Feed Additive

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Market Report:
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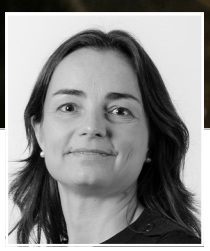

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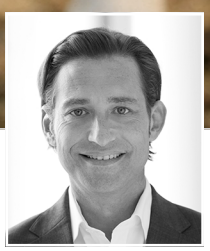

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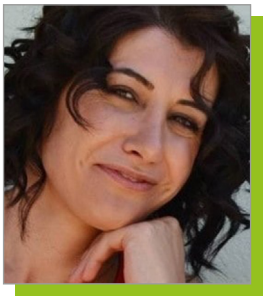

In livestock production, nutrition is no longer merely an element supporting performance; it has become a fundamental pillar directly shaping the future of production. Rising feed costs, climate-oriented regulations, and uncertainties in access to ingredients necessitate more meticulous ration formulation and more effective management.

In this issue, under the focus of Precision Nutrition and Optimum Ration Management, we explore why creating diets tailored to the actual needs of animals is vital and the methodologies that make this possible. Precision nutrition, based on data-driven feeding practices and more accurate nutrient balance, enable the prevention of performance losses while reducing nutrient wastage. Today, ration optimization stands out as a factor as critical to profitability as genetics and herd health.

The environmental footprint of nutrition is also gaining increasing prominence. In our Sustainability section, we examine nutritional solutions aimed at mitigating methane emissions in ruminants. Feed additives and precise ration design offer actionable and short-term tools to reduce environmental impact without compromising production output.

In this issue's Market Report, we analyze the global fishmeal and fish oil market. Surging demand and limited supply have made these commodities more strategic in terms of both pricing and accessibility. Particularly in aquafeeds, the balance between performance expectations, cost-efficiency, and sustainability is at its most delicate point yet.

All the topics covered in our February issue demonstrate that nutrition is no longer solely a technical issue. Precision nutrition, sustainability, and market dynamics have become complementary fields. Throughout this transformation, the right nutritional strategies remain one of the most powerful tools of production.

We hope you enjoy the read.

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Selko®

Optimising dairy performance, minimising environmental impact with IntelliBond

Over-feeding of trace minerals is very common in dairy cattle

The long standing culture of "adding a little extra, just in case" is no longer aligned with modern scientific insights or economic realities. By embracing precision nutrition models, accurately accounting for basal diet mineral contributions, and selecting Selko IntelliBond, feed formulators can safeguard animal health, enhance farm performance, reduce waste, and contribute meaningfully to the sustainability goals of the dairy value chain.

Learn more, visit www.selko.com

trouw nutrition
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FROM LABELS TO LEVERS:
How Benchmarking Is Reshaping Aquaculture Sourcing Decisions

Steffan Edward
Seafood Certification Specialist
Aquatic Life Institute (ALI)

Imagine you work at a major supermarket supply chain, and your directors have just been notified of critical Environmental, Social, and Governance (ESG) risks outlined in the latest compliance report. The message is unequivocal: unless the company restructures its supply chain to align with stronger animal welfare standards, its credibility and market access are at serious risk.

Now, you have a challenge at hand: you must rethink how the company selects its suppliers. Certification labels, once considered sufficient, are no longer enough. The new directive is clear: all seafood products must not only be certified but certified in a way that meaningfully reflects the company's values and the growing expectations of both consumers and regulators.

This is where benchmarking enters the scene, not as a corporate buzzword, but as a tool for making sense of a complex landscape.

REVEALING THE HIDDEN LEVERS BEHIND SOURCING DECISIONS

In the expanding world of aquaculture, certification labels have become the lingua franca of sustainability. For buyers, they offer reassurance; for producers, a pathway to market. Yet the apparent uniformity of certification often masks wide variation in what those standards actually require, and deliver.

Enter benchmarking. Not as a judgment or a leaderboard, but as a form of translation. Aquatic Life Institute's (ALI) Aquaculture Certification Schemes Benchmark decodes the dense architecture of global certification schemes, revealing how each addresses animal welfare, not just in isolated touchpoints, but across the system.

While a certifier logo may suggest parity, the analysis by the ALI Benchmark reveals divergence. Two certifiers may claim to uphold welfare, yet one might enforce precise limits on stocking density and water quality, while another leans on flexible, principle-based guidelines. The outcome? Drastically different conditions for the same species in different farms.

Welfare, as the Benchmark underscores, is not defined by a single moment. It extends far beyond the stunning method or handling at slaughter. It's the lived experience of aquatic animals, shaped daily by water quality, feed formulation, stocking density, and behavioral stressors. These are the "hidden levers", policy decisions disguised as technicalities, often omitted or vaguely treated in many standards.

And while the ethical imperative to improve animal welfare is compelling in itself, its impact reaches further. Strong welfare practices are increasingly linked to sustainability outcomes, public health, and biosecurity. Poor welfare conditions can increase disease risk, raise reliance on antibiotics, and destabilize ecosystems—issues that ripple across global supply chains. In this light, investing

in welfare is not only an ethical decision, but a strategic one.

BEYOND THE LABEL: MAKING SOURCING DECISIONS SMARTER

For decision-makers facing pressure to tighten ESG oversight, the Benchmark becomes more than a report; it becomes a lens. By cross-referencing current suppliers against the ALI Benchmark results, companies often discover unexpected gaps. A long-time supplier, though certified, may operate under a scheme that lacks enforceable thresholds on critical welfare indicators. Meanwhile, a smaller, previously overlooked producer may align more closely with emerging scientific consensus.

This kind of insight reframes the sourcing conversation. It's no longer about whether a product has a certification; it's about what that certification implies for the animal's experience, and for the company's brand integrity.

CLOSING THE GAP BETWEEN SCIENCE AND GOVERNANCE

What makes the ALI Benchmark particularly relevant is its responsiveness. Welfare science is advancing rapidly. Chronic stress, behavioral needs, and long-term health are better understood than ever. Certification schemes, however, often lag behind. They must balance audit feasibility and commercial viability, leading to conservative updates that underrepresent certain welfare drivers.

Benchmarking doesn't aim to shame or disrupt. Instead, it creates a collaborative space for certification bodies, producers, and upstream actors to align on science-driven improvements. It spotlights where progress is happening, and where inertia risks undermining welfare credibility.

HOW TO USE A BENCHMARK REPORT

For retailers and buyers, the Benchmark serves as a decision-support tool. It clarifies what certification means. A sourcing manager can now ask: Does this scheme set explicit stocking density thresholds? Does it mandate environmental enrichment? Does it provide a numerical limit for the amount of fishmeal and fish oil (FMFO) allowed in aquafeed? How robust are the stunning/slaughter requirements?

Now, imagine you are back in the office at your supermarket supply chain job. With the ALI Benchmark at hand, you can identify that Supplier A, while certified, scores low on welfare integration, whereas Supplier B, certified by a different scheme, meets stronger, science-aligned criteria. The Benchmark report becomes your map. Not just for switching suppliers, but for engaging current ones in a conversation about improvement.

In a sector where certification often serves as a proxy for trust, benchmarking gives that trust a foundation. It makes the invisible visible. And for companies navigating the complexities of responsible sourcing, that visibility is no longer optional; it's essential.

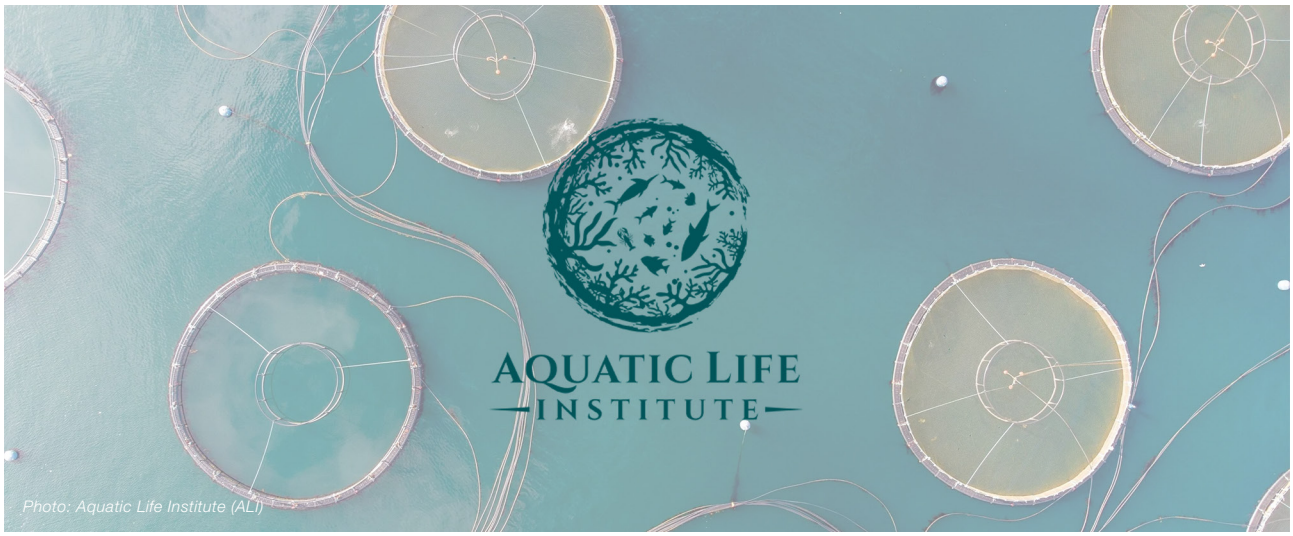

Photo: Aquatic Life Institute (ALI)

Hendrix Genetics opens swine nucleus farm in China

Hendrix Genetics, in partnership with Huanshan Group, opened the Hendrix Huanshan Nucleus Farm in Yuexi, South-East China. This groundbreaking facility is poised to transform China's swine industry through innovation, biosecurity, and genetic excellence.

The new Hendrix Huanshan Nucleus Farm in Yuexi embodies the shared ambition of Hendrix Genetics and the Huanshan Group to accelerate breeding progress of swine in China. Equipped with the latest technologies in biosecurity, environmental management, and animal welfare, this state-of-the-art facility is set to become a benchmark for the industry.

"The establishment of the Hendrix Huanshan Nucleus Farm is the result of determined collaboration with Huanshan group. Together, we are creating local value for Chinese producers by uniting global genetic expertise with an operational model designed for China's realities," said Chen Ji, Managing Director at Hendrix Genetics China. "The farm has already received its first shipment of 1,000 high-health sows, laying the foundation for robust local production and genetic progress."


Photo: Hendrix Genetics

A highlight of the inauguration event was the guided tour of the Hendrix Huanshan Nucleus Farm, where participants observed the real-world application of the innovative solutions discussed during the forum. The guests experienced first-hand innovative solutions implemented, such as positive-pressure filtration and ventilation systems, precision management, standardized practices, and integrated data management for optimal traceability.

Read more>>

Aboitiz Foods expands specialty nutrition with Diasham Resources

Aboitiz Foods, the integrated food and agribusiness company of the Aboitiz Equity Ventures Inc., announced the acquisition of Diasham Resources Pte. Ltd. (Diasham), a Singapore-based manufacturer of high-quality animal nutrition and health solutions. The acquisition significantly expands Aboitiz Foods' specialty nutrition portfolio and enhances its manufacturing capabilities in this area. Diasham, with nearly five decades of expertise in animal nutrition and health, is renowned for its high-quality products and solutions, including feed additives, water-soluble products, injectables, and liquid products. Aboitiz Foods states that with its advanced technologies and state-of-the-art facilities, Diasham has built a strong reputation for innovation, quality, and exceptional customer service across the region.

"This acquisition strengthens our specialty nutrition portfolio and positions us to deliver broader, high-quality animal nutrition and additive solutions to our customers," said Eric Nojac, Business CEO at Aboitiz Foods. "Building on Diasham's strong foundation in animal nutrition, we will leverage our combined expertise to drive innovation, accelerate growth, and expand our presence in this space."

"Finding the right partner to take this legacy forward was extremely important to us," said Tuck Onn Chow, outgoing Owner, Chairman, and Chief Executive Officer of Diasham. "Aboitiz Foods not only shares our values but also brings the vision and scale needed to bring Diasham's expertise to more customers across Asia. I am confident this next chapter will deliver even greater opportunities for growth and innovation."

With its established distribution network across the Asia-Pacific — including Thailand, Indonesia,

China, Hong Kong, Korea, Taiwan, the Philippines, Vietnam, and Malaysia — Diasham brings new depth to Aboitiz Foods' regional footprint. Its trusted, long-standing partnerships with well-recognized industry players further strengthen Aboitiz Foods' ability to deliver value and support customers across diverse markets.

"This acquisition gives us a more complete range of products and solutions to offer our customers across the region," said Tristan Aboitiz, President and CEO of Aboitiz Foods. "Diasham has built a strong legacy and developed deep customer relationships over many decades; factors that mattered very much in our decision to engage in this transaction. We look forward to carrying on the legacy and to working with the talented team at Diasham to continue to enhance the ways in which we add value to our customers' businesses across the region."

Integrating Diasham enhances Aboitiz Foods' ability to serve customers across the food value chain through a broader catalogue of animal nutrition and health solutions. This acquisition builds on Aboitiz Foods'

established success in Asia, starting with its first international investment in Vietnam over a decade ago and further strengthened by the 2018 acquisition of Gold Coin Management Holdings Pte. Ltd. (Gold Coin), now Aboitiz Foods' largest operation outside the Philippines.

Read more>>

New Anta®Sync feed additive focuses on resilience and energy efficiency

Dr. Eckel Animal Nutrition, a German manufacturer of high-quality feed additives, launched its new phytogenic innovation, Anta®Sync. The formulation is distinguished by its high content of secondary plant substances, with double-soluble polyphenols that enable optimal absorption in both fat and water environments within the animal. Thus, it supports improved bioavailability, metabolic efficiency, and resilience in high-performance livestock under pressure.

Modern livestock production faces a growing contradiction: while genetics, nutrition, and management continue to advance, animals are increasingly challenged by metabolic pressure, environmental stress and immune load. Much of the resulting performance loss does not stem from visible disease, but from oxidative stress and systemic inflammation acting silently at the cellular level.

With Anta®Sync, Dr. Eckel Animal Nutrition introduces a new phytogenic feed additive designed to address exactly these hidden drivers of inefficiency. The company says that Anta®Sync supports animals in maintaining metabolic balance, immune resilience, and productive performance, even under challenging conditions.


Photo: Dr. Eckel Animal Nutrition

Oxidative stress and chronic inflammation are triggered by routine events such as heat stress, feed transitions, pathogen exposure, or high metabolic demand. These processes consume energy, weaken immune responses, and ultimately reduce performance, product quality, and longevity. Dr. Eckel points out that Anta®Sync tackles this problem at its source.

"Improving profitability and resource efficiency means addressing hidden energy losses," says Dr. Viktor Eckel, Managing Director at Dr. Eckel Animal Nutrition. "Oxidative stress and inflammation bind energy and make production systems more vulnerable. Anta®Sync helps limit these burdens and supports more robust animals – a key lever for sustainable livestock production."

Read more>>

Strategic R&D partnership aims to bring probiotics to insect farming

Phileo by Lesaffre, one of the global leaders in probiotics and functional ingredients for animal nutrition, and Nasekomo, a European biotech company specializing in industrial insect bioconversion, announced a long-term strategic research partnership aimed at accelerating innovation in the rapidly evolving insect industry.

The collaboration is formalized through a multi-year R&D framework agreement covering joint research, co-development, and knowledge exchange between the two companies. According to a statement, at the core of the partnership is a shared ambition to unlock the full potential of microorganisms and insects working together to improve efficiency, scalability and profitability in insect-based production systems.

The first concrete project under the partnership focuses on the development and validation of a probiotic solution tailored specifically for insects. While probiotics are widely used and well-established in sectors such as poultry, swine, and aquaculture, their application in insect farming remains largely unexplored at an industrial and regulatory level. "Insects and microorganisms naturally function as a biological system. By selectively enhancing

Photo: Phileo by Lesaffre and Nasekomo

microbial communities with targeted probiotics, we can support more efficient nutrient conversion and more resilient production processes. Our collaboration with Phileo allows us to do that in a scientifically robust and industrially relevant way," said Marco Tejeda, Nasekomo's R&D Manager.

Read more>>

Two new vaccines aim to control aMPV in U.S. poultry

U.S. poultry producers now have additional tools to combat avian metapneumovirus, a highly contagious and costly virus impacting turkeys, broiler chickens, and laying and breeding birds. With cold weather approaching around the country and birds becoming more susceptible to viruses during these colder months, Elanco Animal Health and HIPRA introduced two avian metapneumovirus (aMPV) vaccines to help poultry producers manage this costly respiratory disease.

aMPV is a highly contagious respiratory disease affecting turkeys and chickens. It causes significant economic losses due to reduced egg production, increased mortality rates, and decreased performance in infected flocks. The virus primarily affects turkeys, with an estimated 60-80% of commercial turkey flocks nationwide impacted by aMPV; yet broilers and laying and breeding birds are also susceptible to the virus. Certain husbandry and ventilation tactics can help the outcome; however, vaccination is a

critical tool to effectively control the virus.

"Avian metapneumovirus has led to devastating losses for many producers," said Scott Gustin, U.S. Poultry Technical Leader at Elanco Animal Health. "The aMPV subtypes A and B were foreign to the U.S., and after seeing this virus spread now from coast to coast, it became clear that biosecurity was not going to be sufficient on its own to combat the virus. Vaccines became the clear solution to reduce the impact of this highly contagious respiratory disease."

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IMPROVING ANIMAL PERFORMANCE

A&P Nutrition brings together decades of expertise in design and production of high-performance animal feed additives.
Our robust portfolio is tailored to meet the evolving needs of markets worldwide.

A&P Nutrition

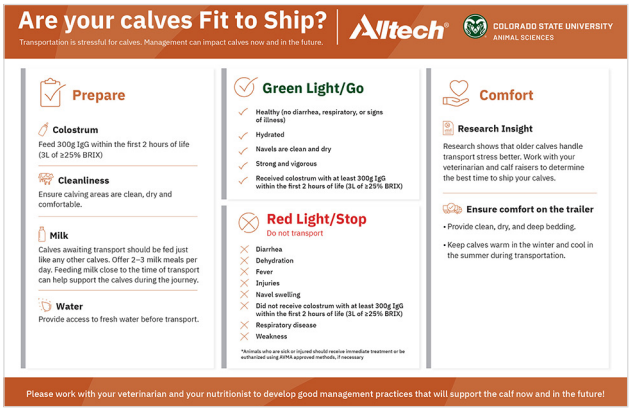
Alltech and CSU launch bilingual calf transport poster

Alltech, one of the global leaders in animal health and nutrition, in partnership with Colorado State University (CSU), announced the development of a new bilingual educational poster designed to assist the dairy industry in making informed decisions when preparing calves for transport. This resource will be available in both Spanish and English, ensuring accessibility across a diverse dairy workforce.

Recognizing the critical importance of calf welfare during transit, the poster provides clear, easy-to-read guidance aimed at improving communication among dairy workers and enhancing animal care standards. Its visually engaging format simplifies complex information, making it an effective tool for daily use on dairy farms.

Further endorsing its quality and relevance, the poster meets FARM (Farmers Assuring Responsible Management) Animal Care calf fitness-for-transport protocol requirements, underscoring its alignment with industry best practices and welfare standards.

"We are excited to offer a practical resource that bridges language barriers and supports better decision-making in calf transport," said Jorge Delgado, Alltech On Farm Support, People+. "By collaborating with Colorado State University and aligning with FARM program standards, we are confident this poster will have a meaningful impact on calf health and welfare throughout the dairy sector."



"I am excited to partner with Alltech to provide this fitness-for-transport poster to dairy producers and calf raisers. This resource provides clear, practical guidance to inform transport decisions that prioritize calf welfare," said Dr. Catie Cramer, Associate Professor in the Department of Animal Sciences at CSU.

Read more>>

Harbro agrees deal to acquire J&W Tait's feed business

Scottish-based feed producer Harbro Limited reached an agreement with J&W Tait, based in Orkney, Scotland, to acquire its feed and fertiliser sales operations, effective from 1 March 2026. The company states that this strategic acquisition strengthens its position within the industry and provides access to a key location, enhancing the company's ability to support customers and extend its market reach.

"This acquisition is an important step in our growth strategy. By integrating the feed and fertiliser business of J&W Tait into our operations, we gain greater access to the area and can deliver an even wider range of solutions to the Orkney farming and rural community," says Chris Baxter, CEO of Harbro.

As part of this integration, the existing team at the Kirkwall site will join Harbro as it assumes responsibility for feed and fertiliser sales from that location. Furthermore, Harbro will broaden its range of available products and services, giving customers a wider choice and greater access to nutritional support.


Photo: Harbro

Read more>>

On-site feed analysis transforms equine nutrition

Eurofins Agro Testing and trinamiX GmbH announced a jointly developed solution extending mobile feed analysis to the equine sector that brings best-in-class forage testing directly to stables and pastures across Europe. The companies state that this empowers stable owners, horse feed producers, equine nutritionists, forage dealers and veterinary professionals to make informed decisions based on real-time nutritional insights. The solution is intended for the full range of equine segments, from sport horses and breeding to leisure and rehabilitation.

Forage is the cornerstone of every horse's diet, yet its nutritional value can vary widely due to species, harvest timing, soil, storage and regional conditions. Eurofins and trinamiX point out that accurate, on-site analysis is essential for formulating balanced rations, supporting digestive health, preventing metabolic disorders and enhancing performance.


Photo: trinamiX

Using the handheld trinamiX PAL Two spectrometer, users can instantly analyse the nutritional composition of key forages such as fresh grass (and clover), hay, and haylage, on site. The following parameters are available within seconds, enabling immediate dietary adjustments: ADF, ADL, crude ash, crude fat, crude fibre, crude protein, dry matter, NDF, digestibility coefficient of organic matter (OMD), sugar and fructans for hay and pH for haylage. Energy values are currently available for Germany, the Netherlands and Sweden; values for other countries will be added shortly.

Read more>>

Australia tests methane reduction in grass-fed cattle

Australia's largest retailer, Woolworths, partnered with Sea Forest and industry collaborators to launch a multi-year, commercial-scale trial aimed at reducing methane emissions and improving productivity in grass-fed cattle. The project will exclusively use Sea Forest's, SeaFeed, using water delivery technology developed by Direct Injection Technologies and is supported by major Australian beef processor, Teys Australia.

While cattle being fed grain fed diets are relatively easy to manage with methane-inhibiting feed additives, finding effective and reliable ways to deliver emissions reduction to cattle during the earlier stages of their life on grass has always been a bigger challenge. The shared ambition of the initiative is to significantly reduce methane emissions and unlock additional productivity across the beef value chain and support the broad adoption of SeaFeed by the Australian beef industry.

The partners will conduct a commercial-scale trial at a cattle property in New South Wales, testing both water-delivered and dry-lick formulations of SeaFeed, with the water-delivered formulation administered via DIT dosing technology.


Photo: Sea Forest

"Partnering in the grassfed trial would help validate animal performance outcomes delivered in addition to the established emissions reduction and supports the scalable adoption of a science-based solution for producers and retailers," said Sam Elsom, Sea Forest Founder and Chief Executive.

Read more>>

De Heus and Minh Phu join forces to enhance Vietnam's shrimp value chain

Announcing a strategic agreement to promote the sustainable development of the shrimp industry value chain, De Heus and Minh Phu Seafood Group aim to improve aquaculture efficiency in Vietnam, ensure production stability, and strengthen the global position of the country's shrimp industry.

