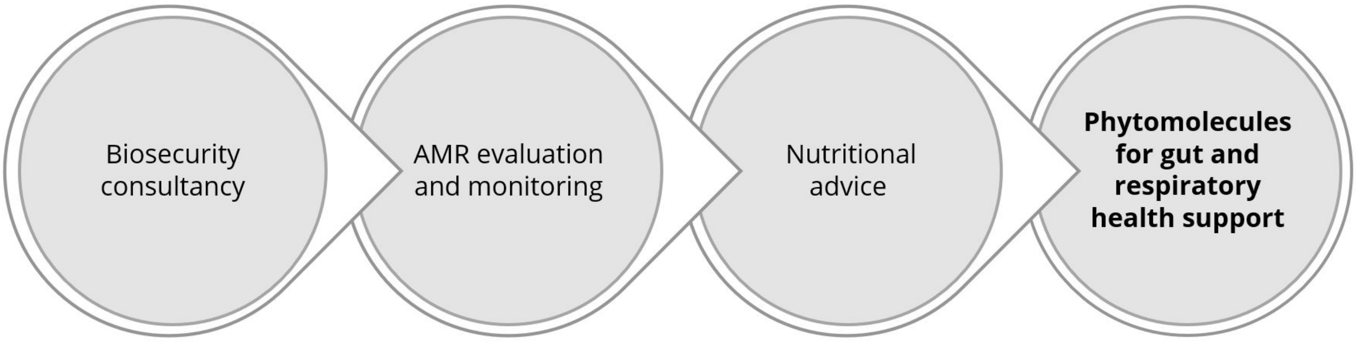

Figure 1: The role of phytomolecules within EW Nutrition's holistic Antibiotic Reduction program

A combination of *in vitro* and *in vivo* studies provides evidence that specific phytomolecules can support both enteric and respiratory systems through biome stabilisation and pathogen management (Bajabai et al., 2020). Antimicrobial activity of thymol, carvacrol, and cinnamaldehyde has been reported against respiratory pathogens including *S. suis, A. pleuropneumoniae*, and *H. parasuis* (LeBel et al., 2019)*;* multi-drug resistant and ESBL bacteria (Bozin et al., 2006); enteric pathogens including *E. coli*, *Salmonella enteritidis*, *Salmonella cholerasuis*, and *Salmonella typhimurium* (Penalver et al., 2005); *Clostridium* spp., *E. coli* spp., *Brachyspira hyodysenteriae* (Vande Maelle et al., 2015); and *Lawsonia intracellularis* (Draskovic et al., 2018). These results have shown phytomolecules to be effective antimicrobial alternatives for incorporation into holistic pig health programs.

Additionally, the inclusion of phytomolecules into pig production systems also enhances production performance by reducing the negative impact of stress on the pig and increasing the positive effects on gut health and nutrient utilization (Franz et al., 2010). Phytomolecules that directly impact digestive actions include capsaicin, which optimizes the production of digestive enzymes and increases serotonin for gut contraction maintenance and improved digesta mixing (Zhai et al., 2018). Cineol's antioxidative activities provide support during times of stress (Cimanga et al., 2002).

Phytomolecules are key to reducing antibiotics in pig production

The pig industry searches for alternatives to therapeutic, prophylactic, and growth-promoting antibiotic applications to keep available antibiotics effective for longer – and to address the social responsibility of mitigating AMR. This search for ways to produce safe pork has made it clear that only a combination of management and antibiotic alternatives can achieve these aligned goals.

Biosecurity, hygiene, stress reduction, and husbandry and nutritional advances form the foundation for the strategic application of specific phytomolecules (Zeng et al. 2016). Supporting pig production and health, this complete holistic solution (EIP-AGRI) moves the pig industry into a future where antibiotic reduction or removal, with equivalent or increased production of safe pork, becomes a reality.

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Feed hygiene in animal nutrition is vital – and organic acids help achieve it

by Technical Team, EW Nutrition

Feed safety is essential for animal health and performance – and food safety. Inadequate feed sanitization is still a problem across the globe. It impacts not only the feed industry and animal producers but also puts workers and consumers at risk of being exposed to harmful substances.

Developing a hygiene program for the whole feed chain needs to include proper monitoring of microbial growth, as well as feed processing methods that prevent feed contamination and enable decontamination. This article outlines the importance of feed hygiene and focuses on how organic acids help reduce contamination from “farm to fork”.

Corn is often contaminated with Aspergillus fungi that can produce poisonous mycotoxins

How to achieve feed hygiene

Feed hygiene requires the control of microorganisms throughout the feed production chain. However, producers or retailers can rarely certify or verify feedstuffs' safety due to the wide range of potential microbial contamination agents and hazards encountered in different feed environments (den Hartog, 2003). The relationship between feed and microorganisms varies, depending on the conditions: feed can transport pathogenic microorganisms and thus directly transmit disease; likewise, microorganisms can also be responsible for feed spoilage and thereby indirectly cause issues (Baer, Miller, and Dilger, 2013).

Since its foundation, the World Organization for Animal Health (OIE) has established standards, guidelines, and recommendations for toxin risk management, including for microorganisms that are transmissible via feed. Recurring outbreaks of *Salmonella*, *Escherichia coli,* and other familiar *Enterobacteriaceae* are a key concern for animal health professionals and the feed industry (Elsayed et al., 2021). However, as factors ranging from climate change to genetic mutations come into play, feed producers are working with moving targets; some of the most significant issues they might face tomorrow are unknown today. There are no easy solutions to these multifactorial problems – but in any case, corrective measures need to include quality control and quality assurance for assessing and managing the pathogenic and microbial risk situation.

To improve animal productivity sustainably, producers regularly experiment with modifying production techniques, innovating feed formulations, but also exploring new ingredients. The inclusion of new ingredients such as animal proteins, oils, and fermented products, among others, heightens the need for strict feed quality monitoring (Truelock et al., 2020). New ingredients come with causative agents of feedborne illnesses, some of which might be unknown (Goodarzi Boroojeni et al., 2016). Therefore, feed and animal producers need to consider how feed changes impact feed safety and include these hazards in their planning and risk assessments.

Better feed hygiene is crucial

For any animal production, feed processing constitutes the most crucial part of feed hygiene management, as it covers all treatments of the feed before ingestion. It is referred to as "hydrothermal processing" due to the use of heat that is required to kill most of the pathogens in raw materials, feedstuffs, and compound feed (Jones, 2011). However, whether or not hydrothermal processing will effectively eliminate a given pathogen depends on its heat resistance. Moreover, factors such as the type of feed components involved and water activity levels also need to be considered to reduce microbial pressure (Doyle and Mazzotta, 2000).

The new generation of feed milling equipment – besides elevating feed costs – can also improve feed quality (Truelock et al., 2020). These technologies tend to enhance feed stability and hygiene by modifying the physicochemical properties of the ingredients. This improves the absorption of nutrients, thereby enabling a higher feed intake efficiency with positive results for animal performance (Abdollahi, Svihus, and Ravindran, 2013). However, while increasing processing time at a given temperature can lead to a better decontamination process, it can also negatively affect some nutrients' dynamics. This includes enzymes, proteins, minerals, vitamins, fiber and starch, and especially non-starch polysaccharides (Goodarzi Boroojeni et al., 2014).

Organic acids as a solution of feed hygiene risk management

Hence, while significant progress in feed science and feed production technology has already been made, researchers and the industry are still searching for alternative approaches to supporting feed hygiene (Goodarzi Boroojeni et al., 2016). Organic acids are a central research field as they offer promising antimicrobial properties. In combination with feed mill techniques, they already play an essential role in feed preservation (Brul et al., 2002). Despite their efficacy in inhibiting microbial growth, weak organic acids are safe to handle (especially when they are buffered) compared to inorganic acids.

In addition to their preservative effect in feed, it has been shown that organic acids can support gut health. They are not just antimicrobial agents but also acidifiers that display their impact in the stomachs of monogastric animals (Tugnoli et al., 2020).

A combined solution for microbial contamination challenges

To support the feed industry and animal production in light of feed safety challenges in AGP-free production, EW Nutrition focuses research efforts on maximizing the beneficial effect of organic acids. The ACIDOMIX range of products supports the stabilization of the gastrointestinal microflora, inhibiting pathogenic bacterial growth in feed and water. Acidomix is an efficient acidifier specially formulated to have strong antimicrobial effects applicable in feed hygiene programs. Various powder and liquid solutions offer a wide range of benefits:

- Strong antimicrobial effect, supporting the prevention of bacterial infections
- Reducing the incidence of dysbiosis
- Acidifying the feed and digestive tract
- Supporting the improvement of production performance
- Preventing feed re-contamination
- Flexible application

Feedstuffs and compound feed are at risk of contamination and re-contamination throughout the feed production chain: processing, transportation, delivery, storage, and on-farm. Thus, a holistic and integrated approach that includes optimized feed mill processing and customized organic acids is required to improve the feed's hygiene status. The positive effects are clear: feed producers benefit economically, animal producers reap the effects of improved animal health and performance, and people get to enjoy producing and consuming safe and nutritious food.

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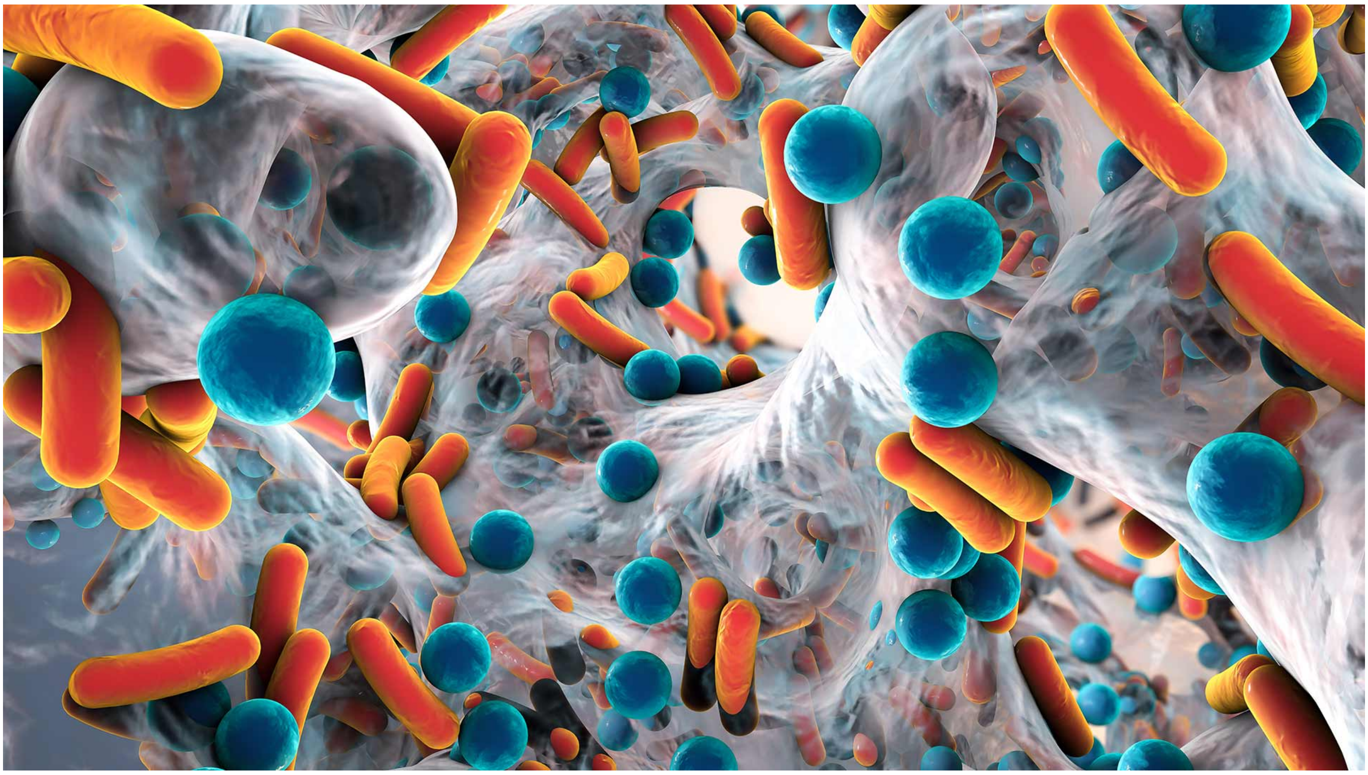
How producers keep the egg supply chain going amid COVID-19