According to the cooperation agreement, De Heus will provide Minh Phu with advanced nutritional solutions, high-quality aquaculture feed, and technical support services. Minh Phu will use shrimp feed products supplied by De Heus in its farming areas. In addition, the two parties will cooperate in implementing pilot programs, transferring technology, developing farming areas, and enhancing the value of Vietnamese shrimp products in the international market.

The partners note that integration across all stages of the chain – from breeding, farming, processing, and exporting to supporting elements such as feed, additives, supplies, and technology – will help create a sustainable value chain, ensuring stable output

Photo: De Heus

and enhancing the position of Vietnam's shrimp industry. De Heus and Minh Phu believe that their partnership is a significant step in improving the efficiency of aquaculture. The companies aim to develop a more professional shrimp value chain that meets international standards and expands export opportunities. This effort is further supported by the ASC international certification awarded in October to the De Heus Vinh Long 4 aquaculture feed production plant, one of the world's most prestigious standards.

Read more>>

Achieve the Ideal AA Formulation for Swine with BestAmino REQ

Step 1

Start with G:F ratio or ADG based on your preference

G:F ratio | ADG

$$ADG = \frac{\text{Final Body Weight} - \text{Initial Body Weight}}{\text{Number of Days in Period}}$$

$$G:F = \frac{\text{Total Weight Gain}}{\text{Total Feed Intake}}$$

Step 2

Select the specific growth stage

Weanling Pigs	Growing Pigs	Finishing Pigs
7–25kg	25–75kg	75–135kg

*Optimized for Web

Start Optimization Now!

Step 3

Find out the details of selected parameters

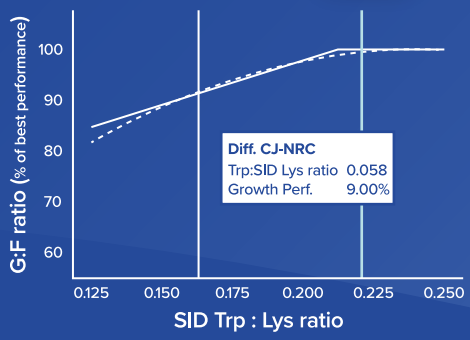
	NRC(2012)	CJ	Ratio diff.	
Trp	0.163	0.221	▲ 0.058	Details
Lys:ME	3.971	4.410	▲ 0.439	Details
Lys:NE	5.515	5.528	▲ 0.014	Details
Ile	0.511	0.614	▲ 0.103	Details

Step 4

Receive CJ BIO's precision amino acid recommendation

Trp : SID % Lys Requirement for Weanling pigs (7-11 kg)

Trp requirement from CJ BIO : 0.221



Dr. Julian Wiseman to speak on feed additive trends in Bangkok

Ecolex Animal Nutrition, a leader in innovative animal nutrition solutions, become a Platinum Sponsor for the Advanced Poultry Nutrition Forum, taking place on 9 March 2026 in Bangkok. As part of its commitment to driving poultry production forward through evidence-based research, innovative feed additives, and sustainable practices, Ecolex will sponsor forum keynote speaker, Dr. Julian Wiseman, Emeritus Professor of Animal Production at the University of Nottingham, UK. A frequent and highly regarded visitor to Asia, Dr. Wiseman is an internationally acclaimed authority on non-ruminant nutrition, feed efficiency, and product quality. His decades of research have shaped modern poultry feeding strategies, including the growth of individual portions of broiler carcasses as influenced through dietary inputs, and the influence of dietary cereals (both raw and processed) on gut environment and how these ingredients might influence gut morphology.

He will deliver a highly anticipated presentation titled "Next Generation of Feed Additives—What's Happened in the Last 5 Years and Where We Are Heading?" This session promises actionable insights to future-proof poultry operations amid rising input prices, regulatory pressures, and consumer demands for antibiotic-free products.

Dr. Julian Wiseman

"We are excited to support this forum and bring Professor Wiseman's world-class expertise to Asia's poultry professionals," said Ecolex's Global Commercial Director, Edward Manchester. "His presentation aligns perfectly with our mission to deliver next-generation solutions that meet the evolving needs of the region's poultry sector."

Read more>>

Chemlock Nutrition raises quality expectations for 25OHD3

Chemlock Nutrition introduced Nutrivit® Puri-D®, setting a new standard in Vitamin D supplementation for animal feed. The company states that Puri-D®, produced in the world's only vertically integrated, pharma-grade 25 Hydroxy Vitamin D3 (25OHD3) facility, deploys a patented enzymatic conversion process to deliver unmatched purity and consistency for livestock nutrition.

According to the statement, Puri-D® is the only full 25OHD3 where 100 % of batches are made using the same process in the same facility for maximum consistency and control. Unlike conventional products that rely on multi-step synthesis, Chemlock Nutrition uses a patented enzymatic conversion process. The company notes that by eliminating variables in the production process, the risk of contamination with the unwanted and highly regulated 1,25 hormone is almost zero, resulting in a higher purity final product.

Dr. Grant Shouldice, Vice President of Chemistry, Quality and Innovation at Chemlock Nutrition, said, "Nutritionists and feed formulators can't afford uncertainty when it comes to the purity of the ingredients they are feeding animals. Unlike other products on the market, which rely on fermentation, manufacturing Puri-D® with enzymatic conversion uses a highly specific proprietary enzyme to convert vitamin D3 into its 25-hydroxy form with no side reactions, resulting in a high-purity, hormone-free product you can trust."

Read more>>

Insect-based aquafeed reaches industrial scale in the Mediterranean

Innovafeed, one of the global leaders in insect ingredients, and NaturAlleva, a major aquaculture feed producer and farmer, announced the signing of a commercial partnership for the integration of Black Soldier Fly (BSFL) ingredients into aquafeed formulations for key Mediterranean species, including sea bass, sea bream, sturgeon and trout.

This partnership marks a new milestone in the large-scale commercial deployment of insect-based ingredients in aquaculture, moving beyond pilot projects and trials toward industrial and market-driven adoption.

The partners point out that this agreement reflects a shared ambition to accelerate the transition of insect ingredients from scientific proof points to real-world application in aquaculture production systems.

Beyond its commercial dimension, this partnership is built for scale and innovation. Starting in January 2026, NaturAlleva will deploy Innovafeed's BSFL ingredients at meaningful commercial volumes across its Sea Bass and Sea Bream feed formulations, while both companies will jointly invest in R&D to further investigate additional functional properties of insect-based

ingredients, with a particular focus on chitin-related benefits in other aquaculture species.

The partners note that this collaboration also underscores the role of insect ingredients as functional, performance-driven components in aquaculture feed formulations.

Read more>>

Sustell™-powered partnership paves the way for scalable low-carbon eggs

dsm-firmenich Animal Nutrition & Health, Hardeman Egg Group and Royal Agrifirm Group joined forces to set a new benchmark for sustainable eggs, with the goal of making them affordable and accessible for everyone. According to the press release, the partnership, which combines industry-leading technology and innovation, will give consumers access to eggs produced more sustainably than conventional eggs, while maintaining a comparable price point and simultaneously enabling companies along the value chain to meet their sustainability commitments in a cost-effective way.

dsm-firmenich's Sustell™ Carbon Value Program will be key to creating a new industry standard for sustainable eggs. The three companies have already completed a commercial pilot, with initial outcomes showing groundbreaking results.

Bas van Driel, Group Director Specialties at Royal Agrifirm Group, commented: "Through nutritional solutions we achieved more than a 17% reduction in carbon emissions, while layer performance was above the baseline. If we apply this approach at scale across roughly 10 billion eggs produced yearly in the Netherlands, we can reduce around 180 million kilograms of CO_2e—equivalent to the yearly energy and gas consumption of 70,000 households—using technology that exists today."

"The biggest impact comes from producing a lower-footprint egg that is attractively priced, ideally at price parity," said Ton Gielen, CEO at Hardeman. "There are already far too many options on the shelves. If a consumer sees two cartons at the same price, they'll pick the verified lower-footprint option and feel they're helping the environment without paying more."

Dr. David Nickell, Head of Sustainability & Business Solutions at dsm-firmenich Animal Nutrition & Health, stated: "Accuracy and credibility of measurement at scale are the foundation of an environmental claim that consumers can trust. When you combine robust, verifiable data with proven nutrition improvements, you lower the footprint per egg and improve productivity at the same time."

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Amandus Kahl marks 150 years of engineering innovation

In 2026, Amandus Kahl will celebrate its anniversary under the motto "150 Years of Innovation – Tradition with a Future". The company is currently one of the world's leading manufacturers of pellet mills, process engineering, and complete production plants for the feed, biomass, recycling, food, chemical and pharmaceutical industries. The company emphasizes that its focus has always been on innovation, quality, and long-term sustainability.

"Our anniversary is an opportunity to reflect proudly on the developments of the past 150 years and, at the same time, set the course for the future. Innovation arises where experience and curiosity come together. This interplay between tradition and the future has shaped our company for generations and will remain a central component of our corporate culture," says Joachim Behrmann, Amandus Kahl's Managing Director.

Assembly of a KAHL flat-die pellet mill

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Vilofoss launches MYCOSAFE to mitigate mycotoxin challenges

Mycotoxins are an often underestimated risk in modern livestock production. Invisible to the eye and variable from batch to batch, these toxins produced by molds in feed ingredients can weaken animals' immune systems, reduce feed efficiency, and in severe cases lead to illness or losses.

Vilofoss, a global supplier in the premix and nutrition sector, introduced a new range of toxin binders developed and tested in Denmark and across Europe. The company stated that the new MYCOSAFE range is designed to help reduce the impact of the most relevant mycotoxins in pigs, poultry, and ruminants, supporting stable production even when raw material quality fluctuates.

"The mycotoxin profile varies from batch to batch of raw materials. With MYCOSAFE, customers get a solution that is easy to dose, and independent laboratory tests confirm it helps mitigate the impact of the most relevant toxins," says Jacob Dall, Innovation Manager at Vilofoss.

According to the statement, when used as part of the daily feeding strategy, MYCOSAFE supports feed quality management in

practice, offering easier handling for producers and better conditions for maintaining consistent productivity. "Farmers need confidence in stable production levels, even when mycotoxins occasionally appear in feed," Dall adds.

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Adisseo launches partnership program for AA-balanced dairy nutrition

Adisseo, one of the global leaders in amino acid balancing for dairy nutrition, announced the launch of a new partnership program designed to accelerate the adoption of amino acid (AA) balancing formulation in dairy nutrition. The initiative aims to help feed mills and dairy farmers maximize profitability, improve herd health, and reduce environmental impact through precision feeding.

Today, dairy farmers face critical challenges such as producing more milk efficiently with fewer resources (reducing protein fed and nitrogen excreted in the environment), maximizing herd health and reproduction, and ensuring the profitability and sustainability of the dairy operation.

According to the statement from Adisseo, amino acid (AA) balancing formulation and precision feeding are proven solutions to address these challenges. The company points out that not all dairy diets are AA-balanced, representing a missed opportunity for the dairy industry. Adisseo states that for over 30 years, millions of dairy cows worldwide have benefited from AA-bal-

anced diets, delivering consistent results in milk yield, milk component and lifetime performance, contributing to cows' health and high reproductive performance.

Adisseo's extensive research programs, conducted in collaboration with leading universities, have demonstrated the effectiveness of AA balancing. A recent IFCN evaluation of 18 typical European farms across 9 countries estimated the implementation of AA balancing could increase annual income by €293 per cow per year.

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EW Nutrition advances toward full GRASP ownership

EW Nutrition and GRASP announced a significant strengthening of their collaboration through a new agreement that will see EW Nutrition increase its ownership stake in GRASP from its current position to full ownership over the next four years.

This strategic move reflects both companies' commitment to long-term growth and their shared vision for expanding EW Nutrition's market-leading position in the industry. The phased transition will ensure business continuity while supporting GRASP's ongoing operations and development initiatives in Brazil.

"This agreement represents a natural evolution of our successful partnership," said Jan Vanbrabant, CEO of EW Nutrition. "We are excited to deepen our investment in GRASP and its exceptional team, products, and operations in Brazil."

EW Nutrition stated that GRASP's portfolio includes world-leading products for toxin mitigation (Mastersorb), gut health management (Activo), and other industry-recognized solutions. The company's dedicated team will remain focused on delivering the quality and innovation that have established GRASP as a trusted name in the market, according to the statement.

"We look forward to this next chapter in our partnership with EW Nutrition," said Alysson Hoffmann Pegoraro, GRASP Managing Director. "I am confident that this agreement will help to not only continue producing and delivering innovative solutions for our customers worldwide but further significantly increase the global footprint of GRASP."

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AGI marks U.S. launch of FLEXmill feed processing systems

AGI (Ag Growth International), a global provider of storage, handling and processing solutions for grain, feed, seed and fertilizer, delivered its first AGI FLEXmill™ systems to customers in the United States, marking an important milestone in expanding modular feed production technology across the country.

"Producers are looking for flexible ways to increase capacity without major construction," says Noam Silberstein, AGI Senior Vice President, Global Food & Feed. "The AGI FLEXmill system solves real facility challenges with a compact, configurable design that delivers consistent, high-quality feed."

According to a statement of company, developed for today's on-farm and commercial feed production operations, the FLEXmill feed processing system delivers precise batching, efficient grinding, advanced microdosing and streamlined material handling in a compact, modular footprint.

Last year, AGI partnered with regional dealers to install the first AGI FLEXmill system at a poultry operation in the Mid-Atlantic. The company noted that the project showed how a FLEXmill's low-profile, modular design can upgrade feed production in existing buildings with minimal disruption while delivering commercial grade batching consistency for on-farm feed production.

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Adisseo reaches 'B' in CDP climate assessment

Adisseo, one of the world leaders in animal nutrition and health, is being recognized for its transparency on environmental issues and sustainability by CDP (Carbon Disclosure Project), the global environmental non-profit that runs the world's only independent disclosure system.

CDP is considered one of the most widely recognized and demanding international benchmarks today for assessing climate performance, ESG transparency, and environmental risk management.

Bingjing Ding, Adisseo Executive Vice President Strategic Investment & Sustainability said, "Adisseo is deeply committed to limiting the environmental impact of its activities. This improved CDP score recognizes the continuous efforts of all our teams worldwide. It reinforces our determination to build a sustainable future for our company, our customers, and the livestock industry globally."

"A CDP score is a sign of commitment to high-quality data that enables companies to take earth-positive economic decisions that future-proof their operations, improving access to capital, competitiveness and compliance. Tackling environmental risks head-on will create a more resilient economy and increase companies' ability to innovate and invest," said Sherry Madera, CEO of CDP.

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Aerbio: New microbial protein shows impressive results in aquafeeds

Is it possible to improve feed conversion ratios by 10% in aquafeed applications while cutting reliance on fishmeal? Peaking at 30% for salmon? For a Danish biosolutions company, the answer is yes. Trial results from Aerbio's innovative protein ingredient, Proton™, demonstrate its potential to transform the aquafeed industry. The company notes that, having been rigorously tested, the protein ingredient's performance in feed conversion trials has exceeded all expectations.

In trials conducted by independent third parties, Proton™ has replaced fishmeal at 5–20% inclusion rates in commercial-like feed mixes, used as control diets. The outcome was an improved feed conversion ratio of 10% for shrimp, while the salmon feed conversion ratio improved by up to a remarkable 30% in some tested feed formulations.

Aerbio points out that the commercial upside is significant. Based on the current market pricing of incumbent protein ingredients, the company estimates that using Proton™ could increase aquafeed value chains' earnings by up to €700 per tonne of aquafeed where Proton™ is included. Proton™ targets an annual aquafeed market well above 50 million metric tonnes.

Photo: Aerbio

"The results have been overwhelming, even for us," says Aerbio's CEO, Kaspar Kristiansen. "To meet the protein needs of the future, we need to think innovatively, and that is what our team has done with Proton™. In itself, our product holds strong traits, but in a wider perspective, we believe our technology is the large-scale solution to meet the demand for protein in aquafeed."

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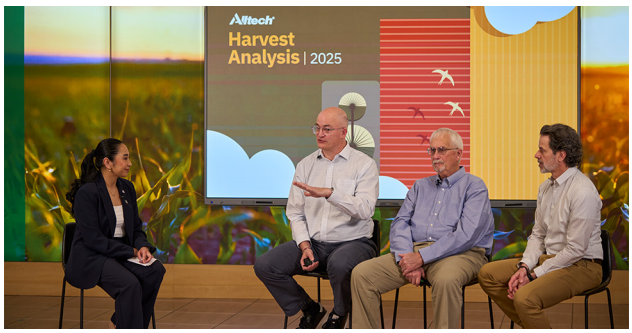
Alltech broadcast focuses on 2025 harvest challenges

Alltech, one of the global leaders in the agriculture industry, hosted a live broadcast, "From Field to Feed: 2025 Crop and Mycotoxin Analysis", streamed live from Alltech's headquarters in Lexington, Kentucky, U.S., on January 15, 2026. During the broadcast, the panel of experts shared timely insights into this year's harvest conditions and emerging mycotoxin risks, including these highlights:

• Changing climate trends are no longer anecdotal — weather data clearly shows their direct impact on crop production. As noted by panelist Dr. Jan Dutton, meteorologist and CEO of CropProphet, warming temperatures have extended growing seasons across much of the U.S. Midwest by as much as two weeks over the past 40 years, while precipitation patterns are shifting toward fewer but more intense rainfall events. Together, these changes are increasing the frequency of excess moisture events, making what were once considered "rare" occurrences far more common, and something producers must now plan for and expect.

• Elevated mycotoxin findings in key regions, including significantly higher levels of deoxynivalenol (DON) and T-2/HT-2 toxins in feed across all species, with an increased frequency of DON being detected across the U.S. and in over 40% of samples in Canadian grain.



• Accelerated progress has been made in mycotoxin predictive models, and as we continue to utilize growing data sets and more advanced AI tools, we can expect to see expedited results in the coming years.

"What we're seeing is a convergence of factors — changing weather patterns, increased variability in crop quality and the presence of both known and emerging mycotoxins — that is making risk more complex and more frequent," said Dr. Alexandros Yiannikouris, Research Group Director at Alltech.

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Devenish NA bolsters feed additive capabilities with Nutribins deal

Devenish Nutrition North America acquired Nutribins, a U.S.-based company specializing in feed ingredients and nutritional technologies. Devenish views the acquisition as a significant step in expanding its presence and product portfolio across key poultry and livestock sectors in North America. The acquisition by Devenish Nutrition's North American business further reinforces the company's long-term strategy to broaden its capabilities in feed additives and value-added nutritional solutions that support sustainable livestock production.

The integration of Nutribins' product portfolio, strategic partnerships, and market presence is expected to generate significant synergies. Devenish states that combining its research capabilities alongside Nutribins' proven nutritional solutions will enhance customer value across North America while supporting shared goals of sustainability, animal health, and production efficiency.

Cory Penn, President of Devenish Nutrition, North America, stated: "The strategic acquisition

of Nutribins further strengthens the Devenish technical team, adds proven nutritional solutions to our portfolio, and brings an exciting innovation pipeline that will deliver value to the poultry and livestock industries for years to come."

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IFFO reports positive momentum in global marine ingredients

IFFO – The Marine Ingredients Organisation released its latest market assessment based on data collected from its member companies, providing an overview of recent developments in global marine ingredients production. The update highlights regional supply trends, fishmeal and fish oil output, and evolving market dynamics, including changes in China.

According to the reports, in Peru, the second fishing season in the North–Centre region has ended with the anchoveta fleet having landed almost all of the 1.63 million metric tonne quota. "This is positive news; while data still needs to be confirmed for the full year, we expect 2025 to have delivered slightly lower production of both fishmeal and fish oil compared with 2024," said Dr. Enrico Bachis, Market Research Director at IFFO.

By November 2025, the total cumulative annual fishmeal production rose by approximately 2% compared to the same period in 2024. This increase was driven by higher output in most regions, except for the African countries and Iceland and North Atlantic area, which reported a year-on-year decline.


Photo: Freepik.com

Similarly, cumulative fish oil output through November 2025 showed a year-on-year increase of around 7%. Most countries recorded positive trends compared to January–November 2024, with the exception of Peru, where lower oil yields in 2025 played a significant role in the decline.

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IPPE 2026 concludes with record floor space and high engagement

The 2026 International Production & Processing Expo (IPPE) was a trade show with strong crowds, busy exhibitors and great energy evident throughout the expo floor. This year, IPPE approached 33,000 registered attendees, more than 663,000 square feet of exhibit space and 1,385-plus exhibitors. It was reported that this was the largest trade show floor square footage in IPPE's history.

Sponsored by the U.S. Poultry & Egg Association, American Feed Industry Association and the Meat Institute, IPPE is the world's largest annual poultry, egg, meat and animal food industry event of its kind.

The IPPE organizers said in a statement during the event: "Despite the weather-related challenges, we are really excited about the efforts attendees and exhibitors made to be at IPPE this week. The large trade show floor and attendee and exhibitor numbers continue to complement IPPE's comprehensive education sessions, networking opportunities and extensive exhibits showcasing the latest innovative technology, equipment and services for our industries."

The large trade show floor remained the central attraction. Exhibiting companies showcased their new products and services at IPPE, with all phases of the animal food, meat, poultry and egg industries represented, from live production and processing to further processing and packaging.

The comprehensive education program schedule complemented the exhibits by informing industry management about the latest issues impacting the industries. The 2026 line-up included more than 80 hours of education sessions, providing information on artificial intelligence, animal agriculture sustainability, food safety, worker safety, animal food industry trends, poultry market trends and more.

Other featured events included the International Poultry Scientific Forum, the Latin American Poultry Summit, Pet Food Conference, Foundations of Listeria monocytogenes Intervention and Control Workshop, TECHTalks program, New Product Showcase and publisher-sponsored programs, all of which have been great contributions to the 2026 IPPE.

The 2027 IPPE dates have been set for January 26-28 in Atlanta, Ga.

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Trouw Nutrition highlightes sustainable feed solutions at IPPE 2026

Trouw Nutrition, Nutreco's livestock feed business, highlighted PhytoComplex discoveries to naturally support flock health and performance, along with digital tools to improve the efficiency, economics, and environmental footprint of poultry production, during the International Production & Processing Expo (IPPE). Beyond interactive demonstrations at its booth, Trouw Nutrition offered a deep dive into its transformative PhytoComplex discoveries.

"The poultry industry is facing increased pressure to achieve sustainability goals, comply with regulatory constraints, and meet retailers' and consumers' expectations while maintaining profitability," said Jose Manuel De La Fuente Garcia, Global Strategic Marketing Director, Poultry. "Trouw Nutrition is excited to exhibit at IPPE and show how research and innovation can help poultry producers around the globe meet demand for safe, sustainable protein and effectively feed the future."

During the event, Dr. Gustavo Carneiro delivered an IPPE TECHTalk that explored how shifting poultry nutrition from a reactive strategy targeting pathogens to a proactive approach supporting physiological enhancement can help birds more fully achieve their genetic potential. Dr. Carneiro explained how a specific PhytoComplex has been shown to address the longstanding challenge of optimising broiler growth without suppressing immune regulation.

An IPSF talk by Dr. Nienke de Groot shared findings from a field trial involving more than 900,000 commercial broilers. The large-scale trial investigated how an extensively researched formulated PhytoComplex (Fytera Perform) improved broiler performance in a commercial setting.