The Covid-19 pandemic has increased consumer demand for eggs. This article discusses how the egg supply chain, from layer farms to supermarkets, works amid disruptions caused by Covid-19.

Antibiotic reduction: The increased importance of high-level biosecurity



Biosecurity is the foundation for all disease prevention programs (Dewulf, et al., 2018), and one of the most important points in antibiotic reduction scenarios. It includes the combination of all measures taken to reduce the risk of introduction and spread of diseases. It is based on the prevention of and protection against infectious agents by understating the disease transmission processes.

The application of consistently high standards of biosecurity can substantially contribute to the reduction of antimicrobial resistance, not only by preventing the introduction of resistance genes into the farm but also by lowering the need to use antimicrobials (Davies & Wales, 2019).

Lower use of antimicrobials with higher

biosecurity

Several studies and assessments relate that high farm biosecurity status and/or improvements in biosecurity lead to reduced antimicrobial use (Laanen, et al., 2013, Gelaude, et al., 2014, Postma, et al., 2016, Collineau, et al., 2017 and Collineau, et al., 2017a). Laanen, Postma, and Collineau studied the profile of swine farmers in different European countries, finding a relation between the high level of internal biosecurity, efficient control of infectious diseases, and reduced need for antimicrobials.

Reports on reduction on antibiotic use due to farm interventions are also available. Gelaude, et al. (2014), evaluated data from several Belgian broiler farms, finding a reduction of antimicrobial use by almost 30% within a year when biosecurity and other farm issues were improved. Collineau et al. (2017) studied pig farms in Belgium, France, Germany, and Sweden, in which the use of antibiotics was reduced on average by 47% across all farms. The researches observed that farms with the most strict biosecurity protocols, higher compliance, and who also took a multidisciplinary approach (making other changes, e.g. in management and nutrition), achieved a greater reduction of antibiotic use.

Biosecurity interventions pay off

Of course, the interventions necessary to achieve an increased level of biosecurity carry some costs. However, the interventions have proven to also improve productivity. Especially if taken with other measures such as improved management of newborn animals and nutritional improvements. The same studies which report that biosecurity improvements decrease antibiotics use also report an improvement in animal performance. In the case of broilers, Laanen (2013) found a reduction of 0.5 percentual points in mortality and one point in FCR; and Collineau (2017) reported a reduction in mortality in pigs during both the pre-weaning and fattening period of 0.7 and 0.9 percentual points, respectively.

Execution

Although biosecurity improvements and other interventions necessary for antibiotic reduction programs are well known, continuous compliance of these interventions is often low and difficult. The implementation, application, and execution of any biosecurity program involve adopting a set of attitudes and behaviors to reduce the risk of entrance and spread of disease in all activities involving animal production or animal care. Measures should not be constraints but part of a process aimed to improve health of animals and people, and a piece of the multidisciplinary approach to reduce antibiotics and improve performance.

Designing effective biosecurity programs: consider five principles

When designing or evaluating biosecurity programs, we can identify five principles that need to be applied (Dewulf, et al., 2018). These principles set the ground for considering and evaluating biosecurity interventions:

1. Separation: Know your enemy, but don’t keep it close

It is vital to have a good definition of the perimeter of the farm, a separation between high and low-risk animals, and dirty and clean internal areas on the farm. This avoids not only the entrance but the spread of disease, as possible sources of infection (e.g. animals being introduced in the herd and wild birds) cannot reach the sensitive population.

2. Reduction: Weaken your enemy, so it doesn’t spread

The goal of the biosecurity measures is to keep infection pressure beneath the level which allows the natural immunity of the animals to cope with the infections (Dewulf, et al., 2018). Lowering the pressure of infection e.g. by an effective cleaning and disinfection program, by the reduction of the stocking density, and by changing footwear when entering a production house.

3. Focus: Hunt the elephant in the room, shoo the butterflies

In each production unit, some pathogens can be identified as of high economic importance due to their harm and frequency. For each of these, it is even more important, to understand the likely routes of introduction into a farm and how it can spread within it. Taking into consideration that not all disease transmission routes are equally significant, the design of the biosecurity program should focus first on high-risk pathogens and transmission routes, and only subsequently on the ones lower-risk (Dewulf, et al., 2018).

4. Repetition: When the danger is frequent, the probability of injury is increased

In addition to the probability of pathogen transmission via the different transmission routes, the frequency of occurrence of the transmission route is also highly significant when evaluating a risk (Alarcon, et al., 2013). When designing biosecurity programs, risky actions such as veterinary visits, if repeated regularly must be considered with a higher risk.

5. Scaling: In the multitude, it is easy to disguise

The risks related to disease introduction and spread are much more important in big farms (Dorea, et al., 2010); more animals may be infected and maintain the infection cycle, also large flocks/herds increase the infection pressure and increase the risk by contact with external elements such as feed, visitors, etc.

Can we still improve our biosecurity?

Almost 100% of poultry and swine operations already have a nominal biosecurity program, but not in all cases is it fully effective. BioCheck UGent, a standardized biosecurity questionnaire applied in swine and broiler farms worldwide, shows an average of 65% and 68% in conformity, respectively, from more than 3000 farms between both species (UGent, 2020). Therefore, opportunities to improve can be found in farms globally, and they pay off.

To find these opportunities, consider three situations you need to know:

1. **Know your menace:** Identify and prioritize the disease agents of greatest concern for your production system by applying the principles of **focus** and **repetition**. Consider the size of the facility when evaluating risks applying the **scaling**
2. **Know your place:** Conduct an assessment of the facility. A starting point is to define the *status quo*. For that, operation-existing questionnaires or audits can be used. However, the “new eyes principle” should be applied and an external questionnaire such as BioCheck UGent (biocheck.ugent.be) is recommended. The questionnaire will help you identify gaps in your

biosecurity plan as well as **processes** that may be allowing pathogens to enter or move from one location to another, and measures that can be implemented applying the principles of **separation** and **reduction.**

3. **Know your processes:** Implement processes and procedures that apply the biosecurity principles and help to eliminate, prevent, or minimize the potential of disease. A deep evaluation of the daily farm processes will aid in risk mitigation, considering, among others, movement of personnel, equipment, and visitors, the entrance of pets, pests and vermin, dealing with deliveries and handling of mortality and used litter.

Compliance – The weak link in biosecurity programs

Achieving systematic compliance of biosecurity protocols on a farm is a complex, interactive, and continuous process influenced by several factors (Delabbio, 2006) and an ongoing challenge for animal production facilities (Dewulf, et al., 2018). Thus, it is clear that the biosecurity plan can only be effective if everyone on the operation follows it constantly, i.e. if everyone performs in **compliance**.

Compliance can be defined as the extent to which a person's behavior coincides with the established rules. Thus, compliance with biosecurity practices should become part of the culture of the facility. Poor compliance in relation with biosecurity can be connected to:

- Lack of knowledge or understanding of the biosecurity protocols (Alarcon, et al., 2013; Cui & Liu, 2016; Delpont, et al., 2020)
- Lack of consequences for non-compliance (Racicot, et al., 2012a)
- A company culture of inconsistent or low application of biosecurity protocols (Dorea, et al., 2010)

In general terms, compliance with biosecurity procedures has been found to be incomplete in different studies (Delpont, et al., 2020; Dorea, et al., 2010; Gelaude, et al., 2014; Limbergen, et al., 2017). In one study (Racicot, et al., 2011) used hidden cameras, to asses biosecurity compliance in Quebec, Canada and found 44 different biosecurity fails made by 114 individuals (farm workers and visitors) in the participating poultry farms, over the course of 4 weeks; in average four mistakes were made per visit. The most frequent mistakes were ignoring the delimitation between dirty and clean areas, not changing boots, and not washing hands at the entrance of the barns; these three mistakes were committed in more than 60% of the occasions, regardless of being farm employees or visitors. These are frequent breaches not only of those farms in Quebec but found frequently in many animal production units around the world and have a high probability of causing the entrance and spread of pathogens.

How to create a high biosecurity culture: start now!

Creating, applying, and maintaining a biosecurity culture is the most effective way to make sure that compliance of the biosecurity program and procedures is high on the farm. Decreasing, therefore, the probability of entrance and spread of pathogens, reducing the use of antimicrobials, and maintaining animal health. Some actions are recommended in order to achieve a high biosecurity culture:

1. Name an accountable person

Every operation should have a biosecurity coordinator who is accountable for developing, implementing, and maintaining the biosecurity program.

This important position should be appointed having in mind that certain personality traits may facilitate performance and execution of the labor (Delabbio, 2006; Racicot, et al., 2012; Laanen, et al., 2014; Delpont, et al., 2020) such as responsibility, orientation to action, and being able to handle complexity.

Additionally, expertise – years working in the industry – and orientation to learn are strategic (Racicot, et al., 2012).

2. Set the environment

When the farm layout is not facilitating biosecurity, compliance is low (Delabbio, 2006), thus the workspace should facilitate biosecurity workflows and at the same time make them hard to ignore (Racicot, et al., 2011).

3. Allow participation

It is important to mention that not only the management and the biosecurity coordinator are responsible for designing and improving biosecurity procedures. Biosecurity practices must be owned by all the farm workers and should be the social norm.

The annual or biannual revision of biosecurity measures should be done together with the farm staff. This not only serves the purpose of assessing compliance but also allows the personnel to suggest measures addressing existing -often overlooked– gaps, and to be frank about procedures that are not followed and the reasons for it. At the same time, participation increases accountability and responsibility for the biosecurity program.

4. Train for learning

Don't take knowledge for granted. Even when a person has experience in farm work and has been working in the industry for several years, their understanding and comprehension around biosecurity may have gaps.

People are more likely to do something when they see evidence of the activity's benefit. Therefore, if workers are told about the effectiveness of the practices, showing the benefits of biosecurity and analyzing the consequences of non-compliance, they are most likely to follow the procedures (Dewulf, et al., 2018). Knowledge of disease threats and symptoms also improves on-farm biosecurity (Dorea, et al., 2010), thus workers should recognize the first symptoms of disease in animals and act upon them.

Discussion of 'What if…?' scenarios to gain an understanding of the key aspects of farm biosecurity should be held on a regular basis. Workers should see examples of the benefits of compliance – and risks of noncompliance – as part of their training.

5. Lead by example

A high biosecurity culture requires everyone to comply regardless of status.