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Sustainability Summit focuses on efficiency at IPPE 2026

Organized by the U.S. Poultry & Egg Association (USPOULTRY), the Institute for Feed Education and Research (IFEEDER) and the Meat Institute, the annual Animal Agriculture Sustainability Summit brought attendees together during the International Production & Processing Expo (IPPE) to hear the latest on how the meat, poultry and egg, animal feed and pork industries are advancing their sustainability programs.

The summit opened with a panel discussion on "Genetics and Production Innovation for Sustainability," moderated by Sam Wildman, director of strategic affairs for the Meat Institute. He remarked that sustainability in animal agriculture centers on efficiency, responsible production and the industry's mission to provide food, not just politics or carbon metrics. Panelist Mark Pitman, sustainability engineer for Pitman Farms, discussed ways to cut Scope 1 and 2 greenhouse gas emissions through value-chain collaboration, solar energy adoption, agrivoltaics,

natural gas microgrids, anaerobic digestion and biochar for soil and carbon benefits.

The second panel about "Air Quality and Ingredient Innovation for Sustainability" was moderated by Dr. Yuan-Tai Hung, senior manager of research at IFEEDER.

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Cargill spotlights integrated poultry solutions at IPPE 2026

Cargill Animal Nutrition & Health (ANH) showcased its integrated poultry solutions at the 2026 International Production & Processing Expo (IPPE) in Atlanta, bringing together producers, customers, and industry leaders to discuss the evolving challenges of modern poultry production.

Throughout the event, Cargill ANH demonstrated how its integrated approach—combining science-backed products, expert people, and decision-enabling platforms —helps poultry producers navigate today's key challenges of rising feed costs, increasing poultry gut-health pressures, and growing performance demands. Cargill ANH experts also met with attendees to show how their integrated solutions turn complexity into clarity, enabling confident decisions that promote gut resilience, improve feed efficiency, and deliver measurable business impact across poultry operations.

Microbiome intelligence was a central theme of Cargill's presence at the expo. Luisa Gené, MSc, Galleon™ Technology Lead, and Fernanda Castro, Micronutrition and Health Technical Lead, shared how Galleon™ transforms microbiome complexity into clear, actionable nutrition and farm-management strategies. Powered by artificial intelligence and a global database of more than 75,000 microbiota analyses, Galleon™ enables producers to identify critical biomarkers, tailor feeding programs, and support gut health and immunity, while helping identify pathogen risk. Gené delivered a TECHTalk on this topic, and Castro presented a poster during the International Poultry Scientific Forum.

Laying persistency and long-term productivity in modern hens were also key discussion

points at the Cargill ANH booth. Angela Guaiume, Director of Poultry Nutrition Services North America, and Lieske van Eck, Senior Research Scientist, highlighted research-proven nutritional strategies that support improved egg count over production cycles of up to 100 weeks. They emphasized the role of REVEAL™ Layers, which enable producers to non-invasively monitor hen body condition in real time to inform the nutrition strategies that help sustain laying persistency, optimize feed efficiency, and reduce feed costs.

Read more>>

ADM showcases poultry nutrition research at IPPE 2026

ADM, one of the global leaders in nutrition and agricultural solutions, presented its latest research and science-backed strategies for poultry producers during the International Production & Processing Expo (IPPE) 2026. At the event, ADM's poultry nutrition experts focused on practical, science-based approaches for layer, breeder, and broiler operations, sharing research findings and applied nutritional strategies relevant to commercial production systems.

As part of the IPPE Tech Talk program, Dr. Jose Charal, Director of Monogastric Technical Sales at ADM, delivered a presentation titled "Practical Approaches to Sustaining Egg Production in Layers and Breeders." The session addressed applied nutritional strategies to support long-term egg production in

both layer and breeder flocks.

In addition, Dr. Andrea Hanson, Scientific Manager for ADM's Animal Nutrition Research & Development team, presented at the International Poultry Scientific Forum (IPSF) on "The Effect Of XTRACT 6930 and Feeding Regimens on Male, Female, and Straight-Run Broilers."

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Amlan International focuses on gut health and feed efficiency at IPPE

Amlan® International, one of the global leaders in mineral-based feed additives, exhibited at the International Production & Processing Expo (IPPE) 2026. The company explained to visitors at its booth how science-backed solutions can help optimize gut health, feed efficiency and profitability in antibiotic-free poultry production.

As poultry producers continue to move away from antibiotic growth promoters, maintaining profitability under real-world production pressure has become increasingly complex. With feed representing up to 70% of total production costs, feed efficiency is a primary driver of economic performance. Subclinical disease, pathogenic bacteria, and biotoxins can persist even in flocks that appear healthy, quietly eroding margins by suppressing feed intake, compromising gut integrity, impairing nutrient utilization, and diverting energy away from growth.

"Today's producers are facing unprecedented pressure to perform without antibiotics while still protecting margins," said Dr. Wade Robey, President of Amlan International. "Our focus is on delivering proven, natural solutions that help customers maintain consistent performance when it matters most — in real production environments, not just controlled trials."

During IPPE 2026, Amlan spotlighted how Varium®, a natural alternative to antibiotic growth promoters, helps improve feed efficiency and performance in antibiotic-free systems.

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Layn introduces new fertility solution for breeders at IPPE

Layn Natural Ingredients, one of the world's largest manufacturers and innovators of polyphenol-rich botanical extract solutions, announced the debut of TruGro FERTIVA at the 2026 International Production & Processing Expo (IPPE). The company showcased the new solution at its booth, highlighting its expanding portfolio of science-backed botanical technologies for poultry production.

According to the statement, TruGro FERTIVA is a proprietary blend of polyphenol-rich botanical extracts designed to counteract the negative impact of reactive oxygen species (ROS) in breeder roosters and hens throughout the reproductive cycle. The launch further strengthens Layn's TruGro portfolio of natural solutions that help optimize fertility, hatchability, and long-term breeder performance.

Polyphenols comprise a diverse class of more than 8,000 naturally occurring compounds, many of which function as metabolic antioxidants. These bioactives help reduce oxidative stress in specific target organs, improving ROS-mediated conditions that can compromise reproductive efficiency and longevity in production species.

"TruGro FERTIVA is a natural, research-driven tool that helps maintain parent stock performance at peak levels," said Mary Joe Fernandez, Global Vice President Sales and Business Development at Layn Natural Ingredients. "By mitigating oxidative stress, it supports fertility and breeder longevity, reduces premature performance decline, and ultimately enhances chick quality and vitality, while helping producers manage replacement costs."

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AB Vista spotlights Ultra-25 D and enzyme solutions for poultry at IPPE

AB Vista, one of the leading companies in animal nutrition, participated in the International Production & Processing Expo (IPPE), held in Atlanta, GA, from January 27 to 29, 2026. During the event, the company showcased Ultra-25 D, a 25-hydroxy vitamin D_3 source and metabolite of vitamin D, at its booth.

According to the statement from the company, Ultra-25 D offers higher bioavailability than traditional vitamin D_3, allowing producers to use less while maintaining performance. In poultry, its use ensures faster biological response, improved muscle performance, and stronger bones. It also enhances eggshell quality and boosts immune response, especially during periods of stress. When combined with Quantum Blue, AB Vista's phytase, it provides the ideal mineral balance for animals.

"Several strategies are applied to improve calcium (Ca) and phosphorus (P) absorption in the intestine – mainly vitamin D_3 and phytase. Together, these products work synergistically to maximize the absorption of these minerals, directly contributing to bone and muscle development as well as eggshell quality," explained Tiago Santos, Innovation Director at AB Vista.

In addition to the showcase of Ultra-25 D, AB Vista also presented its portfolio of key products and services designed to support gut health and promote better feed efficiency while caring for the environment.

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Novus features new poultry nutrition findings at IPSF 2026

From variability at the feed mill to processing-level outcomes, five new studies from Novus and its research partners were presented at the 2026 International Poultry Scientific Forum (IPSF). The research demonstrated how targeted enzyme and trace mineral strategies support nutrient utilization, bird performance, and carcass and egg quality. Together, the research offered a comprehensive look at how intelligent nutrition can translate into measurable value across the poultry production chain.

"Producers are under constant pressure to get the most out of every ingredient they feed," said Rasha Qudsieh, Global Enzymes and Microbials Senior Manager at Novus. "This research shows how thoughtful nutrition strategies, from enzyme selection to trace mineral source, can support how birds use nutrients across the entire production cycle, starting with feed formulation and extending through carcass and egg quality."

The presentations at the 2026 IPSF were as follows:

• Zn-Methionine Hydroxy-Analogue Chelate supplementation improves carcass quality in broilers under commercial conditions. Presented by Ana Clara Polo Ferreira of Bello Alimentos

• Dietary protease mitigates the negative effects of trypsin inhibitors on digestive function and gut health in broilers beyond super-dose phytase – Jejunum and pancreas transcriptomics. Presented by Luis Romero of Biofractal

• Gene expression explained the benefits of HMTBa-Chelates of Zinc and Manganese under different copper programs on broiler performance. Presented


Photo: Novus International

by Hugo Romero of Novus

• Dietary protease mitigates the negative effects of trypsin inhibitors on digestive function and gut health in broilers beyond super-dose phytase – Performance. Presented by Rasha Qudsieh of Novus

• Effects of inorganic, HMTBa-chelated trace mineral, or blended sources of zinc, copper, and manganese on the egg quality of laying hens. Poster presented by Ruth Wallace of Mississippi State University as part of the Student Competition

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A&P Nutrition focuses on performance in animal nutrition

A&P Nutrition, established through the strategic union of PATENT CO. and agromed under the RWA (Raiffeisen Ware Austria) umbrella, introduced its performance-oriented solutions to industry professionals at IPPE 2026, held from January 27-29.

The new brand, which combines the decades of expertise of PATENT CO. and agromed into a single portfolio, aims to redefine the future of animal nutrition. At the heart of this transformation lies a mission focused on improving animal performance.

According to the company, this is more than a slogan—it's a customer-centric promise backed by innovation, transparency, and a deep understanding of species-specific needs.

A&P Nutrition stated its commitment to delivering


Photo: Freepik.com

nature-inspired, scientifically validated solutions that address the most pressing challenges in animal health and performance. The company highlighted that the decades of experience have been transferred into a portfolio made of nature-inspired solutions that are safe for animals, humans and the environment, efficient even in small dosages and fast in action.

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  Dr. Laura Niehues, Balchem Animal Nutrition & Health
- Colostrum Management: A passport to life
  Mélody Baudon & Julia Novitska, Elvor – Savencia Group
- Rethinking trace minerals in dairy nutrition
  Gavin Boerboom, Trouw Nutrition
- The impact of rapid feed analysis in reshaping animal health
  Dr. Markus Wiltafsky-Martin, Evonik Animal Nutrition
- Precision nutrition in commercial poultry production
  Aaron Cowieson, dsm-firmenich Animal Nutrition & Health
- Role of microencapsulated probiotics in feed degradation
  Juan Esteban Vásquez, Bialtec
- Learning from AGP mechanisms to advance poultry nutrition
  Ilinca Anghelescu & Dr. Andreas Michels & Predrag Persak, EW Nutrition
- More eggs, stronger shells: The role of activated vitamin D
  By Phytobiotics Futterzusatzstoffe GmbH
- Understanding functional nutrition to support precision nutrition
  Dr. Virginie Blanvillain, AB Vista

PRECISION PROTEIN: HOW AMINO ACIDS ARE REDEFINING DAIRY NUTRITION

Dr. Laura Niehues
Technical Services Specialist
Balchem Animal Nutrition & Health

"Today, nutritionists increasingly recognize that the solution isn't more protein—it's the right balance of nitrogen sources. Switching to amino acid-focused ration formulation allows us to "narrow the road," delivering only what the cow needs and reducing waste in the process. Commonly, this can result in decreased crude protein of around 2 percentage units."

Precision feeding has rapidly gained momentum across the dairy industry as producers face rising pressure to improve efficiency, reduce environmental impact, and maximize the genetic potential of modern cows. While the concept is simple—provide each cow exactly what she needs and nothing more—the execution on a high performing dairy can be complex. A few starting points to begin precision feeding and improve efficiency include different rations for each stage of lactation and parity, improving feeder training and nutrient analysis of feed ingredients to avoid having to formulate for excess nutrients, ensuring data-driven decisions based on milk meters, behavior and rumination collars, and strategic supplementation of vital nutrients required for high producing, feed efficient dairy cows. This article will focus on strategic supplementation, specifically of amino acids. In this way, nutritionists can narrow the gap between theoretical models and on-farm reality.

IMPORTANCE OF AMINO ACIDS

Amino acids (AA) are the fundamental building blocks of protein, supporting a wide array of biological functions. Specifically for dairy cows, AA can support production of milk and milk components. Though milk protein and fat are vital for the milk check, AA can also support lactose production, and since lactose is the primary osmoregulatory molecule in the mammary gland, it dictates milk volume. When cows receive the correct AA required for protein, fat, and lactose synthesis, they can more effectively convert feed into milk and milk component yields. It is also important to note that AA influence not only milk protein, fat, and lactose synthesis, but also immune function, reproduction, and tissue growth.

FROM CRUDE PROTEIN TO PRECISION NUTRITION

Historically, protein nutrition centered around simply feeding more protein. High crude protein (CP) diets were common because they offered a wide safety margin—essentially a broad road intended to cover all possible amino acid requirements, especially given feed variability. But this approach has critical flaws:

- Deficiency of some essential amino acids

• Oversupply of some amino acids
• Metabolic energy costs associated with excreting excess nitrogen due to oversupply
• Lost production potential due to imbalanced AA supply

The result? Inefficient nitrogen use, unnecessary feed costs, and suboptimal performance.

Today, nutritionists increasingly recognize that the solution isn't more protein—it's the right balance of nitrogen sources. Switching to amino acid-focused ration formulation allows us to "narrow the road," delivering only what the cow needs and reducing waste in the process. Commonly, this can result in decreased CP of around 2 percentage units. This creates a more efficient cow.

Dairy cows require ten essential amino acids (EAA) but methionine and lysine consistently rise to the top as most limiting for milk and milk protein synthesis. Histidine often follows, depending on the diet and production system. Emphasis is often placed on lysine, methionine, and histidine for this reason; however, all EAA are required and must either be produced by microbial protein in the rumen or consumed by the cow. For that reason, it is vital to assess all EAA that are within the metabolizable protein portion, since this would encompass AA that bypass the rumen and AA contributed from microbial protein.

Currently, only rumen protected methionine (RPM) and rumen protected lysine (RPL) are widely available in commercial forms, making them the primary amino acids that can be reliably supplemented in precision rations. Even with high quality protein ingredients, reaching ideal methionine and lysine through feedstuffs alone is difficult—making rumen protected products essential nutritional tools. Utilizing rumen-protected AA such as AminoShure™-XM (Balchem Corporation, Montvale, NJ; 38% metabolizable methionine) and AminoShure™-L (Balchem Corporation, Montvale, NJ; 24.3% metabolizable lysine) allows for a consistent and reliable source of metabolizable methionine and lysine. Additionally, using a range of protein ingredients improves the overall AA profile and reduces dependency on any single feed ingredient's inherent variability. This strategy is more likely to provide a comprehensive supply of all EAA and meet the needs of the rumen. Rumen protected AA can then be used to "fine tune" the final balance.

To test this concept, a study at Cornell University designed multiple rations with varying AA supply. Comparing a ration with adequate methionine but inadequate metabolizable protein to a ration


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with adequate methionine, metabolizable protein, and EAA, energy-corrected milk was 1.6 kg greater in the ration adequate for methionine, metabolizable protein, and EAA (Higgs et al., 2022). This indicates that it is not sufficient to only add in rumen-protected methionine, but instead to have a comprehensive supply of all EAA. Though it is important to note there was a 1.3 kg increase in energy-corrected milk yield when methionine was adequate compared to the base ration that was only adequate in metabolizable energy and was inadequate in metabolizable protein, methionine, and rumen nitrogen. This indicates that there can be a small response when only RPM is added, but a larger response when all metabolizable EAA are adequately supplied, alongside rumen nitrogen.

CONCLUSION

Precision nutrition represents a powerful opportunity for dairy producers striving for efficiency, sustainability, and optimized performance. Central to this approach is shifting from crude protein-centric feeding to amino acid based formulation, especially through targeted use of rumen protected lysine and methionine.

As data technologies advance, ingredient analysis becomes more refined, and nutritional models continue to evolve, the industry will continue moving toward a future where every nutrient counts and every cow receives precisely what she needs to thrive and more fully express her genetic potential.

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About Dr. Laura Niehues

Living in the United States in Florida, Dr. Laura Niehues obtained her Bachelors degree in Animal Science from University of Florida and went on to complete a Masters in Equine Nutrition from Kansas State University and a PhD in Dairy Cow Nutrition from University of Illinois. During her PhD, Niehues focused on amino acids during the transition period of dairy cows, specifically rumen-protected lysine. After completing her PhD, she worked as a Technical Services Manager for Novita, working specifically with bypass protein for dairy cows, and for Native Microbials working with rumen microbes and on farm technical support. Currently, Laura Niehues is the Technical Services Specialist for the Eastern United States and Canada at Balchem. She greatly enjoys providing technical support for balancing for amino acids in modern dairy cow rations.

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COLOSTRUM MANAGEMENT: A PASSPORT TO LIFE

Colostrum management is the first and most decisive step in securing a calf's survival, health, and long-term performance. As calves are born without immune protection, the quality, quantity, timing, hygiene, and verification of colostrum intake determine the success of passive immunity transfer. Applying science-based colostrum management practices reduces early-life mortality, strengthens disease resistance, and lays the foundation for lifelong productivity in dairy herds.

Calf rearing represents a major investment for the future of a dairy farm, and its success is determined by many factors, including the management of the first hours of life. Colostrum provides energy, essential antibodies, and nutrients for the future performance and health of the animal. Effective management is critical to ensure passive immunity transfer, reducing mortality while boosting future production.

THE FUNDAMENTALS OF COLOSTRUM MANAGEMENT: THE 5Q's RULE

Optimal colostrum management follows a precise methodology summarized by the "5Q's" rule. Each of these parameters has to be strictly monitored to ensure the survival and development of the newborn calf. Each "Q" is defined by specific scientific thresholds that must be met.

Quality is defined by the concentration of immunoglobulin G (IgG) in the colostrum. Colostrum is considered high quality when it contains at least 50 g/L of IgG[1]. In practice, this corresponds to a value greater than 22% on the Brix scale when using a refractometer. Scientific data indicates that colostrum measuring less than 18% Brix is highly insufficient, while values above 28% Brix represent excellent quality. It is important to note that visual appearance, such as color or density, is not a reliable indicator of actual antibody concentration. However, more yellow or darker colostrum generally contains higher fat content.

The **Quantity** distributed must provide the calf with a sufficient immune load to establish protection. A newborn calf requires an intake of minimum 200 g of IgG in its first meal. This is typically achieved by feeding a volume equivalent to 10% of the calf's body weight (BW), which makes approximately 4 liters for a 40 kg Holstein calf. Feeding only 2 liters has been shown to result in significantly lower serum IgG status and increased incidence of scours. While a second feed of 2 liters is recommended within 12 hours, providing more than 12% BW in a single feed may cause gastric disorders without necessarily increasing serum IgG levels[2].

Quickness is one of the most critical factors because the calf's intestinal permeability to large molecules like antibodies decreases exponentially after birth. IgG absorption is highest within the first two hours of life (approaching 30%) and drops to nearly zero after 20 hours. Simultaneously, the quality of colostrum in the udder degrades quickly: there is a 25% loss of IgG concentration by the second milking (12 hours) and a 50% loss after 24 hours[3].

sQueaky clean management focuses on hygiene to prevent the calf from ingesting pathogens before its immune system is established. Scientific standards require colostrum to have a total bacterial count below 100,000 CFU/mL and less than 10,000 CFU/mL for E. coli. High bacterial loads directly interfere with the efficiency of antibody absorption across the intestinal wall.

Finally, **Quantifying** involves verifying the success of passive immunity transfer by measuring serum protein levels in the calf ideally, between 24 to 48 hours of age, or up to 7 days maximum. A good transfer is marked by serum IgG levels ≥ 18.0 g/L or a Serum Total Protein (STP) ≥ 5.8 g/dL (Brix ≥ 8.9%)[4].

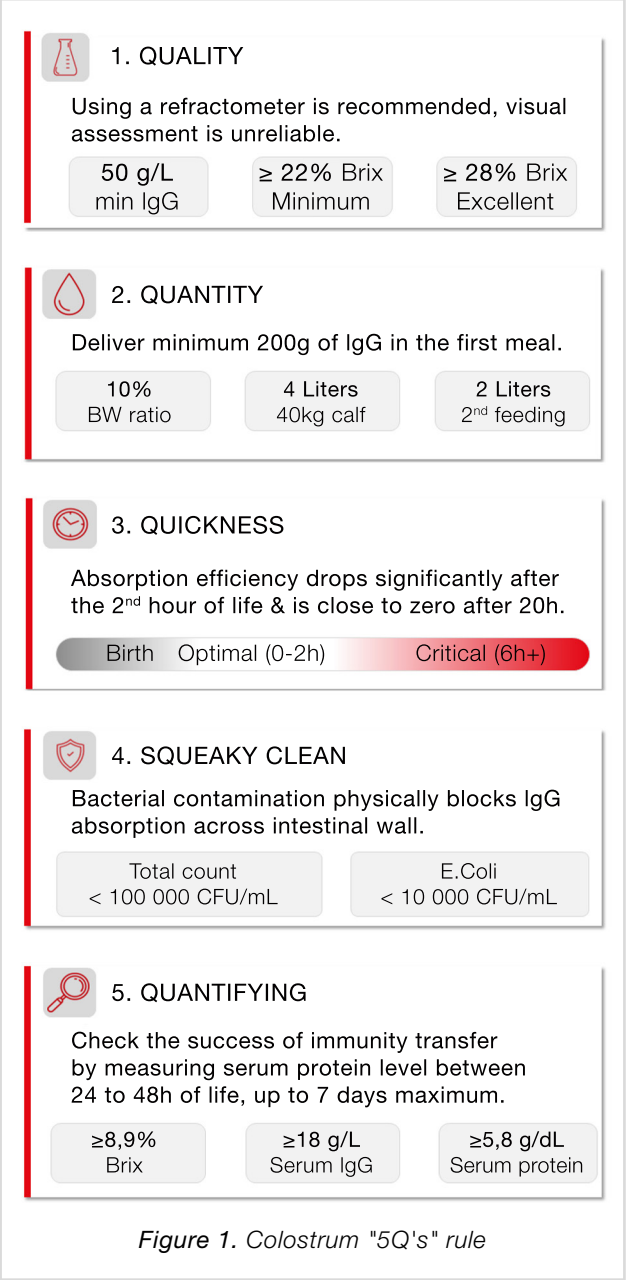

Figure 1. Colostrum "5Q's" rule

BIOLOGICAL IMPORTANCE OF IMMUNITY TRANSFER

Unlike many species, cattle's placenta is impermeable to large proteins, including immunoglobulins. Consequently, calves are born without immune defences and no circulating antibodies to protect them from environmental pathogens. They depend entirely on the passive immunity transferred via colostrum to survive environmental challenges in the first weeks of life until their own immune system becomes entirely functional at approximately 3 to 4 weeks of age.