Personnel practice of biosecurity procedures is not only affected by the availability of resources and training, but also by the position that management takes on biosecurity and the feedback provided. The management and owners must transmit a message of commitment to the farm personnel, owning and following biosecurity practices, procedures and protocols, giving positive and negative feedback on the personnel's compliance, supplying information on farm performance and relating it with biosecurity compliance and ensuring adequate resources for the practice of biosecurity (Delabbio, 2006).

When necessary, management also should enforce personnel compliance by disciplinary measures, firings, and creating awareness about the consequences of disease incidence. Nevertheless, the recognition of workers' contribution to animal health performance also has a positive impact on biosecurity compliance (Dorea, et al., 2010).

The bottom line

Biosecurity is necessary for disease prevention in any animal production system. Actions and interventions that prevent the entrance and spread of disease in a production unit have a pay-off as they often lead to performance improvements and lower antimicrobial use. Maintaining a successful production unit requires a multidisciplinary approach in which biosecurity compliance needs to be taken seriously and also actions to improve in other areas such as management, health, and nutrition.

By Technical Team, EW Nutrition

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China lockdown sends ripples across international animal production

For animal production, just as for many other sectors that trade globally, China is a central node within our industry's complex supply chains. As China is starting to lift its restrictions again, what can we say about the knock-on effects of China's lock-down on animal production to date? And what happens now that these measures are replicated in other markets?

Soaring Chinese demand for chicken and pork imports

Wuhan, the capital of Hubei province in China, is home to more than 11 million inhabitants and to the Huanan Seafood Wholesale Market, where the first human infection with SARS-CoV-2 likely took place. From January 23, 2020, onwards, Chinese authorities effectively put all of Wuhan under quarantine: Places and trains could no longer leave the city, buses, subways, and ferries were suspended. Lock-down measures were extended to much of Hubei province and beyond.

According to analysts and Chinese state media, poultry production was seriously affected: Transport restrictions prevented feed such as soybean meal from being delivered to poultry farms, forcing farmers to cull millions of young birds. Hence, the first noticeable ripple effects on international animal production were felt in terms of Chinese import demand. In February, the Financial Times reported that China lifted the ban on importing live chickens from the US to tackle the worsening protein shortage.

This protein shortage is, of course, a longer-term issue due to African Swine Fever's decimation of the Chinese hog population by 40% that has sent pork prices skyrocketing in the past year and fueled inflation. According to Nikkei Asian Review, the added pressure of COVID-19-related domestic transport disruption on pork prices has led to a boost in Chinese demand for imported meat. The U.S. Meat Export Federation reported that US pork exports to China in January 2020 were almost ten times higher than the year before, reaching 74,350 metric tons. However, pork exporters were and still are having trouble getting their pork into China because of the lockdown measures' paralyzing effect on sea freight.

Prices hikes for vitamins and amino acids

By the same token, Chinese manufacturers were and still are having trouble getting their products out of China, or even more fundamentally, producing them in the first place. Much of the world's supply of feed ingredients such as B vitamins, vitamin D3, threonine, and lysine is produced in China. The ripple effect of China's lockdown on global animal production supply chains has thus been keenly felt in terms of the availability and pricing of multiple vitamins and amino acids.

Delayed January exports are starting to trickle in, but disruptions in shipping links are expected to continue for some time yet – and supply chain bottlenecks translate into price hikes. Analysts report vitamin and amino acid price hikes of varying magnitude relative to pre-pandemic levels, and markets appear to be getting more volatile rather than more stable. Among others, Nan-Dirk Mulder, Senior Global Specialist for Animal Protein at Rabobank, therefore, expects animal health and feed additive prices to continue to rise in 2020.

China restrictions ease, but everyone else under lockdown

If we look at China in isolation and assume that its lifting of restrictions will steadily continue, there is reason to be cautiously optimistic. Martijn de Cocq, Lead Analyst at FeedInfo News Service, reports that Chinese production of premix, compound feed, and amino acids and vitamins is back to 80-90% of 2019 levels. Against a backdrop of backlogs, low stock levels, and shortages of certain raw materials, manufacturers are playing catch-up now to meet both domestic and export demand, putting pressure on spot prices for various feed additives and also on seaport capacity.

Chinese economic recovery also bodes well for animal product import demand. Despite the delays and disruptions to supply chains and trade flows caused by COVID-19, Iowa State University researchers Wendong Zhang and Tao Xiong, for instance, anticipate American exports of poultry, pork, and beef products to China to grow from $3 billion to $5 billion in 2020.

However, even if China bounces back quickly, eschews further rounds of lockdown measures, and returns to producing and shipping its usual volumes of feed additives (albeit at temporarily higher prices) – in terms of global animal production, we also have to ask ourselves what happens in the target markets for Chinese exports.

Deciding factors: transport and labor

Specifically, we have to consider domestic transport logistics, e.g., how raw materials are getting from ports to feed manufacturing facilities how end products are getting to farms. The undisrupted functioning of the feed supply chain is indispensable for animal production. Hence, many countries have already explicitly classified feed as an essential good that needs to be exempt from transport restrictions imposed to stem the spread of Sars-Cov-2. The EU Commission, for instance, has adopted a directive on “green lanes” to facilitate cross-border freight transports, including that of feedstuffs. The other hot-button cross-border topic, which eventually will affect animal feed as well, is, of course, seasonal labor, which is urgently required for spring planting in both Europe and North America.

The big dark cloud hovering over every sector within animal production is the question of what would happen if they are severely affected by staff shortages due to coronavirus infections. We simply don’t know. All lockdown measures put in place right now, at a considerable social and economic cost, are about preventing a scenario where large parts of the population are simultaneously ill. However, at the level of, say, a feed mill or a farm, even just a few infections among staff, could require them to suspend operations, with unthinkable consequences for animal welfare and food security.