When the consumption of colostrum is not of the right quality or quantity, it may lead to Failure of Passive Transfer (FPT), defined as serum IgG levels below 10 g/L. It can have significant economic and health consequences, especially on the long term. Research indicates that calves with poor immunity transfer are 4.3 times more likely to die before weaning and are significantly more susceptible to

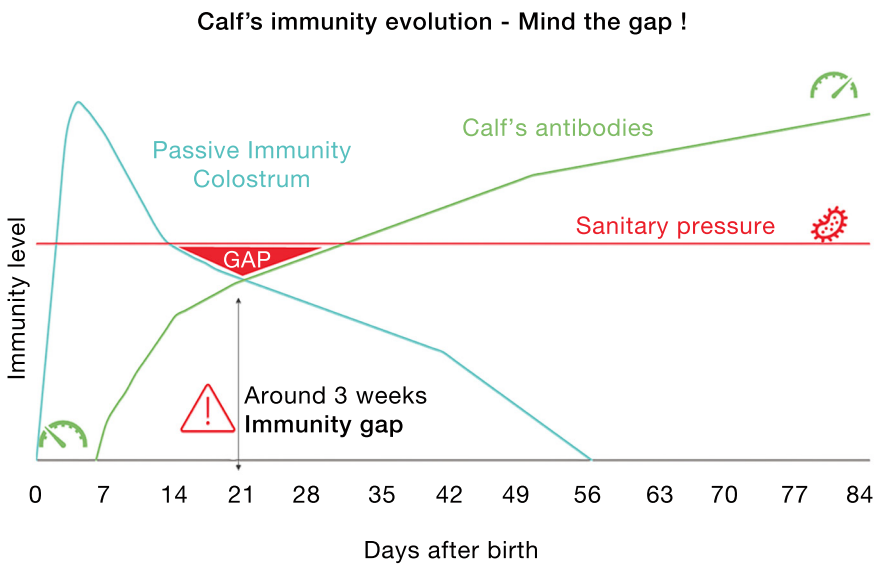

Figure 2. Around 3 weeks of age, the calf is more vulnerable to pathogens due to immunity gap between decrease of passive immunity brought by the mother and its own immunity not entirely built.

disease: the risk of diarrhea increases by 49%, and the risk of respiratory diseases increases by 39%[4,5].

Beyond immune protection, colostrum acts as a complex energetic soup containing essential elements in higher quantity compared to milk, like growth factors, hormones, bioactive molecules, or vitamins. It contains IGF-1 (which is 300 times more concentrated in colostrum than in mature milk), insulin, and prolactin, all of which stimulate the early development of intestinal microvilli. These benefits persist throughout the animal's life: heifers receiving 4 liters of quality colostrum at birth produce an average of 1 kg more milk per day during their first lactation than those receiving only 2 liters, representing a total gain of over 550 kg across two lactations[6].

Best practices for maximizing colostrum quality start with the cow's dry period. A balanced diet rich in proteins, energy, minerals, and vitamins is essential, at least 3 to 4 weeks before calving. Furthermore, vaccinating the dry cows against pathogens such as Rotavirus, Coronavirus, and E. coli specifically enriches the colostrum with targeted antibodies, providing the calf with superior local and systemic protection.

DISTRIBUTION BEST PRACTICES

The distribution method directly influences the quantity and speed of colostrum ingestion. Allowing the calf to suckle the mother is not recommended because it provides no control over the quality or volume consumed. In France, data shows that around half of farmers still allow suckling, which frequently results in failure of passive transfer. Using a bottle or a nipple bucket is preferred, as the nipple stimulates the oesophageal groove reflex, directing the colostrum to the abomasum. If a calf refuses to drink, oesophageal drenching is a scientifically validated technique that guarantees the administration of the full 4 Liters requirement in a single meal.

Hygiene is often the weakest link in colostrum management. It is estimated that 75% of colostrum samples exceed bacterial contamination limits, often due to biofilms in scratched buckets or poorly cleaned hoses. It is particularly essential to have a rigorous hygiene as some bacteria can double their population every 20 minutes. To ensure cleanliness, all equipment must be rinsed with ambient temperature water, washed with detergent at a temperature above 50°C, disinfected, and air-dried. On top of a visual checking to control hygiene, the use of an ATP-meter allows for instant verification of surface cleanliness. It is also possible to collect samples for culturing.

Regarding conservation, fresh colostrum should not remain at room temperature for more than 30

minutes. It can be refrigerated for 48 hours, or up to 7 days if a preservative is added. For long-term storage, colostrum can be frozen at -20°C for up to one year to maintain a safety stock for emergencies. Thawing must be conducted slowly in a water bath at a temperature below 50°C. The use of microwaves or boiling water is prohibited as it may alter the delicate molecules like antibodies. Pasteurization (60°C for 60 minutes) is a recommended practice that reduces microbial load, thereby improving the rate of transfer into the calf's bloodstream.

A NEW TECHNICAL COLOSTRUM REPLACER

In situations where maternal colostrum is unavailable, of insufficient quality (<22% Brix), or comes from cows infected with diseases, a high-performance substitute is required. Elvor Immune is a technologically advanced scientific solution specifically formulated to secure calf's start in life through a formula that integrates both immunity and nutrition to meet all the needs of the newborn calf.

A primary advantage of Elvor Immune is its high concentration of colostrum powder (50%), providing a direct and reliable source of bovine IgG for systemic immunity. This base is supplemented with 10% egg products containing immunoglobulins Y (IgY). These IgY molecules offer a complementary and synergistic effect: while bovine IgG circulate in the blood to protect the entire body, IgY act locally within the intestinal lumen. They specifically bind to pathogens like Rotavirus, E. coli and cryptosporidium, preventing them from adhering to the intestinal wall. This dual-barrier approach maximizes survival chances and significantly reduces the incidence of early digestive disorders.

Beyond immune support, Elvor Immune contains high-tech nutritional additives to support the newborn's metabolism. It includes partially chelated trace elements (Iron, Zinc, Manganese) and organic selenium, which offer superior bioavailability compared to inorganic forms, ensuring optimal assimilation for skeletal and immune development. The addition of live yeasts and fructo-oligosaccharides (FOS) promotes the establishment of beneficial gut microflora and accelerates rumen development. By providing the right IgG levels, Elvor Immune allows farmers to overcome colostrum deficiencies while providing the necessary energy for thermoregulation and vigorous early growth.

Photo: Elvor

Figure 3. Elvor App helps the farmer to manage his calves! Check the colostrum level and the recommended Elvor Immune dosage directly through the App.

Elvor Immune can be administered as a complete or partial replacement of the colostrum: its dosage must be calculated according to quality and quantity of the colostrum. It should be fed within the first two hours of life to maximize immunoglobulin absorption. Farmers can reconstitute the appropriate dosage in warm water or in the mother's colostrum: it guarantees the newborn receives essential systemic protection and local intestinal defence, regardless of maternal colostrum quality. Elvor App can help to check colostrum quality and to give the recommended Elvor Immune dosage.

In summary, colostrum management is the foundation of a dairy herd's future productivity. Strict adherence to the 5Qs, supported by precision tools and innovative solutions like Elvor Immune, transforms a major health risk into a powerful lever for sustainable herd performance. A calf requires the biological foundation of colostrum to reach its full genetic potential.

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About Mélody Baudon

With a master's degree in Animal Production, Mélody Baudon joined Elvor in 2025 to provide technical and marketing support. Mélody aims to showcase the company's expertise in milk replacers and calf management worldwide. She previously served as an International Technical and Marketing Manager specialised in mineral nutrition for ruminants.

About Julia Novitska

With a master's degree in International Business, Julia Novitska has served as Export Sales Manager at Elvor since 2022. With over eight years of specialised experience in the milk replacer industry, she currently oversees business follow-up and development across Northern and Eastern Europe, the Balkans, Middle East, and Asia. Beyond commercial promotion, Julia provides her support to guide and optimise the use of milk replacers products.

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- ✓ Fructo-oligosaccharides for maintaining an **adequate digestive microflora**

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RETHINKING TRACE MINERALS IN DAIRY NUTRITION

Gavin Boerboom
Category Director Trace Minerals
Trouw Nutrition

Trace minerals play a critical role in dairy cow health, performance, and fertility, yet emerging data suggest that oversupply—rather than deficiency—is increasingly common in modern dairy rations. Across production systems, imprecise mineral supplementation can quietly undermine reproductive efficiency, metabolic stability, and sustainability. Rethinking trace mineral strategies through a precision nutrition lens is becoming essential for balancing animal health, economic efficiency, and environmental responsibility.

Trace minerals have long been recognized as essential components of dairy cow nutrition. They are vital for immunity, fertility, enzyme function, and metabolic stability. Yet new studies show that many dairy production systems are facing over supplementation rather than deficiencies in minerals. Across regions and production environments, copper (Cu), zinc (Zn), and manganese (Mn) are routinely supplied far above a cow's actual requirements, with consequences that reach beyond the farm gate.

Recent research and precision nutrition initiatives led by Trouw Nutrition have brought this issue sharply into focus, prompting a shift in the way formulators and nutritionists approach trace mineral strategies. The push toward sustainability, coupled with rising feed costs and increasing regulatory pressure, makes mineral accuracy, not excess, a priority.

A WIDESPREAD, UNDERESTIMATED CHALLENGE

Multiple global surveys reveal a consistent trend: dairy diets commonly contain mineral levels far above NASEM 2021 guideline recommendations. In a large data set of 139 herds in California and eastern Canada, average copper levels were found to be 70–80% above the requirement for a 32kg milk lactating cow. Similar cases have been documented across Europe, with dairy cows often accumulating excessive copper reserves in the liver, frequently without visible clinical signs until levels approach toxicity.

This pattern is not unique to copper. Zinc and manganese, while less prone to toxicity, also display chronic overinclusion in many rations.

The root causes are well known to formulators:

- Wide variability in mineral content of forages and byproducts
- Fear of antagonistic interactions (iron, sulfur, molybdenum)
- Historic emphasis on preventing deficiency at all costs
- Limited or irregular trace mineral testing
- Premixes designed with generous safety margins

However, the cumulative effect of these "insurance policies" is now clear: systematic oversupply has become more common, and more harmful.

SILENT BUT SIGNIFICANT: HEALTH AND REPRODUCTIVE COSTS

Trace mineral overload rarely presents rapid, dramatic symptoms. Instead, it develops quietly.

Copper Accumulation and Chronic Toxicity

Studies from the United States, Canada, the Netherlands, and the UK indicate that a substantial percentage of dairy cows carry liver copper concentrations exceeding safe thresholds. Chronic copper load can heighten vulnerability to stress induced hemolytic crisis, reduce feed intake and metabolic efficiency, increase oxidative stress and interfere with immune response.

Reproductive Consequences

Research consistently shows that elevated copper levels reduce conception rates and increase the number of services per pregnancy. This has clear implications for farm profitability, especially in high performance herds where reproductive efficiency underpins economic sustainability.

Subclinical Performance Drag

Like many metabolic imbalances, mineral overload often manifests as:

- Lower milk persistency,
- Reduced rumen efficiency,
- Greater susceptibility to disease,
- Poorer transition cow resilience.

The lack of obvious signs contributes to the misconception that "more is better," even when productivity quietly suffers.

ENVIRONMENTAL AND ECONOMIC PRESSURES MOUNTING

Oversupplied minerals are not stored indefinitely; they are excreted. Elevated levels of Cu, Zn, and Mn in manure accumulate in soils over time, disturbing soil microbial communities and raising concerns around water contamination.

Several regions are facing increased regulatory scrutiny around land application limits. In regions already facing nitrogen and phosphorus regulation, trace mineral excretion is emerging as an additional sustainability pressure point.

Economic Inefficiency

Although trace minerals represent a small percentage of feed cost, oversupplying them is economically irrational. Feed budget is wasted, fertilizer and manure management challenges increase, and no performance benefit is gained.

For formulators working within tight margin structures, eliminating unnecessary mineral inclusion represents instant cost savings.

A PRECISION APPROACH: INTEGRATING THE BASAL DIET

A key insight from Trouw Nutrition's extensive dataset of 5,000 dairy diets is that basal rations already supply a significant proportion of required trace minerals (~50% of copper, ~32% of zinc, ~68% of manganese). These contributions often go unrecognized. When mineral content from forages and byproducts is not accounted for, premix supplementation levels become inflated by default.

The challenge is that routine trace mineral testing of forages is not standard in many regions. NIR systems, while efficient, do not reliably measure Cu, Zn, or Mn. This leaves nutritionists relying on book

values, values that may lead to compounding overestimation.

THE TROUW NUTRITION PRECISION MODEL: A PRACTICAL TOOL FOR FORMULATORS

To address the complexity of balancing mineral requirements across variable diets and animal categories, Trouw Nutrition developed a comprehensive precision mineral supplementation model. The model integrates:

- Basal diet mineral contributions
- Expected variations in milk yield and DMI
- Antagonist presence (e.g., iron, sulfur)
- Mineral interactions
- Requirements across lactating cows, dry cows, and growing heifers
- Maximum tolerance limits

The output is a set of science based, category specific supplementation guidelines for copper, zinc, and manganese that reduce both under and oversupply.

Why This Matters for Formulators?

Such a model helps standardize practices across nutrition teams, reducing the reliance on "safety margin" blending and promoting more stable reproductive performance, lower toxicity risk, reduced environmental trace mineral excretion as well as increased formulation efficiency and consistency.

RETHINKING MINERAL SOURCES: SOURCE MATTERS

An important complement to precision mineral levels is mineral form. Higher reactive sulfate sources can generate free radicals, damage vitamins, or reduce fiber digestibility. More stable, less reactive sources, such as hydroxy trace minerals, can offer:

- Improved bioavailability
- Reduced reactivity in the TMR
- Lower inclusion levels without compromising cow performance
- Decreased excretion due to better absorption

When the nutritional goal is to meet requirements rather than overshoot them, source quality becomes a key factor in achieving predictable results.

A CALL TO ACTION FOR FEED FORMULATORS

To move the industry toward more sustainable, precise mineral feeding, formulation teams should consider the following next steps:

1. Audit current trace mineral inclusion levels
Compare premix and TMR mineral concentrations with modern requirement guidelines and updated forage test results.

2. Reduce or eliminate outdated safety margins
Replace blanket overfortification with data driven adjustments based on analytical results and model recommendations.

3. Encourage targeted forage mineral testing
Even limited seasonal sampling can improve formulation accuracy significantly.

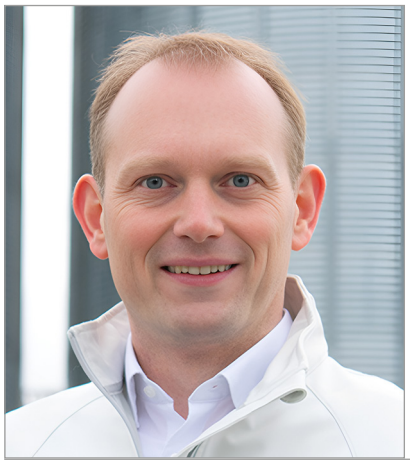
4. Evaluate mineral source bioavailability
Shifting to more stable and predictable mineral forms may allow lower dosage without risk.

5. Communicate with producers
Explain the value of precision: better fertility, improved sustainability, lower feed costs, and reduced risk of toxicity.

CONCLUSION: TOWARD SMARTER, SUSTAINABLE MINERAL NUTRITION

The dairy industry is undergoing a transformation, one in which precision, data, and sustainability are shaping the future of ration formulation. The long standing culture of "adding a little extra, just in case" is no longer aligned with modern scientific insights or economic realities.

By embracing precision nutrition models, accurately accounting for basal diet mineral contributions, and selecting higher quality mineral sources, feed formulators can safeguard animal health, enhance farm performance, reduce waste, and contribute meaningfully to the sustainability goals of the dairy value chain.



THE IMPACT OF RAPID FEED ANALYSIS IN RESHAPING ANIMAL HEALTH

Dr. Markus Wiltafsky-Martin
Director of Service Commercialization
Evonik Animal Nutrition

Tools such as near-infrared spectroscopy (NIR), real-time nutrient profiling, and digital monitoring systems enable faster and more accurate evaluation of feed quality. By ensuring precise nutrient delivery and early detection of antinutritional factors, rapid feed analysis helps improve growth rates, strengthen immune function, and reduce health risks across livestock species.

Feed quality is never constant, and this variability can negatively affect livestock health and performance. Inconsistent raw materials can disrupt growth, compromise gut integrity and immune function, and increase vulnerability to pathogens, worsening feed conversion ratios (FCR). Poor feed efficiency also raises costs and nitrogen emissions, reducing farm resilience. To overcome the challenges of feed variability, rapid feed analysis has become an essential tool for the livestock industry. It is the foundation of precision nutrition, enabling producers to improve animal health and performance while meeting sustainability goals.

THE IMPORTANCE OF PRECISION NUTRITION

The goal of feed formulation is to meet animal needs without overfeeding. Achieving this balance supports performance, profitability, and environmental responsibility. However, nutritional requirements are not fixed — they vary by species, breed, age, sex, housing conditions, and production objectives. For example, broiler diets may prioritize live weight or breast meat yield depending on market demands. Precision nutrition allows producers to customize diets for these changing conditions, ensuring animals receive exactly what they need for optimal health and growth.

BETTER HEALTH THROUGH BALANCED DIETS

Animals require amino acids in just the right quantities and ratios to each other. Excess protein can feed harmful bacteria in the gut, causing microbiome imbalances and compromising overall gut health. At the same time, it increases the metabolic burden of detoxifying surplus nitrogen, leading to higher water consumption and increased nitrogen emissions.

Low crude protein (LCP) diets, supported by targeted amino acid supplementation, are a proven way to maintain growth performance, reduce nitrogen emissions, and support animal welfare. Lower nitrogen levels in excreta lead to lower ammonia levels, resulting in healthier litter and improved air quality. This translates into practical welfare benefits, from fewer respiratory issues to reduced instances of footpad dermatitis in broilers.

Balanced diets also support the removal of antibiotic growth promoters (AGPs) and help minimize overall antibiotic use, reinforcing animal health through prevention rather than cure. Accurate information about the nutrients in raw materials, combined with precision feeding, is crucial to optimizing this approach.

ANALYTICS: THE FOUNDATION OF PRECISION FEEDING

Accurate feed analysis is the first step toward precision nutrition. Modern livestock operations that rely on rapid, reliable nutrient data are better equipped to manage variability in raw materials and ensure that each animal's diet matches their requirements as closely as possible. Near-infrared spectroscopy (NIR) has emerged as a valuable tool for this, offering rapid analysis of key nutrients across a range of feed ingredients and finished feeds.

Producers can integrate NIR into their operations in several ways. Samples can be scanned onsite using FOSS or Bruker devices, or sent to external labs. The process is simple: scan the feed ingredient with the NIR device, which shines near-infrared light onto the sample. The sample absorbs and reflects that light in a unique pattern, a spectrum. These spectra are uploaded for analysis, and in return you receive a detailed report within minutes. This speed enables large-scale screening at low cost, supporting more consistent feed ingredient evaluation and tighter quality control.

Photo: Evonik

Services such as Evonik's AMINONIR translate NIR spectra into nutrient profiles for more than 60 raw materials and finished feeds. This real-time data helps producers to verify ingredients and adjust feed formulations quickly, reducing reliance on costly protein and energy sources without compromising performance.

Modern feed formulation also relies on high-precision laboratory analysis to characterize raw materials and monitor variability. Wet-chemistry services – including long-established providers such as Evonik's AMINOLab – can measure amino acids, reactive lysine, fibre fractions, starch digestibility, mycotoxins and other key parameters. These data help nutritionists identify and manage imbalances, support low-crude-protein strategies and maintain consistency across ingredients and finished feeds. Used alongside rapid NIR screening, they provide a more complete analytical foundation for precision feeding.

QUALITY CONTROL IN ACTION

Soybean products illustrate why analytics matter. Under-processing leaves trypsin inhibitors that reduce digestibility and performance, while over-processing destroys heat-sensitive amino acids and lowers digestibility of amino acids in general. With these effects not always visible, analytical tools are essential for detecting variation and maintaining consistent feed quality.

Tools that assess processing intensity provide a reliable way to evaluate heat treatment and optimize digestibility. For example, indicators such as the Processing Conditions Indicator (PCI) within AMINONIR can help quantify the impact of thermal processing on nutrient availability. Continuous monitoring identifies sources of variation, providing the basis for informed decision-making and action to improve consistency. In many cases, variation can be reduced by more than 50%, supporting better feed efficiency. These improvements contribute to stronger animal health outcomes and underline the role of analytical tools as a foundation for performance and welfare.

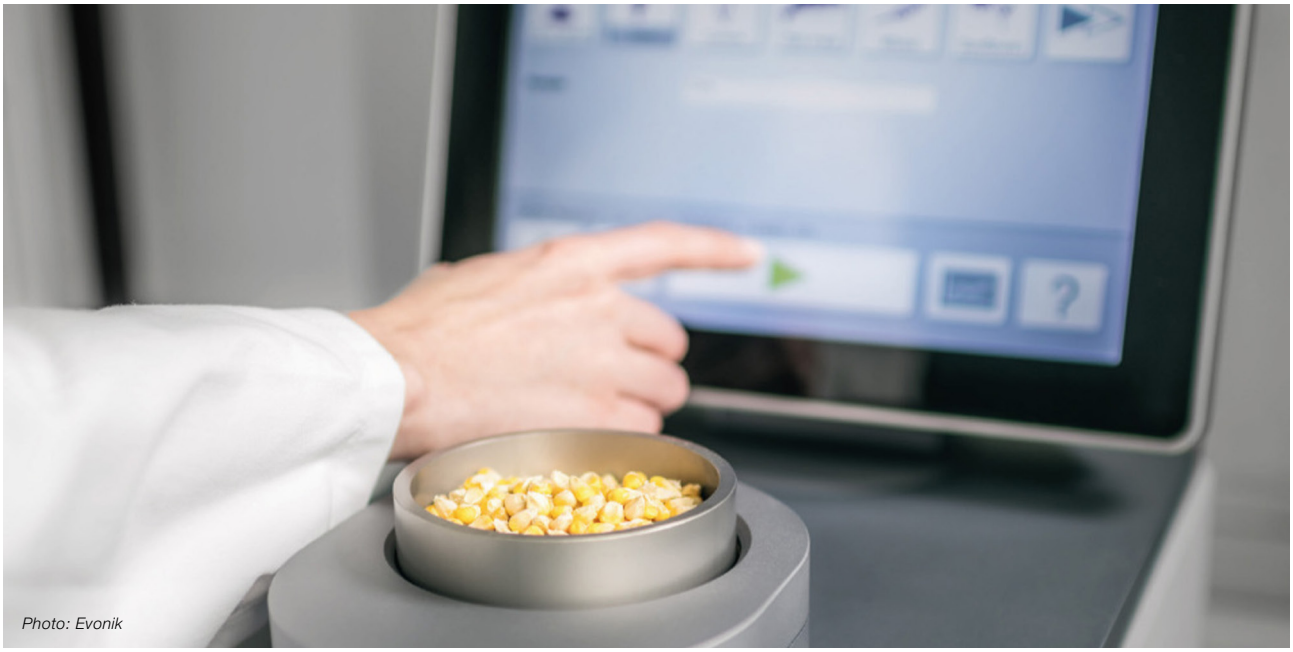


Photo: Evonik

A HOLISTIC APPROACH: COMPREHENSIVE DATA, FEEDING PROGRAMS AND ACCURATE DOSING

Analytics are most effective when combined with smart planning and integrated services. Modern feeding programs increasingly rely on platforms that translate nutrient data into dynamic feeding programs for poultry, pigs, and aquaculture. These systems allow users to enter key details such as production goals, feed form, and phase lengths, before generating tailored nutritional targets. Many also connect to large ingredient databases, such as AMINODat – containing more than 1.2 million feed ingredient samples from across the world and over 68 million analytical results – providing up-to-date matrix values for formulation.

Precise feed formulation is only part of the story. Accurate dosing during feed production is also needed to achieve precision nutrition. Automated micro-ingredient systems such as AMINOSys help ensure accurate dosing of micro-ingredients, reducing errors and improving consistency across batches. Taken together, these complementary services give producers a more reliable foundation for providing the best feed for their animals.

CONCLUSION: RAPID ANALYSIS AS A FIRST LINE OF DEFENSE

Rapid and reliable analysis is essential for managing the natural variability of feed ingredients. Producers leveraging this technology are able to implement more informed feeding strategies with enhanced precision, supporting more consistent and reliable animal performance. When combined with planning and execution systems, as well as amino acids and additives, these tools create an end-to-end precision feeding ecosystem, contributing to better business outcomes.

About Dr. Markus Wiltafsky-Martin

As Director of Service Commercialization in Evonik's Animal Nutrition business, Dr. Markus Wiltafsky-Martin received his degree in Agricultural Science from the Technical University of Munich, Germany. He has been with Evonik since 2009 and has more than 16 years of experience in conducting projects with stakeholders of the animal protein business, focusing on the importance of feed ingredient quality for the overall business. In the last 13 years, Wiltafsky-Martin has worked intensively on the quality evaluation of feed ingredients and on the translation of analytical data into valuable information for the feed industry via advanced data evaluation.

INVISIBLE STRESSORS:
WHEN UNSEEN CHALLENGES LIMIT PERFORMANCE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Modern poultry production is increasingly shaped by factors that are not immediately visible but have a decisive impact on performance. Beyond nutrition and genetics, invisible stressors such as microbial imbalance, low-grade inflammation, dietary toxins, and environmental pressure can quietly undermine efficiency and resilience. Understanding how these hidden challenges interact with the gut microbiome is becoming essential for sustaining animal health and unlocking full production potential.

By A&P Nutrition

Beyond meeting nutritional requirements, modern poultry production requires managing the unseen. Birds are bred for exceptional efficiency, rapid growth and uniform performance. Yet, even under optimal conditions, birds face a variety of invisible stressors that quietly erode this potential. These include heat or crowding, low-grade inflammation, dietary toxins or subtle microbial imbalances.

These invisible stressors share one common pathway: the **gut microbiome**. As a metabolic and immunological "control center", it influences how well birds can cope with challenges. A stable, diverse microbiome helps maintain intestinal integrity, modulate immune responses and optimize digestion. When this equilibrium is disturbed, e.g. by poor fiber quality, feed contaminants or inflammation, the

consequences are inefficient metabolism, reduced resilience and ultimately performance loss.

FEEDING THE MICROBIOME: STRUCTURE MEETS FUNCTION

The microbiota can be influenced by a wide range of dietary factors, yet the dietary fiber profile is one of the fundamental levers. Beyond its structural role, the right fiber provides fermentable substrate that drives the microbiota towards a beneficial composition that produces short-chain fatty acids (SCFAs), the essential energy source for the epithelium. However, not all fiber types act the same. Conventional lignocellulose (LC) supports gizzard function and litter quality but has limited influence on the microbiome and hindgut fermentation. In contrast, eubiotic LC, combining structural fiber from stem wood with fermentable fractions from bark, goes further. It promotes hindgut fermentation, producing measurable shifts in the microbial community and increased SCFA production.

WHEN TOXINS DISRUPT MICROBIAL COMMUNITIES

Even at low concentrations, mycotoxins like AFB1, OTA or T-2 disturb the microbial balance and compromise gut integrity, allowing opportunistic pathogens to proliferate. The resulting dysbiosis reduces nutrient digestibility and triggers secondary inflammation. Effective mycotoxin control therefore requires more than binding capacity. A multi-component approach combining adsorption, biological components that perform biotransformation, as well as ingredients that provide liver and immune system support has proven effective in minimizing the mycotoxin risk. In a mycotoxin challenge trial in Brazil, dietary inclusion of a multi-component feed supplement improved performance parameters and increased the count of beneficial *Bacillus* spp., which have probiotic function.

INFLAMMATION AS THE SILENT THIEF

Chronic, low-grade inflammation develops gradually through repeated immune activation, often secondary to mycotoxins, dietary imbalances or microbial shifts, among others. Inflammatory processes consume energy that is diverted away from performance. This may disrupt the microbiome by suppressing beneficial taxa and favoring opportunistic, undesired species. Wood lignans have the potential to counteract both oxidative stress and excessive inflammatory signals which arise in response to numerous stressors. In broilers, lignan supplementation shifted microbial composition towards beneficial genera such as *Lactobacillus*, *Bacillus* and *Akkermansia*, while opportunistic pathogenic species declined. At the same time performance was improved.

RESPIRATORY STRESS, THE OFTEN-FORGOTTEN PERFORMANCE FACTOR

The respiratory tract as well is a large surface in contact with the environment and a major interface of stress. High dust load, ammonia or temperature fluctuations can trigger oxidative stress and inflammatory responses. Recent research in layers showed that supplementation with a blend of essential oils, lysozyme and vitamins improved tracheal integrity and antioxidant status after NDV and IBV vaccination. Birds receiving the blend developed higher antibody titers, lower oxidative stress, and fewer tracheal lesions.

A&P Nutrition, the newly unified brand born from the strategic alliance of PATENT CO. and agromed under the RWA (Raiffeisen Ware Austria) umbrella, is redefining the future of animal nutrition with decades of expertise now consolidated into a single, robust portfolio. At the heart of this transformation lies a clear mission: Improving animal performance. This is more than a slogan—it's a customer-centric promise backed by innovation, transparency, and a deep understanding of species-specific needs. Through the targeted solutions of **A&P Nutrition** - eubiotic lignocellulose (OPTICELL), multilayered mycotoxin control (MYCORAID), wood lignans as gut performance tool (AGROMED ROI) and respiratory support (LIQUIHYPE) - we offer an integrated approach to conquer unseen performance barriers, focusing on the microbiome as the central link between nutrition, metabolism and resilience.

References are available on request.

PRECISION NUTRITION IN COMMERCIAL POULTRY PRODUCTION

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Precision nutrition is reshaping commercial poultry production by extending beyond feed formulation into data-driven health and performance management. Advances in sensor technologies, blood biomarkers, and machine learning now enable more accurate, timely nutritional decisions. By integrating multiple data streams, precision nutrition supports improved bird performance, flock uniformity, animal welfare, and long-term sustainability in modern poultry systems.

HAS NUTRITION NOT ALWAYS BEEN PRECISE?

The term 'precision nutrition' could suggest that current nutrition practices are 'imprecise'. However, nutrition has been, and will always remain, a precise science, striking a balance between providing enough nutrients to meet the requirements of the animal for optimal growth, without unnecessarily inflating feed cost or nutrient excretion into the environment.

Production animal nutrition has also been a constantly evolving discipline, with regular adoption of novel concepts e.g. digestible nutrient formulation systems, net energy etc. In the past few years, improved access to sensor technologies, data science tools such as machine learning and artificial intelligence, has accelerated this evolution. Systematic data generation, advanced analytics, and interpretation, offer disruptive opportunities to better understand the nutrition and health status of the flock.

In this new paradigm of animal nutrition, veterinary health, and live production, data is the new currency. Companies that collect, monitor, map, visualize, analyze, and interpret their data will be the most competitive and sustainable. The new tools available to the poultry industry present an opportunity to be more precise.

Figure 1 shows how data are gathered, collected, and interpreted in the Verax™ platform. First, blood samples are taken from birds and analyzed on site. The analysis results are added to the secure Verax™ cloud database via a dedicated app. The results are benchmarked, and the significance of the analysis results are given to the producer who can then make more informed management decisions. Over time, comparisons can be made to previous seasons or flocks, helping to identify changes. Using Verax™ is especially helpful when implementing new flock management changes or nutritional changes, as the data can be used to see how the changes are affecting the physiology of the bird.

ALL IN THE DETAIL

What makes Verax™ so valuable is the systematic and thorough method of data collection, notation, and stor-

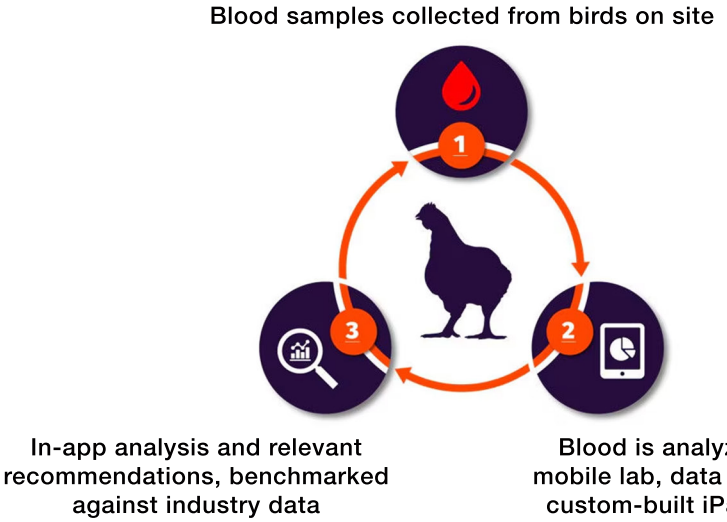

Figure 1. Illustration of how Verax™ works, starting with data collection, data input and then interpretation and making recommendations (Source: dsm-firmenich, 2023)

age. It is only by having such detailed notes on each sample that disruptive insights are found. The level of detail in Verax™ allows certain biomarkers to be linked with veterinary health outcomes. Any high value phenotype can be plugged into machine learning to produce algorithms for diagnostics and predictive tools.

Verax™ is accessed via a user-friendly and secure app interface on a mobile device. There are already many benefits to digitizing necropsies, but the real value comes from the thorough annotation and standardization of the data capture, allowing more in-depth insights to be drawn from the samples. The consistency of capturing several blood biomarkers and veterinary observations from every animal, house, farm and complex, allows machine learning to alert Verax™ users to potential problems before they develop.

Verax™ is part of a wider precision animal farming platform. Blood biomarkers are only one source of input, but data can be gathered from a whole range of biological matrices including saliva, digesta and excreta contents, feed and water consumption, and genetics (Figure 2).

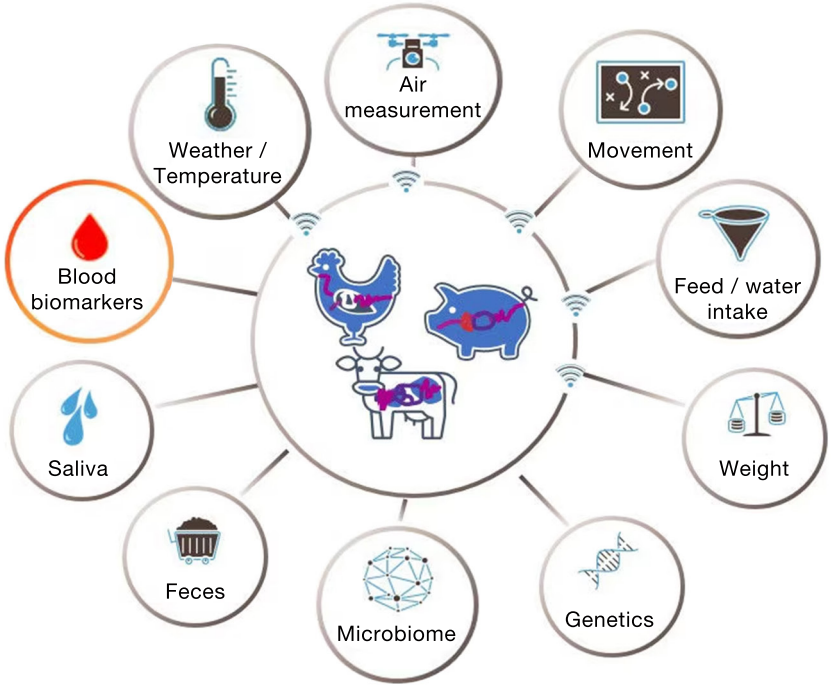

Figure 2. Precision animal farming requires inputs from a wide range of sources (Source: dsm-firmenich, 2023)

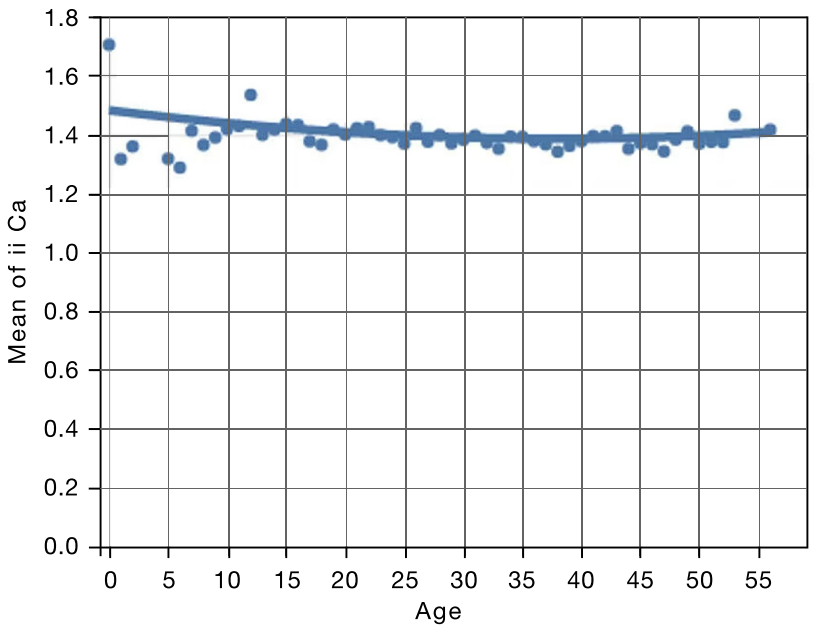

Figure 3. Typical levels of ionized calcium (mmol/l) found in the blood of broilers (Source: dsm-firmenich, 2023)

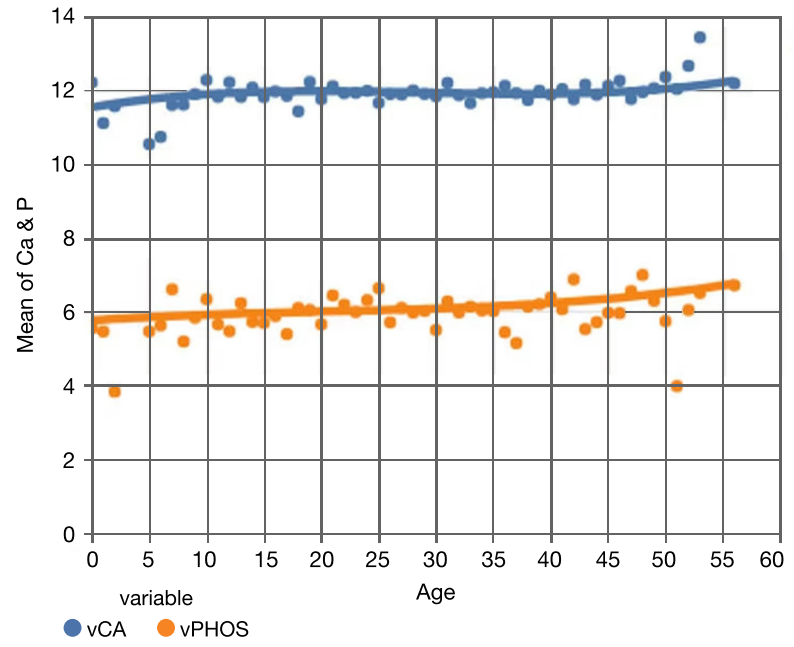

Figure 4. Mean plasma calcium (mg/dL) and phosphorus (mg/dL) concentrations in the blood of broilers (Source: dsm-firmenich, 2023)

EXAMPLES OF GETTING CALCIUM AND PHOSPHORUS RIGHT

Calcium (Ca) and phosphorus (P) are the most abundant mineral elements in the body. Most of the body's Ca and P is stored in the skeleton which is why these minerals are so closely linked to bone health and skeletal integrity. But Ca and P are also involved in several other important pathways such as energy metabolism, blood clotting and neuromuscular function. Insufficient levels or an inadequate ratio of these minerals in the diet can cause several problems such as rickets, tibial dyschondroplasia, lameness, nerve function problems, poor appetite and body weight uniformity.

Total blood Ca is typically around 11.5-12 mg/dL, and P is usually approximately 6-7 mg/dL (Figure 5). Approximately 47-48% of blood Ca is 'ionized' (metabolically active; Figure 4), whereas the remainder of blood Ca is covalently bound to plasma proteins or associated with anions such as phosphate or lactate. These concentrations do not substantially change with bird age or gender but can be disrupted by various nutrition and management factors.

For example, ionized Ca has been observed as low as 0.6 mmol/l. Birds with levels of ionized Ca as low as this will display atypical behaviour, nervous paralysis and elevated mortality. More often, subclinical hypocalcemia or hypophosphataemia are observed, which is associated with low body weight (Figure 6) and poor flock uniformity.


Photo: dsm-firmenich

Skeletal abnormalities such as bacterial chondronecrosis with osteomyelitis (BCO), enterococcus, and femoral head necrosis, are significantly more prevalent when ionized Ca levels drop below 1.1-1.2 mmol/L or when plasma total Ca concentration is below 10-10.5 mg/dL. Low plasma phosphorus, which is often associated with high plasma Ca, is also associated with skeletal abnormalities but most commonly is related to poor growth rate and body weight uniformity.

ENVIRONMENTAL pH CAN IMPACT Ca LEVELS IN THE BLOOD

Verax™ data has shown an association between the Ca and P status of the bird and season. This may be related to blood pH or a more general disruption to the acid/base balance of birds as ambient carbon dioxide concentrations rise and fall with altered respiratory tract health and ventilation rates. Blood pH is important as this influences the proportion of Ca that is metabolically active. This interplay is one example of why more systematic analysis of multiple data streams can shed light on underlying physiological changes relevant for efficiency and welfare. Further investigation is currently being carried out to assess seasonal variations in data held in the Verax™ platform, with the possibility of making recommendations for different feeding programs in warmer or colder seasons that go beyond the traditional adjustments made by nutritionists.

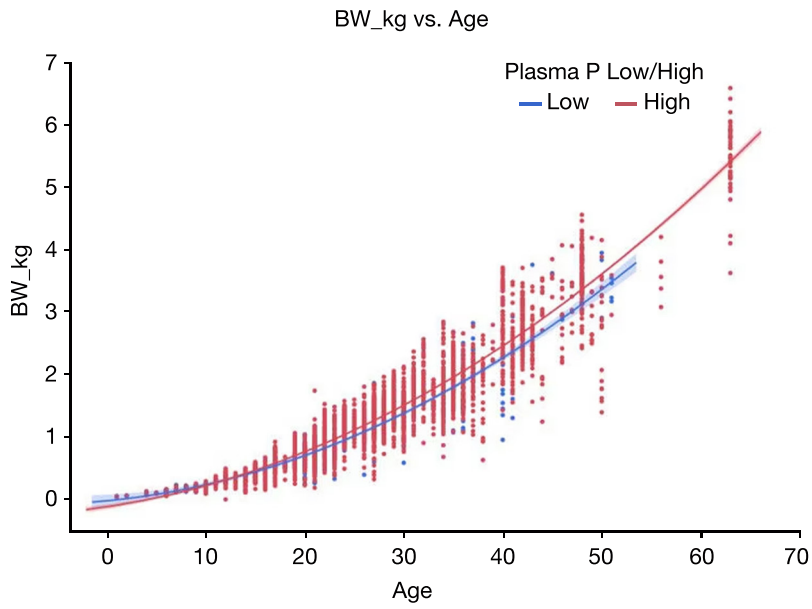

Figure 5. Body weight over time in birds with high (red line) or low (blue line) levels of plasma phosphorus (Source: dsm-firmenich, 2023)

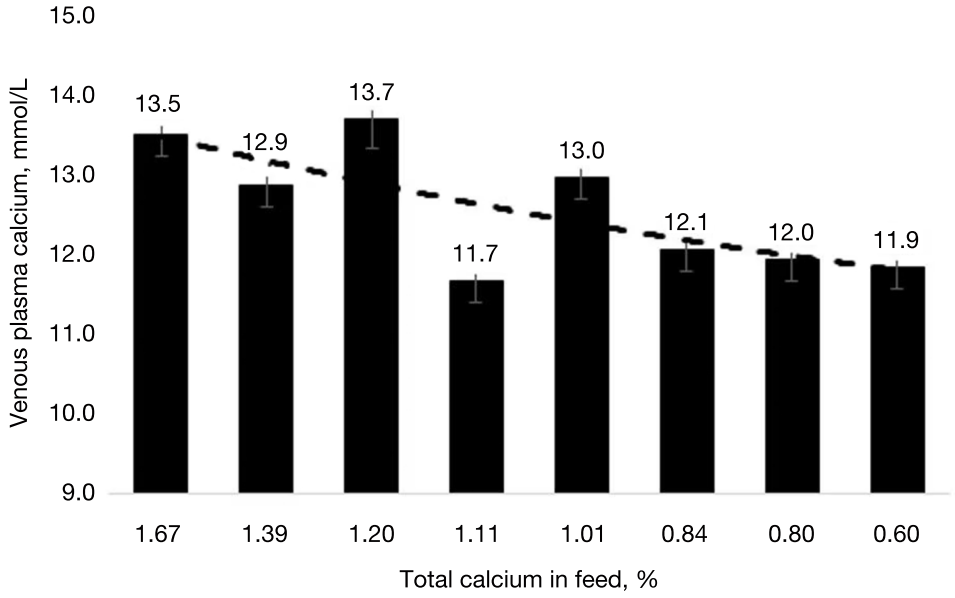

Figure 6. Relationship between dietary calcium and blood calcium in broilers (Source: Walk et al., 2022)

USING BLOOD BIOMARKERS TO ADJUST FEED FORMULATIONS

Even though Ca levels are hormonally regulated, blood Ca and P does respond to dietary inputs. Parathyroid hormone, calcitonin and vitamin D will regulate blood Ca levels to some extent, but not completely. Figure 6 shows a statistically significant association between dietary Ca and plasma Ca. This has also been shown for P (Figure 7). Interestingly, whilst dietary P has an influence on blood P, diet Ca is capable of influencing both Ca and P. Specifically, over-feeding dietary Ca has a supressing effect on blood P and vice versa. Whilst dietary Ca and P do have some influence on blood Ca and P, blood pH and acid/base balance may be more important in order to optimise blood Ca and P concentrations. For example, the proportion of total blood Ca that is metabolically active and can contribute to skeletal mineralisation is normally around 47-48% in broilers. However, this can drop by 2-4% for every 0.1 unit increase in blood pH. These interactions highlight the importance of monitoring biomarkers beyond blood Ca and P when attempting to optimise the nutrition and health status of the bird.

A common disturbance to optimal blood pH in commercial broilers is high chloride intake. Chlorine based sanitizers and water treatments are not unusual, plus sources of chloride are used in the feed. These can all, inadvertently, push blood pH down which might have negative implications, not only for Ca and P, but for renal health, litter quality and growth rate. Nutritionists need to understand the balance between cations and anions, and use them as levers within the least-cost formulation strategy to produce desirable outcomes.