In the absence of a crystal ball, we have to accept a certain baseline of unnerving uncertainty about future developments and focus on the positives: Globally, feed manufacturing is going strong, and animal producers are busier than ever to play their role in maintaining reliable food supply chains during these extraordinary times.

Corona – Must We Fear Transmission from Livestock to Humans?

SARS-CoV-2 is causing one of the worst global challenges in the 21st century right now. The virus is a member of the family of coronaviridae and belongs to the RNA-viruses. It is assumed that the virus was transmitted by wild animals on a wet market in China. If the virus came from wild animals, is it possible that it can also be transmitted to our farm animals and vice versa? There is considerable confusion in the market. In India, e.g., sales of poultry meat broke down by 80% since January, due to rumors that one could catch the virus from eating chicken.

Corona – nothing new in agriculture!

For people working in the agricultural sector, coronaviruses are not unknown. Cattle producers often fight against diarrhea in newborn calves and against winter dysentery in young adult cattle. Pig farmers know Porcine Epidemic Diarrhoea (PED) and Transmissible Gastroenteritis (TGE) very well. Poultry farmers vaccinate their animals against infectious bronchitis (IB). Are these diseases all caused by the same viruses? No! Different members of the coronavirus family are responsible.

Most of the coronaviruses are species – and tissue – specific

To infect animals or humans, the spike-proteins forming the crown – the “corona” – of the coronavirus must bind to receptor molecules on the target cells of the host’s tissues. The binding is highly specific, just like a lock and its specific key go together, or how an antibody binds to a particular pathogen. SARS-CoV-2, for example, needs a particular cell membrane protein (angiotensin-converting enzyme 2 – ACE2) to enter human cells; TGE viruses, on the other hand, depend on the porcine aminopeptidase N (ANPEP). The cells of pigs have other receptor molecules than the cells of poultry. The cells of the gastrointestinal tract are different from the cells of the respiratory tract (Russ, 2020).

Table: examples for the different coronaviruses in livestock and humans (adapted from Ackermann, 2016)

Virus	Disease	Species	Genus*
TGEV PEDV FCoV-I	Transmissible gastroenteritis Porcine epidemic diarrhea Feline infectious peritonitis (FIP)	Pigs Pigs Cats	α
BCoV HEV MERS-CoV SARS-CoV SARS-CoV-2	Diarrhea in newborn calves; winter dysentery Vomiting and wasting disease Middle East respiratory syndrome Severe acute respiratory syndrome COVID-19	Cattle Pigs Humans Humans Humans	β
IBV TCV	Infectious bronchitis Blue comb disease	Poultry Poultry	γ
PDCoV	Porcine delta coronavirus	Pigs	δ

*for the allocation to the genus, one crucial factor is the viral protein nsp 1.

Corona in Pigs

For pigs, five coronaviruses are relevant. The porcine epizootic diarrhea virus (PEDV) and the transmissible gastroenteritis virus (TGEV) belong to the α genus. They show a high affinity to the epithelial cells of the gastrointestinal tract. The porcine respiratory coronavirus (PRCV) is also a representative of the α genus, but does not show any affinity to the gastrointestinal epithelial cells. It causes respiratory diseases. The other viruses are the hemagglutinating encephalomyelitis virus responsible for the vomiting and wasting disease and belonging to the β-genus, and the porcine delta coronavirus (PDCoV), causing diarrhea (Stiebnitz, 2017).

Corona in Poultry

Infectious bronchitis caused by a coronavirus belonging to the γ genus is one of the major economically critical respiratory diseases in poultry. As it also affects the kidney and the reproductive tract, the consequences are kidney damage, decreased egg production, and bad egg quality. A further significant problem of IB in poultry is the rapid spread. Within 48 hours, a whole flock can be infected and remains a virus reservoir, even after recovery. Usually, the infection is horizontal, from hen to hen, not from hen to the chick. However, infection via contaminated eggs shell in the hatcheries is also possible (MacLachlan and Dubovi, 2016).

Corona in cattle

The symptoms associated with bovine coronaviruses are calf diarrhea, winter dysentery (hemorrhagic diarrhea) in adult cattle, and respiratory infections in animals of various ages (MacLachlan and Dubovi, 2016). The bovine coronavirus belongs to the ß genus. The bovine coronavirus is not as host-specific as many other coronaviruses. It can infect dogs, turkeys, and other wild ruminants such as waterbucks, giraffes, or white-tailed deers.

Can SARS-CoV-2 also be exchanged between humans and livestock?

SARS-CoV-2, like the MERS-CoV (Middle East Respiratory Syndrome) and the SARS-CoV (2002/03), belongs to the ß genus of coronaviruses. All three can infect animals and humans, which can be seen from the way they spread: SARS-CoV originated from bats, MERS-CoV was transmitted by camels, and for SARS-CoV-2, bats (Zhou et al., 2020) but also pangolins (Zhang, 2020) are assumed to be the source. But not livestock animals.

There is one known case of a SARS-CoV infected pig, which was discovered in China in the context of research on the SARS epidemy in 2002 (Chen, 2005). Scientists from the Chinese Academy of Sciences in Beijing examined six animal species living in close contact with humans and found this one pig infected by SARS-CoV of human origin. As the only person having contact with the pig was tested negative for the coronavirus several times, it was concluded that the infection likely came from virus-contaminated feed. The pigs in rural areas in China are often fed the leftovers from restaurants.

For now: keep calm

Today, there is no scientific indication that livestock can contract SARS-CoV-2 from humans or vice versa. In Germany, the Friedrich Löffler Institute (2020), a leading research institute on epizootic diseases, is conducting extensive studies at the moment to better understand the sensitivity of animals towards SARS-CoV-2. Reliable results are expected earliest at the end of April. Until then, let's keep calm, and behave responsibly to weather these unsettling times.