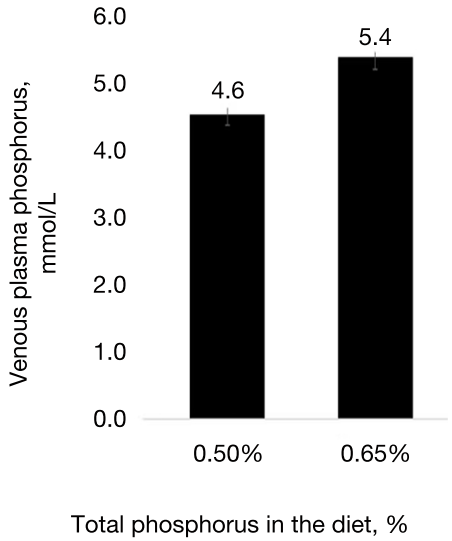

Figure 7. Relationship between dietary phosphorus and blood phosphorus in broilers (Source: Walk et al., 2022)

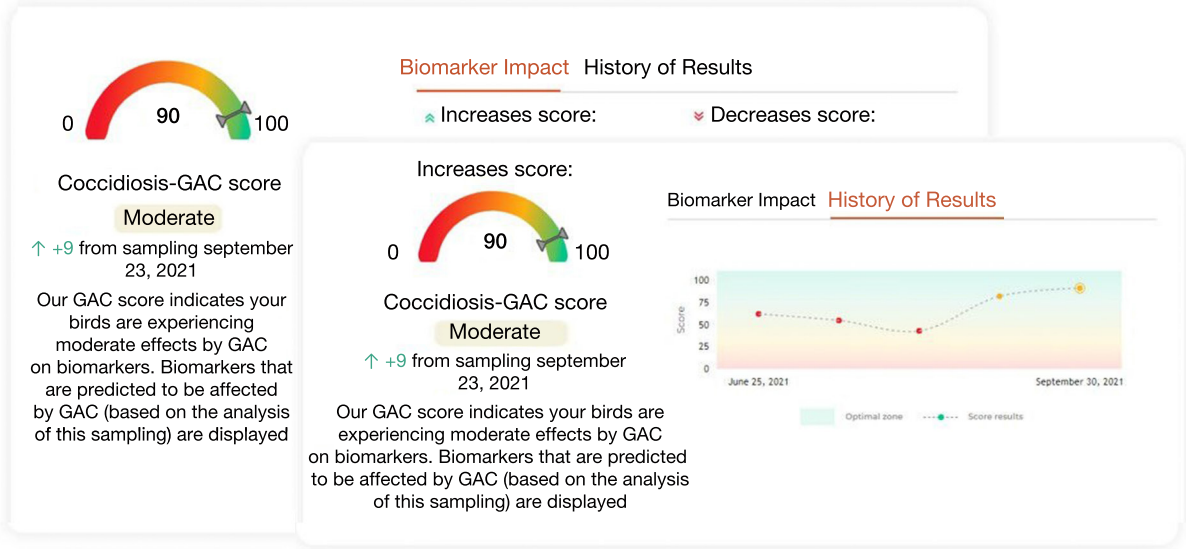

Figure 8. Verax™ user interface

EARLY DETECTION OF HEALTH PROBLEMS

In 2019, a trial was conducted looking at the response time of certain blood biomarkers to a coccidiosis challenge. Potassium and carotenoids began to shift 3-7 days before any other obvious or macroscopic symptoms becoming apparent. This rapid response sparked the idea for an early warning system for coccidiosis. The hypothesis was proposed that with enough data, machine learning could be used to create a classifier model with a forecasting capacity for coccidiosis.

MACHINE LEARNING

Verax™ uses supervised machine learning to create classifier and regressor models. There are currently many tens of thousands of data points in the database, gathered from commercial broilers with a naturally occurring prevalence of coccidiosis. To create the model, the data set was split into two sections; 60% used for training, and 40% used for validation. All the birds with coccidiosis were identified and a biomarker profile was created which predicted that phenotype. The model was then validated on the other subset of birds. Over time and with more data, especially from birds that have coccidiosis, the accuracy of the model increases and permits the identification of specific *Eimeira* species.

This principle was applied in practice on a farm in the US. Blood samples were taken from birds on four different farms on day 14. The blood analysis results were used to predict that two of the farms would have a coccidiosis outbreak later, and the other two would not. A second visit to the farms on day 28 confirmed the predictions.

Although the model is not 100% accurate yet, there is a very strong association with excellent statistical performance in terms of false positive and false negative rates on the forecasting ability of the model. Figure 8 shows an example of the user interface in Verax™ for tracking flocks, including coccidiosis scores, over time.

CONCLUSIONS

- The importance of data cannot be overstated. Data science will continue to unlock new opportunities for poultry producers if a more systematic approach is taken towards data handling, capturing, and processing.
- New technologies and tools are allowing nutrition to be more precise than ever before. Nutritional optimization is getting easier with improved monitoring and shorter feedback loops.
- By collecting and analyzing data from a variety of sources, nutritionists are better able to unlock new levels of bird performance. New tools like large language models are making it much easier to ingest unstructured data sources, but the data must be accessible to begin with.
- Blood biomarkers can be used to predict disease outbreaks earlier than ever before.

ROLE OF MICROENCAPSULATED PROBIOTICS IN FEED DEGRADATION

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The use of microencapsulated multi-strain probiotic premixes is emerging as an effective strategy to improve feed utilization across different animal production systems. By delivering targeted combinations of beneficial microorganisms under simulated gastrointestinal conditions, the effects of probiotic supplementation on the degradation of forage- and grain-based substrates and their fermentation dynamics can be evaluated. While responses may vary depending on species' diet and gastrointestinal conditions, probiotic premixes show potential to improve substrate degradation, nutrient availability, and energy efficiency, particularly through favorable shifts in fermentation patterns. These findings highlight the growing role of probiotic-based feed additives as functional tools to support more efficient and sustainable animal nutrition.

Improving feed efficiency and gut functionality remains a key objective in modern animal nutrition. Probiotic-based feed additives have gained increasing attention due to their ability to modulate gastrointestinal microbiota, enhance nutrient utilization, and support animal performance. Among these, multi-strain probiotic premixes are used across different species, showing efficacy that may vary depending on diet type, inclusion level, and animal physiology. Microencapsulated multi-strain probiotics can have a functional advantage as their use ensures the correct delivery of probiotics inside the gastrointestinal tract.

This article presents the consolidated results of several *in vitro* evaluations of a commercial microencapsulated probiotic premix (FF), focusing on its effects on dry matter degradability and fermentation characteristics under simulated gastrointestinal conditions representative of pigs, ruminants, and poultry.

IN VITRO STUDIES

In vitro gastrointestinal simulation systems are widely used to reproduce key physicochemical and microbial processes occurring along the digestive tract of animals under controlled conditions. These models allow the evaluation of feed ingredients and additives by mimicking species-specific gastrointestinal environments while minimizing animal-to-animal variability. The data presented in this study correspond to a compiled analysis of multiple *in vitro* experiments in which gastrointestinal conditions of different animal species were simulated. The systems were inoculated with fecal material or ruminal fluid obtained from the

corresponding species to establish representative microbial communities. Species-specific physicochemical conditions were applied, including appropriate buffering systems, temperature, retention time, and feeding schedules. The simulators were periodically supplied with the substrates of interest (forage- or grain-based), and experiments were run for periods ranging from 14 to 20 days. Samples were collected at regular intervals to assess substrate dry matter (DM) degradation, pH, and short-chain fatty acid (SCFA) concentrations. In general, system stabilization was observed after approximately one week of operation; therefore, comparative analyses were performed using data collected from day 7 onward.

The composition of the microencapsulated FF premix is defined according to the target species. The formulation used for ruminant systems contained *Bacillus subtilis* and *Saccharomyces cerevisiae*. For broilers, FF included *Bacillus subtilis*, *Saccharomyces cerevisiae*, *Saccharomyces boulardii*, *Enterococcus faecium*, and *Lactobacillus spp*. (*L. casei* and *L. acidophilus*). The FF formulation applied to pig fattening systems consisted of *Bacillus subtilis*, *Saccharomyces cerevisiae*, and *Enterococcus faecium*.

EFFECTS OF FF USE ON THE DEGRADATION OF FORAGE SUBSTRATES

Three different experimental runs were performed in *in vitro* simulators of the ruminal environment to assess the effect of adding FF on the fermentation of forage substrates. A total of 76 data points (51 of simulators with FF and 25 without) were compared.

Statistical analysis showed that FF supplementation improved DM degradation by an average of 3.44 %. This value was statistically significant (p-value of 0.0023) with a 95 % confidence interval on the percentage of improvement of [1.29 ; 5.59] %.

The data also showed that the improvement can be dosage dependent. Figure 1 shows the DM degradation difference (relative to the control with no FF) for different dosages of FF. It can be seen that

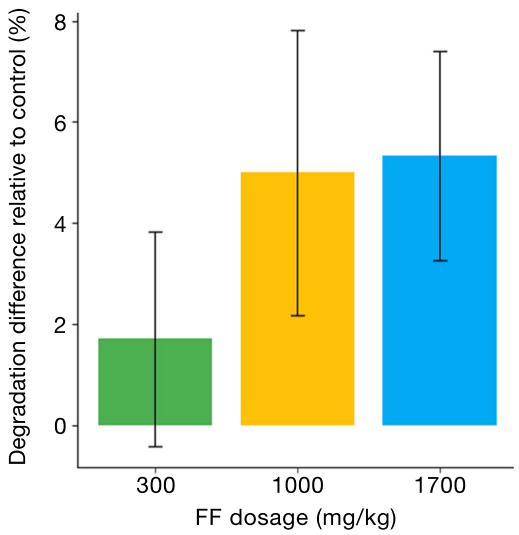

Figure 1. Degradation difference (relative to control with no FF) in in vitro ruminal simulations using forage-based substrates and FF as an additive at different dosages.

a small dosage (such as 300 mg/kg of feed) can lead to an improvement close to 2 % (although this difference shows no statistical significance), but larger dosages, close to 1000 and 1700 mg of FF per kg of feed, can reach a DM degradation improvement of about 5 % (that is statistically significant compared to not adding FF).

Evaluating other variables, FF supplementation resulted in a significantly lower pH (6.41) compared to the non-supplemented control (6.68), while no significant differences were observed in individual short-chain fatty acids concentrations or in the acetate-to-propionate ratio. This indicates that FF enhanced dry matter degradation without markedly altering the overall fermentation profile. Similar responses to those observed in these *in vitro* simulation studies have been reported for different probiotic-based strategies, where improvements in fiber degradation or digestibility of forage diets, ranging from 2.2 to up to 8 %, occurred without major shifts in fermentation end products (Wu et al., 2025; Eyre et al., 2025; McCann et al., 2017). In general, the results highlight the potential of microbial additives to improve the utilization of fibrous feeds through

increased microbial efficiency rather than through drastic changes in fermentation pathways.

EFFECTS OF FF USE ON GRAIN-BASED SUBSTRATES DEGRADATION

Four different experimental runs were performed in *in vitro* simulators of the gastrointestinal system of several species (broilers, pigs, and ruminants) to assess the effect of adding FF on the fermentation of grain-based substrates. A total of 50 data points (32 of simulators with FF and 18 without) were compared.

In contrast to forage substrates, FF supplementation did not result in statistically significant differences in grain dry matter degradation after system stabilization (days > 6). When data from stabilized systems were considered, the mean degradation difference was 1.34 % for FF-supplemented treatments (n = 32) compared with the non-supplemented control (n = 18). However, this difference was not statistically significant (p = 0.42), indicating that the effect of FF on grain substrates was limited and more variable than that observed for forage-based substrates.

When species-specific responses were examined, clear differences emerged that help explain the variability observed in the pooled analysis (Figure 2).

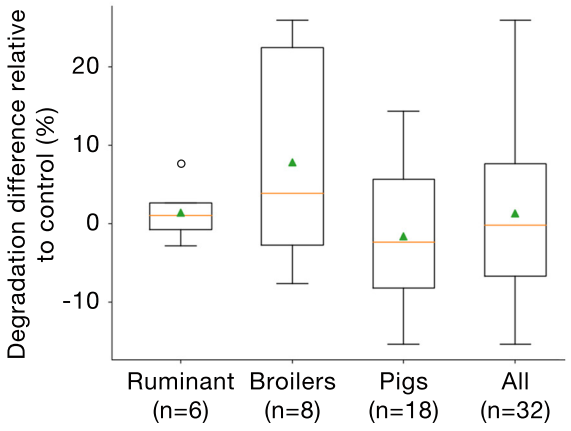

Figure 2. Degradation difference (relative to control with no FF) across species in in vitro gastrointestinal simulations using grain-based substrates and FF as an additive.

The simulations for ruminants showed a relatively narrow distribution of degradation differences, with values clustered close to zero, indicating a limited and consistent response of grain degradation to FF supplementation. Simulations for broilers displayed the highest median and mean degradation differences, together with a broad upper range, suggesting a stronger but more heterogeneous response to FF in grain-based substrates, but with a clear trend to improve DM degradation. In contrast, the simulations for pigs exhibited a wide dispersion of values, including both positive and negative responses, highlighting a highly variable and inconsistent effect. Overall, these species-specific patterns confirm that the response to FF supplementation in grain substrates is strongly dependent on animal species' diets, and gastrointestinal conditions.

In grain-based substrates, FF supplementation did not significantly affect pH, or the individual SCFA concentrations. Nevertheless, there was a trend towards lower values of the acetate-to-propionate ratio.

Figure 3 illustrates the box-and-whisker plot of the acetate-to-propionate (A:P) ratio found in different species when FF is supplemented (FF group) and not supplemented (No group). FF supplementation was associated with a lower average A:P ratio across species compared with the non-supplemented control. When data from stabilized systems (days > 6) were considered, mean A:P values consistently shifted downward in the FF group, both within individual species and in the pooled dataset, indicating a relative increase in propionate production at the expense of acetate. This shift in fermentation balance is generally associated with improved energetic efficiency, as propionate represents a more glucogenic short chain fatty acid, particularly relevant for monogastric species and high-energy diets. The observed reduction in the A:P ratio suggests that FF modulates microbial metabolic pathways toward a more efficient use of fermentable substrates, without inducing major disruptions in the overall fermentation profile.

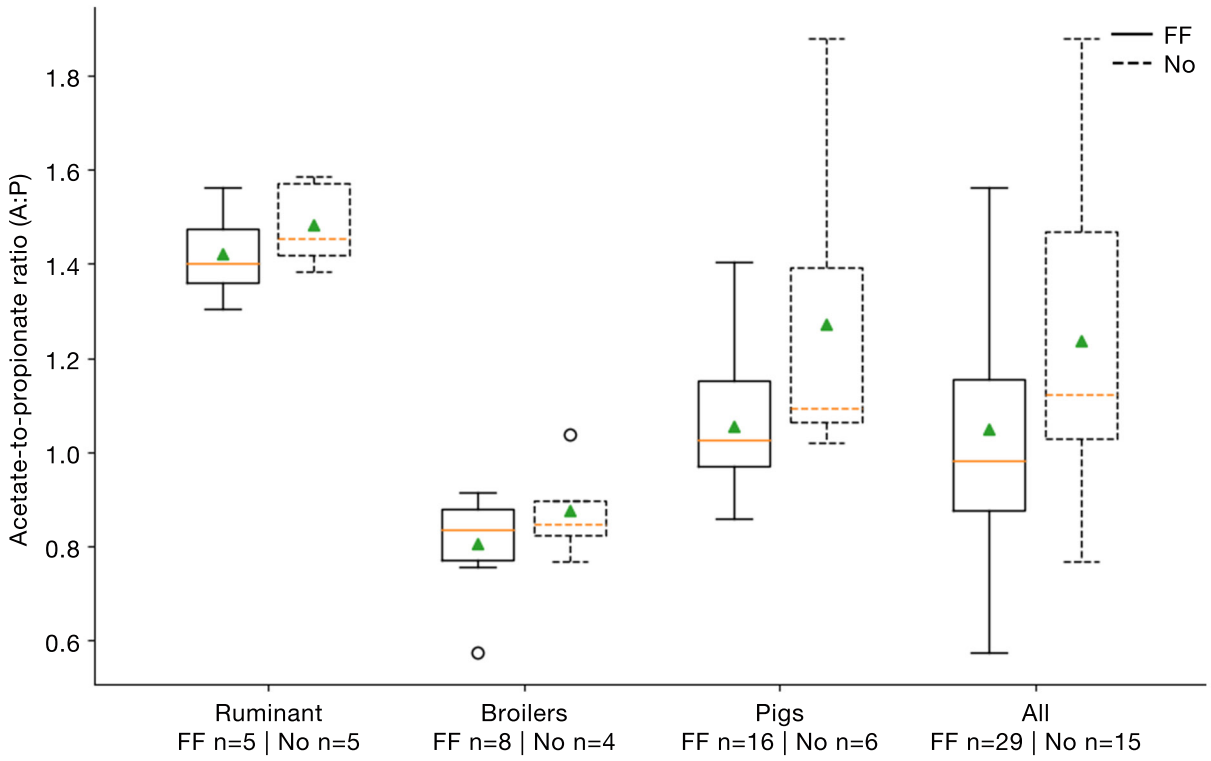

Figure 3. Acetate-to-propionate ratio across species in in vitro gastrointestinal simulations using grain-based substrates.

Considering the data from all species, FF supplementation resulted in a lower average acetate-to-propionate ratio compared with the non-supplemented control (1.05 vs. 1.24), showing a consistent numerical reduction that approached statistical significance ($p = 0.062$). A similar shift toward a lower acetate-to-propionate ratio has been reported *in vivo* following probiotic supplementation (Mavrommatis et al., 2025).

CONCLUSION

Under simulated gastrointestinal conditions, the microencapsulated probiotic premix FF enhanced dry matter degradation of forage substrates and showed potential to increase the degradability of grain-based substrates, although additional evidence is required to confirm this effect in the latter case. In addition, FF supplementation was associated with a shift in grain fermentation toward a lower acetate-to-propionate ratio, suggesting improved energetic efficiency. Overall, these findings support the potential use of probiotic premixes as functional feed additives. Further *in vivo* studies can be conducted to confirm these effects under commercial production conditions.

References can be reached here.

About Juan Esteban Vásquez

Biological engineer Juan Esteban Vásquez holds a Msc and PhD in Biotechnology. Fermentation Coordinator at Bialtec, Vásquez is a researcher with experience in gastrointestinal simulation models applied on animal nutrition, feed evaluation, and the assessment of functional feed additives. His work focuses on understanding fermentation dynamics, nutrient degradability, and the potential of probiotic-based solutions to support feed efficiency and gut health across different animal species.

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LEARNING FROM AGP MECHANISMS TO ADVANCE POULTRY NUTRITION

Understanding how antibiotic growth promoters (AGPs) enhanced poultry performance offers valuable insights for advancing modern nutrition strategies. Recent research suggests that AGPs acted not only through antimicrobial effects, but also via metabolic, immunological, and mitochondrial adaptation pathways. By applying these mechanistic lessons —particularly hormesis, immunometabolic regulation, and microbiome modulation— nutrition science can develop effective, non-antibiotic solutions to support resilience, efficiency, and sustainable poultry production.

Our understanding of how nutrition influences growth and resilience in poultry has greatly expanded in recent years. It is now clear that animal performance stems to a large extent from a balance between metabolism, immune function, and the gut microbiome. These systems interact continuously, and even small nutritional or environmental changes can shift the animals' physiological response. This growing knowledge has encouraged the development of nutritional strategies and feed components that work through adaptive, non-antibiotic mechanisms. One recent proposed explanation for these responses has rapidly gained ground: hormetic modeling.

Hormetic modeling describes how small or moderate doses of nutritional components can activate beneficial adaptive responses (improved resilience or metabolic efficiency), while excessive doses become harmful. This idea parallels, largely speaking, Paracelsus's famous principle: "The dose makes the poison." In poultry nutrition, such hormetic patterns are well recognized in nutrients like trace elements (selenium, zinc) and specific amino acids (for example, arginine). At optimal levels, these nutrients support antioxidant defense, growth, and immune balance, whereas excessive intake may cause oxidative or metabolic stress

This review examines the hormetic principle and its application to modern poultry/swine feeding concepts, exploring how balanced nutrient design and controlled inclusion of bioactive compounds can strengthen cellular adaptation, improve stress tolerance, and enhance production efficiency.

HOW DO AGPs ACTUALLY WORK?

Despite AGP's widespread historical use, the precise mechanisms by which subtherapeutic doses of antibiotics enhance animal productivity remained poorly understood. Recent advances in systems biology and mitochondrial research propose new answers, much needed to develop future advanced nutritional systems.

The traditional explanations for AGP efficacy have focused primarily on antimicrobial effects:

- reducing nutrient competition from microorganisms
- decreasing harmful bacterial metabolites
- improving gut wall morphology (thinner gut wall → better nutrient absorption)
- preventing subclinical infections

However, these mechanisms alone could not fully explain why different classes of antibiotics with diverse mechanisms of action produce similar growth-promoting effects (Gutierrez-Chavez et al., 2025).

Niewold (2007) hypothesized that the primary mechanism of AGPs is non-antibiotic anti-inflammatory activity, reducing the energetic costs of chronic low-grade inflammation. Inflammation diverts nutrients from growth toward immune responses, with cytokine production (particularly IL-1β, IL-6, and TNF-α) suppressing anabolic pathways (Kogut et al., 2018). AGPs appear to selectively inhibit pro-inflammatory cytokine production without completely suppressing immune function.

A paper published in 2024 by Fernandez Miyakawa et al. proposes that antibiotics at subtherapeutic levels act primarily through **mitochondrial hormesis and adaptive stress responses**, and not simply through antimicrobial activity. In this model, mitochondria act as bioenergetic hubs and signaling centers. Low-dose antibiotics trigger mild mitochondrial stress, which triggers the activation of adaptive protective pathways. This in turn induces mitokine release, leading to systemic adaptive responses improving growth, feed efficiency, and disease tolerance.

MECHANISM OF ACTION IN THE HORMETIC MODEL OF AGP EFFICIENCY

Hormesis is a biphasic mechanism whereby high doses are toxic, but low doses stimulate adaptive responses and are beneficial. In the case of AGPs, Fernandez Miyakawa et al. propose that low doses stimulate growth, stress resistance, and cellular repair.

KEY SIGNALING PATHWAYS

As Bottje et al. (2006, 2009) shows, efficient animals often have mitochondrial inner membranes that are less permeable to protons and other ions, allowing for more effective coupling between electron transport and ATP synthesis, which reduces energy loss through proton leak and maximizes the production of ATP per oxygen molecule consumed. Lower membrane permeability is influenced by factors like decreased membrane surface area per protein mass, specific membrane protein content (such as adenine nucleotide translocase), and fatty acid composition in the membrane phospholipids, all contributing to a tighter barrier that prevents unregulated electron or proton flow and supports higher energetic efficiency. Such features make mitochondria in efficient species more capable of maintaining membrane integrity and ATP generation, especially when facing environmental stress, as seen in freeze-tolerant animals whose mitochondria do not undergo damaging permeability transitions under extreme conditions.

Nrf2

Many AGPs interfere with mitochondrial protein synthesis and electron transport chain. At subtherapeutic levels, they cause a mild ROS (Reactive Oxygen Species) increase, which triggers the activation of redox-sensitive transcription factor Nrf2. Since Nrf2 regulates over 250 antioxidant, detoxification, and anti-inflammatory genes, the result is improved cell survival, redox balance, and tolerance to stress (Petri et al., 2012).