By Inge Heinzl, Editor EW Nutrition

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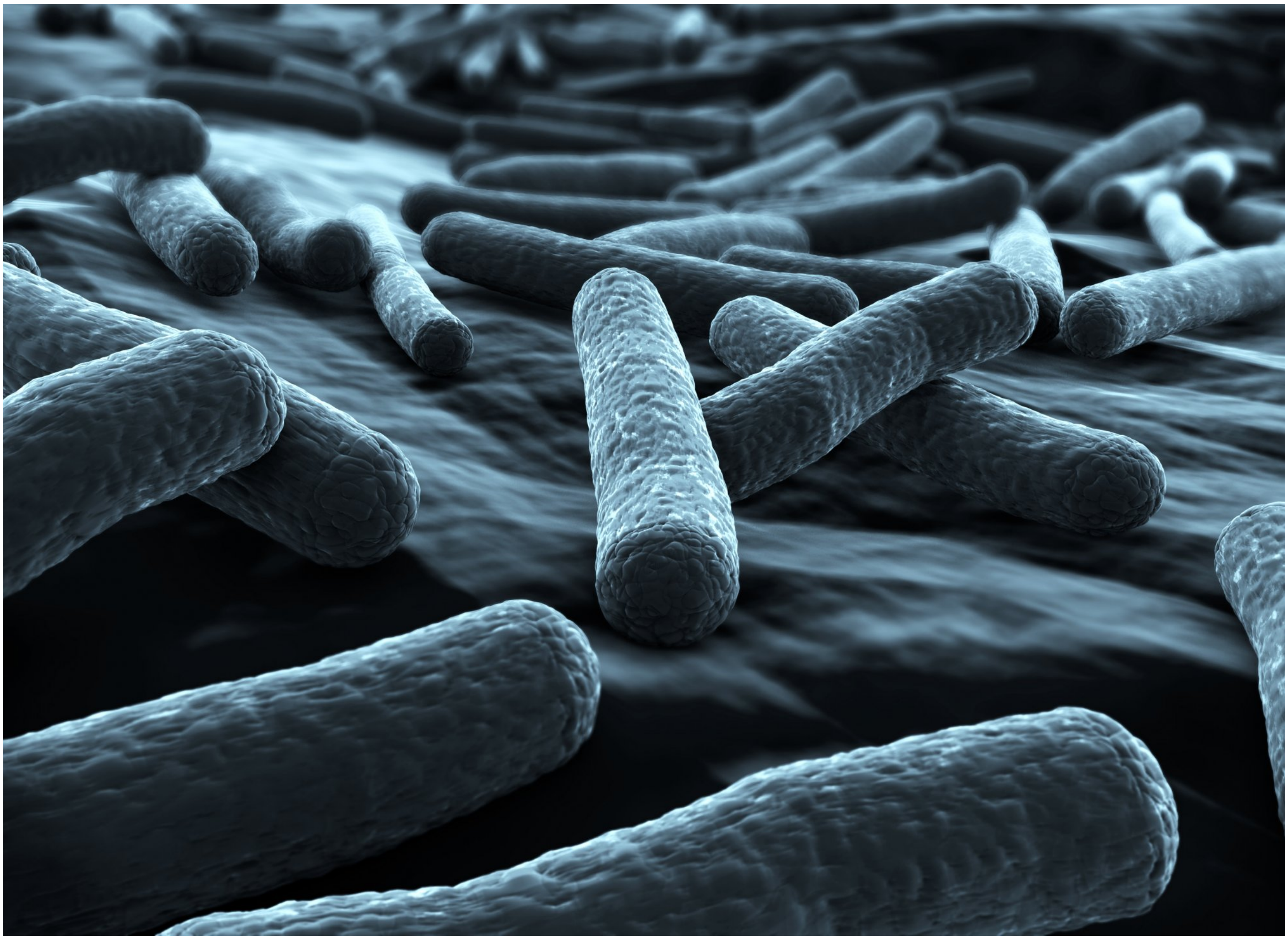
Antibiotic reduction: the key role of biosecurity



Biosecurity is the foundation for disease prevention. It includes all measures to reduce the risk of introduction and spread of infectious agents, using our knowledge of disease transmission processes.

Biosecurity is all the more important in antibiotic reduction scenarios: consistently high biosecurity standards can contribute substantially to the reduction of antimicrobial resistance, by preventing the introduction of resistance genes to the farm, and also by lowering the need for antimicrobials.

Higher biosecurity, lower use of antimicrobials

Laanen et al. (2013) studied the profile of swine farmers across Europe, finding a relation between a high level of internal biosecurity, an efficient control of infectious diseases, and a reduced need for antimicrobials.

In another study, Gelaude et al. (2014) examined Belgian broiler farms, concluding that antimicrobial use could be reduced by almost 30% when biosecurity and other farm issues were improved within a year. Collineau et at. (2017) studied swine farms in Belgium, France, Germany and Sweden. On average, antimicrobial use dropped by 47% – but farms with higher biosecurity compliance and a holistic approach (e.g. management and nutrition changes) needed even fewer antimicrobials.

Interventions pay off

Of course, the interventions necessary to achieve an increased level of biosecurity carry some costs. However, such interventions, especially if combined with better management of newborn animals and nutritional improvements, also strengthen productivity.

The same studies, which report that biosecurity improvements decrease antimicrobial use, also report stronger animal performance. For broilers, Laanen et al. (2013) found a reduction of 0.5 percentage points in mortality and one point in FCR. For pigs, Collineau et al. (2017) found an improvement during both the pre-weaning and the fattening period of 0.7 and 0.9 percentage points, respectively.

Execution is a challenge

Biosecurity is considered the cheapest and most effective intervention in antibiotic reduction programs, but compliance is often difficult to achieve and thus low. It sounds simple: stop the introduction and spread of diseases.