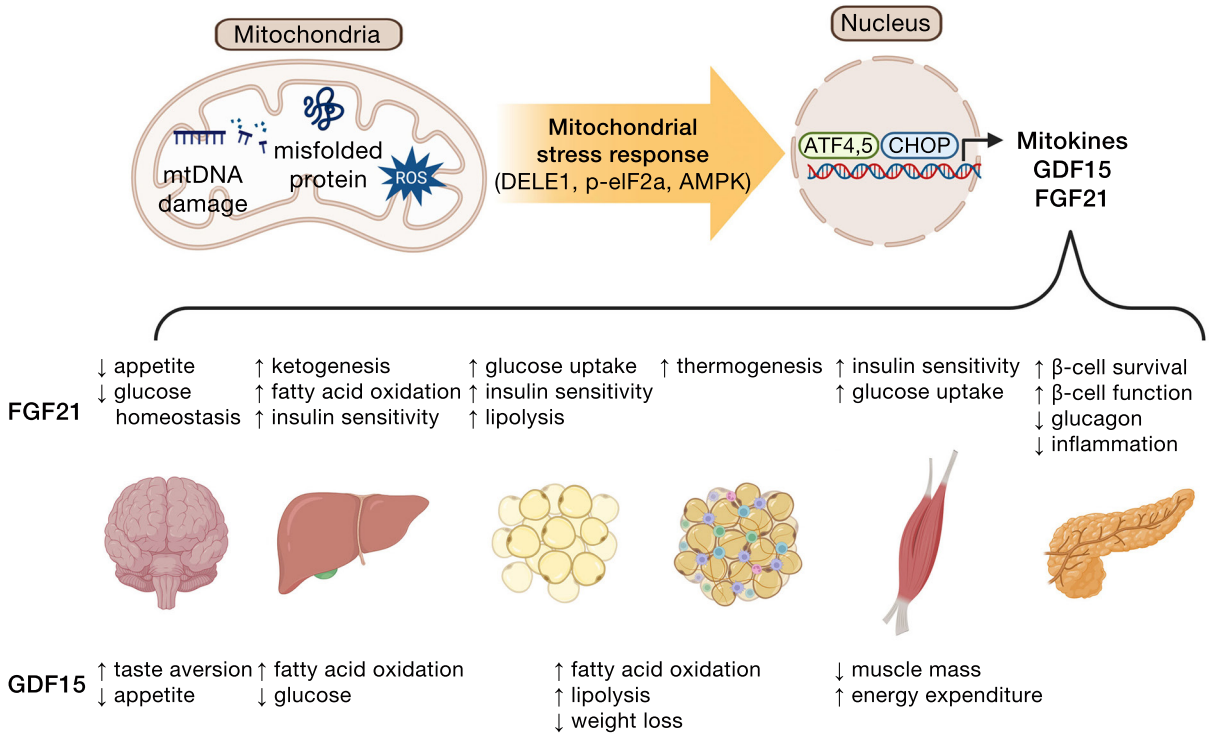


Figure 1. From Zhang et al., 2024

Mitokine production

Mitokines are "signaling molecules that enable communication of local mitochondrial stress to other mitochondria in distant cells and tissues" (Burtscher et al., 2023). Through fibroblast growth factor 21 (FGF21), growth differentiation factor 15 (GDF15), adrenomedullin2 (ADM2) etc, these stress signals are released systemically and coordinate tissue-wide responses, leading to improved growth and resilience.

INFLAMMATION AND DISEASE DEFENSE

While the negative side of antibiotic growth promoters is well researched and understood (Rahman et al., 2022), science can advance by isolating the positive effects and attempting to offer different pathways to the same benefits. One such lesson can be derived from understanding inflammation pathways and responses.

Chronic low-grade intestinal inflammation is common in modern poultry production, due to diet, microbiota shifts, high metabolic demands etc. This inflammation diverts energy from growth to immune responses.

AGPs reduce the energy costs of this inflammation in three main ways:

- Reduces inflammation through adaptive stress response
- Raising the threshold to trigger inflammation
- Promoting overall resilience, rather than simply killing pathogens

Fernandez Miyakawa et al. suggest, in this emerging model, that disease defense can operate two different actions: resistance to health challenges through reduction of the pathogen load (which is driven by the immune system and is energy costly); and overall resilience by reducing host damage without reducing the pathogen load. AGPs, the authors claim, mainly promote resilience by enhancing mitochondrial stress responses and tissue repair, i.e. more precisely:

- Direct mitochondrial stimulation in intestinal epithelial cells
- Systemic mitokine signaling coordinating organ-

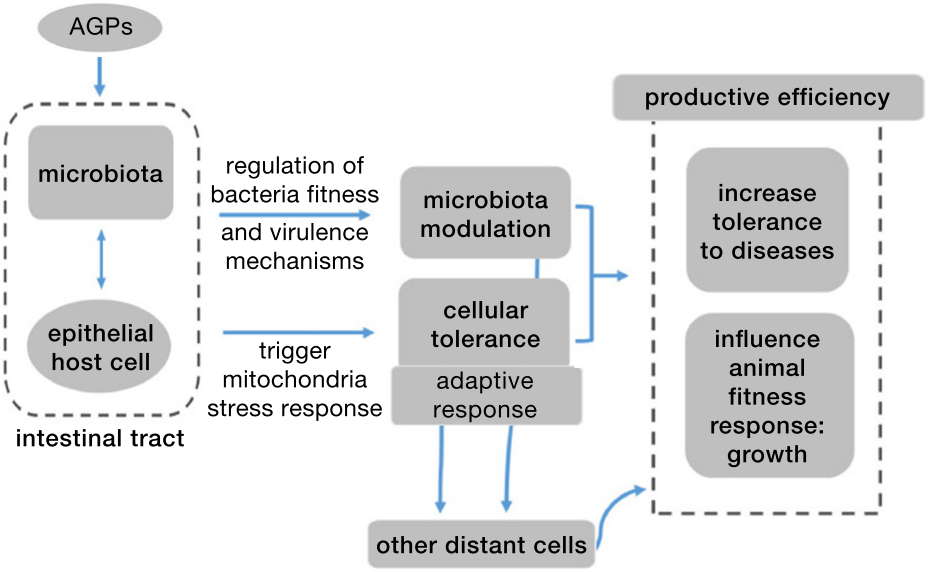


Figure 2. From Fernandez Miyakawa et al., 2024.

ism-wide adaptive responses
• Selective microbiota modulation enhancing beneficial host-microbe interactions
• Improving resilience without immune system costs
• Metabolic optimization supporting growth and feed efficiency

In this context, "metabolic optimization" refers to the enhancement of metabolic processes within livestock or poultry to support efficient growth, feed conversion, and physiological resilience, without relying on immune-mediated pathways that are energetically costly. Scientific evidence shows that metabolic optimization involves improving nutrient assimilation, promoting more efficient energy production in tissues (such as mitochondrial ATP synthesis), and minimizing wasteful metabolic by-products, resulting in reduced feed intake per unit of growth and better utilization of dietary nutrients (Rauw 2025, El-Hack 2025).

FUNCTION OF FEED ADDITIVES AND FEED COMPONENTS

Feed additives and feed components in many ways represent the complete other side of the spectrum from antibiotics, but are there some features where antibiotics and feed additives come close in their functions? There is a good case to be made for certain feed additives ultimately working in the animal to achieve similar benefits to the desirable, non-medicinal usage of AGPs. Especially with the emergent model of AGP mechanism described above, it is worth discussing how certain feed additives can support the same end goal: promoting animal resilience.

Lillejhoj et al (2018), Gutierrez-Chavez et al. (2025) and others outline the end-results such products must achieve:
• Growth performance & feed conversion efficiency
• Promotion of animal productivity under real-world conditions
• Support gut homeostasis
• Non-adverse effect on the immune system
• Reduction of oxidative stress
• Support organism in mitigation of enteric inflammatory consequences

Within the hormetic model, possibly the most important systemic benefit is, in one phrase, promoting resilience. Phytomolecules have long been used, in human and animal medicine, for the same end goal. The mechanisms described below should naturally be seen with caution, as phytomolecule microbiome effects can be subtler and context-dependent. However, the substantiating literature has been increasingly accumulating on these specific topics.

1. Immunometabolic regulation

Phytomolecules demonstrate remarkably similar anti-inflammatory effects to what Niewold (2007) suggested was a primary mechanism of AGPs: non-antibiotic anti-inflammatory activity, reducing the energetic costs of chronic low-grade inflammation. Inflammation diverts nutrients from growth toward immune responses, with cytokine production (particularly IL-1β, IL-6, and TNF-α) suppressing anabolic pathways (Kogut et al., 2018). AGPs appear to selectively inhibit pro-inflammatory cytokine production without completely suppressing immune function. A similar effect can be observed with various types of phytomolecules, which significantly reduced pro-inflammatory and/or increased anti-inflammatory cytokine expression in animals challenged with several pathogens. The anti-inflammatory mechanism appears to involve inhibition of NF-κB activation and modulation of MAPK signaling pathways (Kim et al., 2010; Long et al., 2021).

2. Mitochondrial hormesis and energy metabolism

Fernández Miyakawa et al. (2024, see above) proposed that AGPs exert growth-promoting effects through mitochondrial hormesis – subtherapeutic antibiotic doses induce mild mitochondrial stress, triggering adaptive responses that enhance mitochondrial function, energy metabolism, and cellular resilience. This mechanism, while requiring further validation, explains why different antibiotics with diverse targets produce similar growth outcomes.

The mitochondrial stress response involves activation of the IL-6 receptor family signaling cascade, which regulates metabolism, growth, regeneration, and homeostasis in liver and other tissues (Perry et al., 2024). Subtherapeutic antibiotic exposure activates proteins involved in growth and proliferation through IL-6R gp130 subunit signaling, including JAK, STAT, mTOR, and MAPK pathways.

Phytomolecules demonstrate similar mitochondrial effects. Perry et al. (2024) showed that increased activity of AMPK, mTOR, PGC-1α, PTEN, HIF, and S6K can also be available via phytomolecule activity, suggesting enhanced anabolic metabolism.

Capsicum oleoresin supplementation in broilers increased jejunal lipase and trypsin activity, enhanced ileal amylase activity, improved jejunal morphology, and modulated immune organ development, indicating enhanced digestive efficiency and nutrient utilization (Li et al., 2022).

Compounds such as vanillin, thymol, eugenol have been shown to improve glucose and lipid metabolism through TRPV1 activation and mitochondrial function enhancement (Gupta et al., 2022; Zhang et al., 2017).

3. Gut microbiota modulation

AGPs selectively reduce specific microbial populations, particularly Lactobacillus species that produce bile salt hydrolase (BSH). Since BSH reduces fat digestibility and thus weight gain, AGP-mediated reduc-

tion of BSH-producing bacteria enhances energy extraction and growth (Lin, 2014; Bourgin et al., 2021).

Recent research by Zhan et al. (2025) using single-molecule real-time 16S rRNA sequencing demonstrated that therapeutic antibiotic doses (lincomycin, gentamicin, florfenicol, benzylpenicillin, ceftiofur, enrofloxacin) significantly altered chicken gut microbiota composition, with *Pseudomonadota* and *Bacillota* becoming dominant phyla after exposure. Different antibiotics produced distinct temporal effects on microbial diversity and community structure.

Phytomolecules exert targeted antimicrobial effects while promoting beneficial bacteria. Dietary supplementation with 800 mg/kg Capsicum extract in Japanese quails reduced cecal counts of pathogenic bacteria (*Salmonella* spp., *E. coli*, coliforms) while modulating *Lactobacilli* populations (Reda et al., 2020).

In pigs, 80 mg/kg natural capsicum extract increased cecal propionic acid and total volatile fatty acid concentrations, with increased butyric acid in the colon – indicating enhanced fermentation by beneficial bacteria (Long et al., 2021).

Capsicum and Curcuma oleoresins altered intestinal microbiota composition in commercial broilers challenged with necrotic enteritis, reducing disease severity through microbiome modulation (Kim et al., 2015).

Capsaicin demonstrates selective antimicrobial activity, inhibiting pathogenic Gram-negative bacteria while favoring development of certain Gram-positive bacteria. The antibacterial mechanism involves induction of osmotic stress and membrane structure damage (Adaszek et al., 2019; Rosca et al., 2020).

4. Intestinal barrier function and gut health

AGPs have been associated with improved intestinal morphology, including increased villus height and reduced crypt depth, which enhance absorptive capacity (Gaskins et al., 2002).

Phytomolecules produce similar or superior effects. Capsicum extract (80 mg/kg) in pigs increased ileal villus height and upregulated MUC-2 gene expression, indicating enhanced gut barrier function and integrity. The improved barrier function correlated with reduced diarrhea incidence (Liu et al., 2013; Long et al., 2021).

Allium hookeri extract increased expression of tight junction proteins (claudins, occludins, ZO-1) in LPS-challenged broiler chickens, demonstrating direct enhancement of barrier integrity (Lee et al., 2017).

5. Oxidative stress mitigation

Oxidative stress impairs growth by damaging cellular components and triggering inflammatory responses. AGPs reduce oxidative stress indirectly through anti-inflammatory effects and microbiota modulation (Bortoluzzi et al., 2021).

Phytomolecules possess direct antioxidant properties. Capsicum extract (50 mg/kg) in heat-stressed quails reduced serum and ovarian malondialdehyde (MDA) while increasing superoxide dismutase (SOD) and catalase (CAT) activities. Ovarian transcription factors showed decreased NF-κB and increased Nrf2 and HO-1 expression (Sahin et al., 2016).

A mixture of herbal extracts including pepper reduced thiobarbituric acid reactive substances and MDA in broiler liver and muscle, while increasing glutathione peroxidase (GSH-Px) activity and improving antioxidant enzyme expression (Saleh et al., 2018).

Capsicum extract (80 mg/kg) in pigs increased total antioxidant capacity, SOD, and CAT while reducing MDA levels, demonstrating robust antioxidant effects (Long et al., 2021).

STANDARDIZATION AND CONTROLLED RELEASE: CRITICAL SUCCESS FACTORS

A major criticism of phytomolecules has been inconsistent efficacy across studies. However, this variability largely reflects differences in:

- Active compound concentrations
- Bioavailability and stability
- Dosing precision
- Product quality and standardization

Microencapsulation is one of the technologies that address the standardization and bioavailability challenges. It protects volatile compounds from degradation during feed processing and storage, with encapsulated essential oils showing significantly higher retention compared to unprotected forms (Stevanović et al., 2018). By creating a protective barrier around active ingredients, microencapsulation enables controlled release in specific regions of the gastrointestinal tract, improving absorption efficiency and reducing dose variability (Bringas-Lantigua et al., 2011). The technology also masks unpalatable flavors that can reduce feed intake while standardizing active ingredient concentrations through precise manufacturing processes (Gharsallaoui et al., 2007). Studies demonstrate that spray-dried microencapsulated essential oils achieve encapsulation efficiencies exceeding 93% with minimal loss during storage (Hu et al., 2020), and can be engineered for enzyme-mediated release to ensure bioactive delivery at optimal intestinal sites (Elolimy et al., 2025).

MECHANISTIC SYNTHESIS: AN INTEGRATED MODEL

The evidence indicates that both AGPs and phytomolecules operate through an integrated network of effects:

1. Primary Level: Selective antimicrobial effects modify gut microbiota composition

2. Secondary Level: Reduced microbial metabolites (ammonia, endotoxins) decrease inflammatory signaling

3. Tertiary Level: Reduced inflammation conserves energy for growth; enhanced barrier function improves nutrient absorption

4. Quaternary Level: Mitochondrial hormesis and metabolic optimization increase energy efficiency

5. Systemic Level: Improved immunometabolic homeostasis supports optimal growth

This integrative model explains why multiple antibiotics with different mechanisms produce similar growth outcomes: they converge on common pathways regulating immunometabolism and mitochondrial function (Fernández Miyakawa et al., 2024).

Phytomolecules operate through the same mechanistic framework but with potential advantages:

- Multiple bioactive compounds providing redundancy
- Antioxidant effects enhancing stress resilience
- Lower AMR (Antimicrobial Resistance) selection pressure
- Potential prebiotic-like effects supporting beneficial microbiota

SAFETY AND ANTIMICROBIAL RESISTANCE CONSIDERATIONS

Antibiotic exposure significantly disrupts gut microbiota diversity and stability, with effects persist-

Mechanism	AGPs	Phytomolecules
Anti-inflammatory	✅	✅
Mitochondrial hormesis	✅	✅
Microbiota modulation	✅	✅
Antioxidant activity	❌	✅
AMR risk	⚠️ High	🟢 Low

ing beyond withdrawal periods. The study by Zhan et al. (2025) demonstrated that different antibiotics produce varying degrees of microbiota disruption, with florfenicol and gentamicin showing the strongest and most persistent effects.

In contrast, phytomolecules generally do not generate resistance through the same mechanisms as antibiotics. Some phytochemicals may actually enhance antibiotic efficacy and resensitize resistant bacteria through structural modifications of bacterial membranes (Khameneh et al., 2021; Suganya et al., 2022).

However, one study reported increased correlation between antibiotic resistance genes (ARGs) and mobile genetic elements in pig feces after mushroom powder supplementation, suggesting that certain phytogenic compounds may increase ARG mobility (Muurinen et al., 2021). This emphasizes the need for continued surveillance of phytomolecule effects on resistance gene dynamics.

Capsaicinoids and capsinoids have well-established safety profiles. Capsiate, a non-pungent analogue of capsaicin, exhibits substantially lower toxicity while maintaining similar metabolic and growth-promoting effects (Gupta et al., 2022). No adverse effects on animal health or product quality have been reported at recommended dosages in reviewed studies.

FUTURE DIRECTIONS AND RESEARCH NEEDS

Despite substantial progress, several areas require further investigation:

1. Mechanistic refinement: Detailed characterization of signaling pathways, particularly the IL-6R/gp130 cascade and mitochondrial stress responses

2. Precision formulation: Development of combinations optimized for specific production stages, environmental conditions, and disease pressures

3. Bioavailability optimization: Advanced delivery systems ensuring consistent active compound release and absorption

4. Microbiome-host interaction mapping: High-resolution characterization of microbial community shifts and their functional consequences

5. Economic validation: Large-scale production trials assessing cost-effectiveness compared to AGPs and disease management costs

CONCLUSIONS

The scientific evidence demonstrates that standardized phytomolecules operate through well-characterized biological mechanisms that substantially replicate those of AGPs:

1. Anti-inflammatory effects reducing energetic costs of immune activation

2. Mitochondrial hormesis enhancing energy metabolism and cellular resilience

3. Selective microbiota modulation supporting beneficial bacteria while controlling pathogens

4. Intestinal barrier enhancement improving nutrient absorption and reducing translocation

5. Antioxidant activity mitigating oxidative stress and supporting immune function

When properly standardized and formulated for controlled release, phytomolecules deliver growth promotion, feed efficiency improvements, and disease resistance comparable to AGPs, while potentially offering advantages in AMR risk profile, stress resilience, and consumer acceptance.

The mechanistic convergence between AGPs and phytomolecules, coupled with demonstrated efficacy in controlled trials, provides producers with confidence that science-based phytomolecular interventions represent legitimate alternatives to AGPs. Success depends on product standardization, appropriate dosing, and understanding that phytomolecules work through fundamental biological pathways rather than undefined or mystical mechanisms.

As the livestock industry continues to navigate the post-AGP era, standardized phytomolecules offer a scientifically sound, mechanistically validated approach to maintaining animal performance, health, and welfare while addressing antimicrobial resistance concerns.

References can be reached here.

MORE EGGS, STRONGER SHELLS: **THE ROLE OF ACTIVATED VITAMIN D**

Photo: Manop Boonpeng | Shutterstock

Modern egg production is increasingly focused on the goal of a 100-week laying period and 500 eggs per hen, while maintaining consistent eggshell quality. As hens age, calcium metabolism and shell formation become critical limiting factors for productivity and profitability. Activated vitamin D supports efficient calcium absorption and mobilization, helping sustain eggshell strength and laying performance throughout extended laying cycles.

By Phytobiotics Futterzusatzstoffe GmbH

Commercial egg producers are striving to produce more eggs with adequate eggshell quality within one laying period of their hens. Some poultry farmers already achieve the target of 500 eggs in 100 weeks by adjusting breeds, management and nutrition. These are great examples of how modern hens can achieve performance goals unimaginable only 10-20 years ago. Active D Product Manager Murat Devlikamov explains:

WHAT IS THE BIGGEST CHALLENGE IN TERMS OF EXTENDED LAYING TIME?

Modern laying hens are truly high-performance animals that lay an egg almost every day. However, the eggs need to have a proper eggshell in order to be marketable; if this is not the case, economic losses are inevitable.

The eggshell requires calcium, which is mobilized from the feed and bones. The weight of the eggshell

of the total egg mass remains relatively constant throughout the laying period as its share is genetically predetermined. Consequently, as the egg is getting larger, the eggshell is getting thinner. Considering the fact that the eggshell consists of 96% calcium carbonate the importance of calcium supply is evident to ensure stable eggshells. With age, shell thickness also decreases, because calcium availability reduces. As a result, the breaking strength of the eggshell declines and more and more eggs show cracks or abnormalities.

In the first half of the laying period, the percentage of broken eggs is neglectable, but increases in the second laying period and requires feeding-related or management measures.

HOW ACTIVATED VITAMIN D HELPS

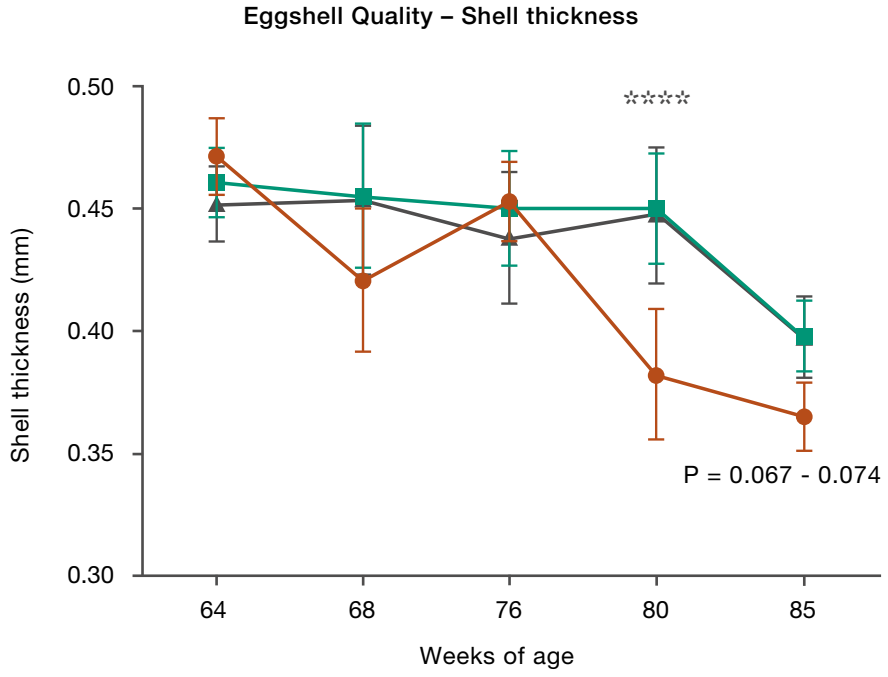
It is not only the size of the egg that influences the breaking strength of the eggshell. It is also a proper absorption, mobilization and transport of calcium. Vitamin D is an essential molecule which activates calcium transport and influences its absorption rate. Because of the importance of both, a supplementation with vitamin D and calcium should be ensured throughout the whole production period. Unfortunately, it is not always the case, especially in older laying hens, as the function of organs such as liver and kidneys is impaired by environmental influences. The production of specific enzymes involved in the metabolization of vitamin D declines. The availability of calcium in bones also decreases as reserves are depleted. In this case plant based Active D may help as it provides the already activated vitamin D glycosides which are directly available for the hen.