However, in practice, this involves adopting a new set of attitudes and behaviors across all animal production and care activities. Measures should not be constraints, but part of a holistic process to improve the health of animals and people, to reduce antibiotics and boost performance.

Best practices

If you want to design a biosecurity program or improve an existing one, consider these three factors:

1. **Know your menace**
   Identify and prioritize the disease agents of **greatest concern** to the facility, focusing on the processes that carry a risk of pathogen entrance and spread, and are frequently **repeated**. Additionally, consider the **size** of the facility – more animals means higher risk.

2. **Know your place**
   Define the *status quo*, ideally using external questionnaires or audits (e.g. BioCheck UGent). This helps you identify and **gaps** in your biosecurity plan. **Measures** need to be based on the principles of **separation** (between high and low-risk animals and areas) and **reduction** (lower the infection pressure).

3. **Know your processes**
   An exhaustive evaluation of the **daily farm practices** – e.g. the movement of personnel, equipment and visitors, and or used litter management – will help you find **weak spots** so you can eliminate, prevent, or minimize the **potential** of disease.

The bottom line

Biosecurity measures are the basis for disease prevention in any profitable animal production system. Preventing the entrance and spread of disease pays off through performance improvements and lower antimicrobial use. Taking this to the next level, where biosecurity compliance complements improvements in management, health, and nutrition, sets your production up for long-term success.

By Technical Team, EW Nutrition

References are available on request.

How COVID-19 is affecting animal producers – and what to focus on right now

As the novel coronavirus pandemic continues to spread and large parts of the world are under lock-down, meat, dairy, and egg producers are working hard to maintain production in the face of many uncertainties. Let's take stock of three major challenges for animal production businesses – and consider three elements of the multi-pronged "solution" our industry is creating to this unprecedented situation.

Demand patterns are volatile

Stock-piling and panic buys in light of quarantine and social distancing measures have driven up consumer demand for non-perishable, shelf-stable, and frozen food. Accordingly, sales of products such as eggs, long-life milk, and fresh chicken have strongly picked up, while demand for restaurant cuts is waning. Animal producers are trying hard to increase retail processing to meet consumer needs, yet future demand slumps are looming: eventually, consumers will purchase less while they use up their provisions.

Moreover, the economic knock-on effects of this pandemic might include higher unemployment and long-term pressure on the hospitality industry. Dan Sumner, an agricultural economist at the University of California, also expects longer-term reduced export demand from areas strongly affected by the virus.

Inputs: feed additive price hikes and labor shortages

Measures to contain COVID-19 have led to multiple production and transport disruptions in China, where much of the global supply of ingredients such as vitamins, threonine, and lysine, as well as fertilizers, originates. According to Nan-Dirk Mulder, Senior Global Specialist for Animal Protein at Rabobank, these developments will drive up animal health and feed additive prices in 2020.

Animal producers are also concerned about the pandemic's impact on labor availability. Staff shortages due to sickness, quarantine, childcare issues, and movement restrictions for seasonal labor could have severe consequences, from productivity losses to major animal welfare challenges. The National Pork Producers Council in the US, for example, warns that “the specter of market-ready hogs with nowhere to go is a nightmare for every pork producer in the nation.”

Misinformation can create hazards

The media landscape, in particular social media, is rife with misinformation about COVID-19. There is no scientific evidence that farm animals can contract, transmit, or spread the SARS-CoV-2 virus, but fake news along these lines may have a detrimental impact on animal production.

In India, rumors were spread that the novel coronavirus can be transmitted through the consumption of chicken. This has led to a 70% drop in the wholesale price of chicken, as reported by Minister of State Sanjeev Kumar Balyan, putting tremendous pressure on the local poultry industry. Knock-on effects are already felt by feed companies, equipment providers, corn, and soybean growers – but also fish, meat, and egg producers as the rumors have morphed into a general suspicion towards animal protein.

Biosecurity and planning matter more than ever

Many of the prevention and control measures against SARS-Cov-2, such as tight hygiene standards and limiting visitors to facilities, are familiar to animal producers. Biosecurity is of paramount importance to prevent the spread of diseases, not least devastating pests such as Highly Pathogenic Avian Influenza and African Swine Fever. Now is the moment to reinforce biosecurity protocols, on farms and in processing plants, to keep both workers and animals safe.

Experts at the Friedrich Löffler Institute, a German swine producer interest group, have also stressed that producers need to develop feasible contingency plans in case key staff members need to self-isolate. Businesses are also exploring how automation can help safeguard production in case of labor disruptions; agricultural drone manufacturers are reporting significant increases in sales already.

Feed additives to safeguard performance

Nick Major, president of the European Feed Manufacturers’ Federation (FEFAC), has urged the European Commission to recognize “feed as essential goods in the EU COVID-19 guidelines, which is crucial to (…) prevent supply chain disruptions and shortages of essential nutrients to the EU farm animal population.”

As border controls, transport restrictions, and port closures upend the normal flow of raw feed materials, quality concerns with regard to the origin and storage conditions, e.g. mycotoxin contamination, are becoming topical. Especially given the added issue of how to guarantee appropriate care for their animals during labor shortages, producers need to, therefore, prioritize their feed additive portfolio. Intelligent feed additive solutions have been proven to support animal performance in challenging situations, boosting gut health and immune functions.

Collaborate and communicate

Now is the moment to remind people that meat, dairy, and egg production is part of a society’s critical agricultural infrastructure. Industry associations and advocacy groups are working hard to prevent the spread of misinformation and to ensure that politicians and regulators do not gloss over the needs of producers and farm animals. These include access to feed supplies and practicable labor arrangements, but also guaranteed allocations of protective equipment, without which safe operations are not possible.

This crisis highlights what should be obvious: animal producers are in the business of “what really matters,” providing safe and nutritious food for everyone. This is a time to rally – if anyone knows how to deal with uncertainty, volatility, and rapidly changing circumstances, it is animal production.