Activated vitamin D offers the advantage that it does not require the vitamin D metabolic pathway and is therefore not dependent on enzymes or organs functionality. As a result, the mobilization of calcium from the feed is maintained in critical phases and more calcium is available for the formation of the eggshell.

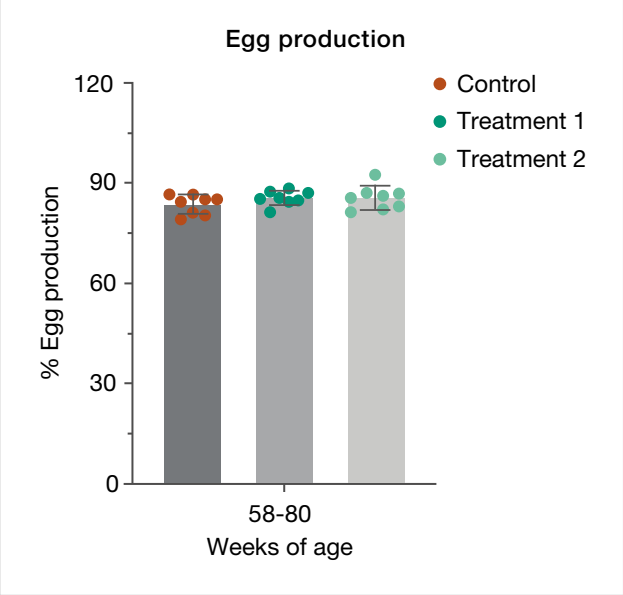
A field study conducted by the University of Sydney and described below shows the positive effect of Active D in old hens.

USE OF ACTIVE D IN OLDER BROWN LAYING HENS

A total of 240 Hy-Line Brown layer hens, 55 weeks of age, were purchased from a commercial



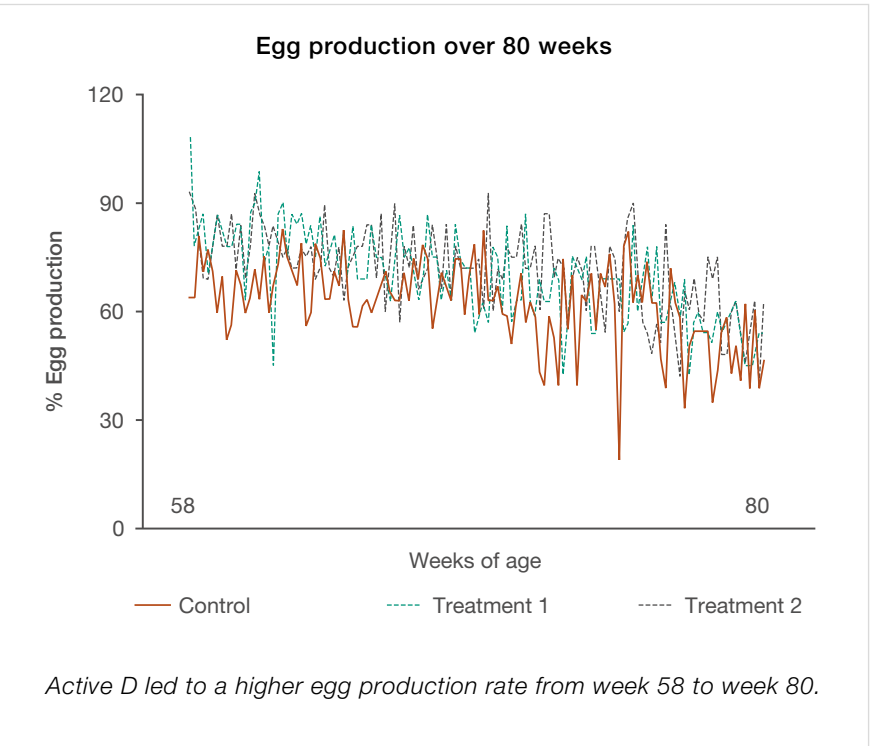
The use of plant-based Active D, containing activated vitamin D led to a significant higher eggshell thickness after 85 weeks of production.



laying farm and housed in the high-rise layer facility at the University of Sydney's Camden Campus. After an adaptation period of 5 weeks, during which the hens received standard commercial feed, the trial started. The animals were allocated into three groups. A control group with standard vitamin D levels in a control diet. Treatment 1 consisted of a control diet plus 75 g of activated vitamin D_3 product/ton of feed, while Treatment 2 consisted of the control diet plus 125 g of activated vitamin D_3 product/ton of feed. From the 60th week, following relevant data was collected, among others: Egg production, eggshell breaking strength, and eggshell thickness.

PROMISING RESULTS

In both treatment groups, shell thickness was maintained relatively throughout the trial, while dropped notably in the control birds at 80 weeks of age. Concurrently, supplementation of both concentrations of activated vitamin D_3 maintained eggshell thickness compared to the control diet, indicating that activated vitamin D_3 may counteract the decrease of shell thickness frequently observed as hens age, because it ensures the calcium absorption and transport to the eggshell. Significant improvements in relative shell weight and thickness indicate that supplementing activated vitamin D_3 in older laying hens may benefit eggshell quality. Additionally, a numerical increase of laying performance indicates that the overall productivity is maintained compared to the control group. This finding shows that Active D is a promising tool for egg producers to achieve the goal of 100 weeks and 500 eggs and thus enables longer economic production.



Active D led to a higher egg production rate from week 58 to week 80.

UNDERSTANDING FUNCTIONAL NUTRITION TO SUPPORT PRECISION NUTRITION

Dr. Virginie Blanvillain
Global Services Manager
AB Vista

While precision nutrition relies on accurately defining nutrient requirements, functional nutrition adds a deeper layer by considering how animals utilise nutrients under real production conditions. Gut health, microbiome activity, and environmental stressors all influence nutrient efficiency beyond theoretical models. The focus here is on how functional nutrition strengthens precision feeding strategies and contributes to future developments in monogastric nutrition.

The definition of nutrient requirements is the basis of precise nutrition. It allows the definition of the levels of individual nutrients to be fed to animals in order to cover their average needs for maintenance and production (i.e., growth, milk, egg).

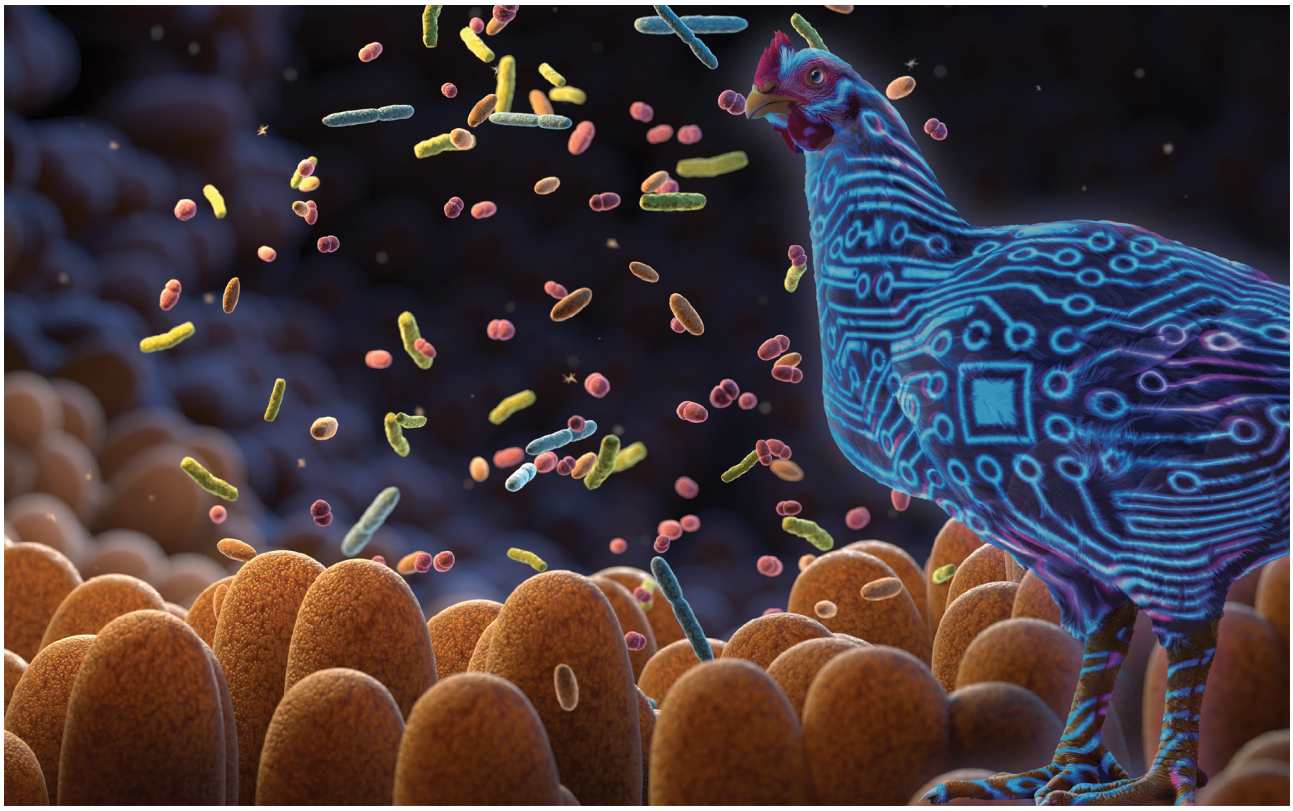
Total and digestible nutrient requirements are usually estimated, following dose-response trials. Based on the estimation of individual requirements, ratios can be determined by species, breed, and age or live weight range, and they need to be constantly re-evaluated to match the ongoing improvement in genetic potential.

Mechanistic models capture interactions between nutrients and describe the dynamic growth response of an average individual under a given feed program, with specific nutrient levels. These models have been widely used in swine and some poultry species. They have proven useful in evaluating commercial feeding program strategies and their impact on performance, and consequently on production cost.

An additional level of complexity has been explored to account for population heterogeneity using stochastic models. Although this type of mechanistic model is more complex, it provides a better representation of the growth performance patterns of individuals within a population.

While mechanistic models contribute widely to precise nutrition by predicting daily requirements, it is also recognised that animals rarely respond exactly according to model predictions. Environmental factors play a key role in phenotypic response, including diet profile, ambient and sanitary conditions, immune status, and others. Nutritional strategies also vary across countries due to differences in genetics, ingredient profiles, production systems, and feed additives. Under these varying conditions, the study of functional nutrition has become critical to accurately estimate requirements and optimise performance and production cost.

The term “functional nutrition” refers to nutrient utilisation dynamics, and to how nutrient and ingre-



dient profiles and levels affect the overall health and performance of animals. Maintenance represents the main contributor to total daily requirements, and maintenance requirements are commonly estimated as a function of live weight (or body surface area). Interestingly, functional nutrition has highlighted the importance of the microbiome and gut health in defining animal growth response. However, a level of complexity remains that makes it difficult to estimate actual nutrient requirements under specific conditions. With functional nutrition, it is possible to gain greater precision in the estimation of maintenance requirements, either by accounting for additional demands or by reducing expenses associated with different contributing factors.

This article will examine how functional nutrition can contribute to precise nutrition, and what this may bring to future monogastric nutritionists.

STRONG GUT BARRIER INTEGRITY TO SUPPORT NUTRIENT UTILISATION EFFICACY

A well-functioning gut barrier is essential for efficient nutrient absorption while protecting the animal from enteric disorders. It helps prevent dysbiosis, limits pathogen adhesion and invasion, and reduces the risk of bacterial translocation into the bloodstream.

This barrier is composed of a protective mucin layer and an epithelial cell layer sealed by tight junctions. Together, these structures provide both chemical and physical protection, restricting pathogen entry while allowing nutrients to be absorbed.

Beyond its protective role, the intestinal barrier is also the site of dietary nutrient absorption. While providing highly and rapidly digestible nutrients is important to maximise absorption in the upper intestine, supporting early gut development also contributes to improved nutrient utilisation efficiency throughout the animal's life. In some instances, early exposure to feed can enhance villi development and, consequently, increase intestinal surface area. Other strategies include the use of specific additives, such as butyric acid, to support villi development; formulating diets with an adequate dietary electrolyte balance to account for ingredient buffering capacity; or feeding the microbiome to accelerate its maturation (e.g., oligosaccharides).

STIMULATING MICROBIOME FUNCTION IN THE LOWER GUT

Most microbial activity occurs in the lower intestine, where the majority of bacterial populations are located. Managing upper gut integrity is key to stimulate optimal microbiome function in the distal part, as excess or undigested nutrients will reach the lower intestine and become substrates for undesirable bacterial fermentation. Limiting starch flow to the lower intestine and maximising absorption by the animal helps control saccharolytic bacteria populations and reduces the risk of excessive lactic acid accumulation. Such accumulation may promote pathogen overgrowth and create more aerobic conditions, which are detrimental to key bacterial families such as butyric-acid-producing *Lachnospiraceae*.

Similarly, the presence of amino acids in the lower intestine stimulates putrefaction, resulting from protein fermentation and the release of branched-chain fatty acids and toxic metabolites such as indole, skatole, phenol, and cresol.

The microbiome plays multiple roles, many of which remain poorly understood. Microbial activity not only results in the production of metabolites that nourish the host, but also stimulates multiple host metabolic pathways and influences inter-bacterial communication (quorum sensing), which directly impacts bacterial family presence and activity.

Although this may have sounded counterintuitive in the past, it is now well established that adding fermentable fibre to the diet is an effective strategy to feed the microbiome and, in turn, reinforce gut and immune function. In addition to carbohydrates, bacteria also require nitrogen. While there is a growing understanding of the types of carbohydrates that benefit key bacterial families (e.g., xylo-oligosaccharides feeding *Bifidobacterium*), bacterial protein requirements in monogastrics remain poorly quantified.

Although an ideal microbiota has yet to be defined, quantifying bacterial family populations represents a valuable starting point to link microbial presence with key metabolites, such as short-chain fatty acids (SCFA), which may influence immune response, metabolism, and behaviour.

In addition, studies have demonstrated how the gut–brain axis can influence animal behaviour, and how the gut–lung axis may play a role in respiratory diseases, as well as in the stimulation of inflammatory or anti-inflammatory responses.

One of the main challenges is managing this high level of complexity, particularly under commercial production conditions. Translating biological responses into practical, actionable insights for decision-making therefore requires measurable and reliable indicators of gut function. One approach is to focus on microbiome activity rather than microbial composition alone.

Short-chain fatty acids are key metabolites that reflect microbial fermentation activity in the gut. These biomarkers can be quantified to provide valu-

able information on both the level and profile of SCFA production.

STRATEGIES TO MAKE ANIMALS ROBUST AND REINFORCING THEIR RESILIENCE

While animals are inherently driven to maintain homeostasis, we know the path is never smooth, and the organism needs to constantly adapt so it can perform as close as possible to its genetic potential. The stronger these adaptations, the higher the demand in energy and other micronutrients to maintain homeostasis. In other words, one should account for these expenses when maintenance requirements are estimated, and diets are formulated.

While inflammation is a normal response, it is demanding in energy, and multiple other micro-nutrients. Providing the nutrients to cope with the increased demand may allow to sustain performance. Other strategies may consist in stimulating the anti-inflammatory response or increase antioxidant capacity.

Animals face multiple sources of stress during their life. From life events such as hatching, vaccination, weaning, farrowing, or laying, to environmental and social stressors, all these events challenge homeostasis and may increase the presence of free radicals, also called Reactive Oxygen Species (ROS). When the availability of antioxidants is limited in the cells, the overaccumulation of ROS may result in oxidative stress. Depending on the duration and the intensity of the stress(es), oxidative stress may impair physiological functions, induce inflammatory response, opportunistic pathogen invasion, and ultimately infections.

Supplementing diets with antioxidants such as selenium, vitamin C and E, or live yeast reinforce antioxidant capacity and may enable animals to better cope with the excess of ROS in situations of stress.

WHAT DOES THAT MEAN FOR THE FUTURE?

To integrate adequate predictions of animal response into precision nutrition, more parameters than nutrient requirements and levels should be considered. Nutritionists need to define feeding strategies that support gut integrity, robustness and resilience to ensure efficient nutrient utilisation for maximum productivity and be closer to genetic potential.

Managing intestinal microbiome is a very complex task, indeed, but it can potentially add value to standard precise nutrition approaches. The microbiome still needs to be explored further, and ongoing research should bring more understanding of the host and microbiota interactions for future leverage.

Microbiome function can be explored in commercial conditions using faecal samples. As we collect more data, we also gain insights into animal responses, which will help us link bacteria presence with fermentation activity and gut health.

If we better understand how animals respond under different conditions, we can hope to better quantify their requirements, and adapt nutritional strategies to different scenarios and targets, and eventually be able to link these responses to mechanistic models.

About Virginie Blanvillain

Born and raised in France, Virginie Blanvillain lives in Quebec, Canada. She developed an international experience in the animal feed industry by working in research and development, technology transfer, nutrition and quality assurance. Over the past years, she has been actively involved in the development and implementation of innovative tools and services for nutritionists, producers, integrators and feed mills. She provides training and technical support to the AB Vista network worldwide, while leading the development and continuous improvement of NIR, carbon emissions and lab services.

Dr. Lukas Maier, CEO of A&P Nutrition:
"We are committed to delivering nature-inspired, scientifically validated solutions that address the most pressing challenges in animal health and performance. At the heart of this lies a clear mission: Improving animal performance. This is more than a slogan—it's a customer-centric promise backed by innovation, transparency, and a deep understanding of species-specific needs."

From Agromed and Patent Co. to A&P Nutrition: BUILDING A UNIFIED GLOBAL FEED ADDITIVES PLATFORM

At the beginning of 2026, one of the notable developments in the livestock and feed additives sector was the unification of the long-established companies agromed and PATENT CO. under the A&P Nutrition brand. Shaped by the strategic vision of Austria's agricultural powerhouse RWA (Raiffeisen Ware Austria), this new organization aims to translate the principle of "*strength through unity*" into a global success story. Active in more than 50 countries, A&P Nutrition is shaping the sector with a broad portfolio ranging from mycotoxin management and phytogenic solutions to sustainable fiber sources and precision nutrition technologies.

In this exclusive interview with **Dr. Lukas Maier, CEO of A&P Nutrition**, we take an in-depth look at the brand's formation process, the challenges of cultural integration, and the operational implications of a truly customer-centric approach. Dr. Maier emphasizes that A&P Nutrition represents far more than a name change; it reflects a new corporate identity built on trust, excellence and a strong people-driven culture. By also examining future agricultural trends—from alternative proteins to AI-supported nutrition solutions—this conversation provides a transparent view of A&P Nutrition's strategic roadmap in global markets.

A&P Nutrition was born from the merger of two well-established companies and a powerful parent organization. Could you tell us the story behind the emergence of this new brand, including the journey of PATENT CO. and agromed, and the strategic role RWA played within this structure?

What cannot be achieved alone should be achieved together. This principle from the founding father of the Raiffeisen cooperative system, Mr. Friedrich Wilhelm Raiffeisen, is deeply rooted in RWA's

heritage. As the umbrella organization of Austria's agricultural cooperatives, RWA carries more than 130 years of history as both a dedicated service provider and a strategic partner to the farming sector.

Over time, it became clear that we needed to expand our role along the value chain. RWA had long been active in feed production and, through Garant, held a leading position in Austria. We also operate in the feed-additive segment through agromed. The acquisition of PATENT CO. strengthened our compound feed leadership in Southeast Europe and enriched our portfolio with expertise in mycotoxin management and phytogenic solutions. Our compound feed activities have been, and continue to be, managed locally. However, it soon became clear that our global Feed Additive activities require central coordination.

Bringing together these long-established cultures was both a challenge and an opportunity. Early on, we made a conscious decision to move away from a top-down integration. Instead, we introduced a transition period in 2023 to identify the shared value that could be created by uniting the feed additive businesses of the two companies. Our starting position was already strong — a global presence in more than 50 countries and established relationships with customers and partners. But we knew we had to professionalize our market approach, strengthen our market intelligence, and focus on being closer to our customers.

Before expanding — and ultimately doubling — our teams, we harmonized and aligned our sales organizations in each market. This meant defining a clear market focus, ensuring a deep understanding of the value our products deliver, and providing enough time to build the right structure and processes to support our vision. Managing these priorities while navigating cultural differences was our most significant challenge and overcoming them is something I am particularly proud of.

Looking back, our key success factor was giving heritage and culture the respect and time they deserve, while identifying where each organization's true value contribution lies. This approach reflects RWA's core beliefs. A&P Nutrition is now coming to life because we have united potential, empowered people, and encouraged them to unlock their true potential. This is how we build our organization: striving to be better than average and learning every day how to improve.

Today, the heritage of PATENT CO.'s and agromed's additive business is fully integrated under our new, unified brand — A&P Nutrition. For us, this new brand is not just a milestone; it is a starting line. Together, we now move forward with one unified identity, clarity, and ambition.

An integration process of this scale inevitably brings operational and cultural challenges. What were the most significant hurdles you faced during the merger, and what management philosophy did you adopt to overcome them?

The most complex part of our transition was bringing people on board with the vision — aligning cultures, expectations, and mindsets. At the same time, the solution was precisely the same: empowering our people and trusting them.

We moved away from a top-down approach and instead built our processes and structures from the bottom up. And our team proved that, when entrusted with responsibility and given the right environment, they can overcome any challenge and deliver performance well above average. They succeeded in a framework that they helped design themselves — and that is what makes this achievement truly exceptional.

As of January 2026, you have begun conducting all operations under the A&P Nutrition name. What are your primary strategic objectives during this transition phase? Where do you aim to position the brand in the medium to long term?

We are shifting our focus from a product-centric model to a truly customer-specific approach. For us, this means being as close as possible to our customers and investing the time to understand their

challenges in depth. Only with this level of insight we can deliver complete and meaningful solutions.

A solution-based approach also means that whatever problem a customer presents, we commit to finding an answer. And we take it a step further: we integrate analytical tools, technical services, and the expertise of our in-house specialists. This is how we build genuine partnerships — by working alongside our customers and tackling their challenges together, at scale.

The new brand places a heavy emphasis on "customer-centricity." What message do the A&P Nutrition name, logo, and brand language convey to your clients? What is the core philosophy driving this brand story?

We aim to become the first choice — and the trusted partner — for feed & animal protein producers on a global scale. Achieving this position relies not only on our holistic portfolio but also on our ability to consistently deliver real value.

To ensure this, we have strengthened our organization with a top-tier technical team: highly educated experts with diverse experience and deep practical knowledge. Their expertise allows us to support customers at a level that goes far beyond products, reinforcing our commitment to performance, reliability, and long-term partnership.

We are committed to delivering nature-inspired, scientifically validated solutions that address the most pressing challenges in animal health and performance. At the heart of this lies a clear mission: Improving animal performance. This is more than a slogan—it's a customer-centric promise backed by innovation, transparency, and a deep understanding of species-specific needs.

The concept of "synergy" is frequently highlighted under the new brand. How will PATENT CO.'s expertise in feed additives—such as phytogenics and mycotoxin binders—and agromed's sustainable, fiber-based solutions translate into tangible added value for customers under A&P Nutrition? What specific advantages will your partners and customers gain from this new identity?

By combining the strengths of both organizations — our knowledge, expertise, products, and services — we have created a unique and comprehensive portfolio for our clients. We are present on the ground, accessible, and in constant dialogue with our key partners and customers. Our approach goes far beyond selling products. It is rooted in the belief that challenges which may seem insurmountable individually can be overcome together. This deep commitment to generating value, supported by strong expertise and practical know-how, is the core advantage of A&P Nutrition. It is what truly sets us apart.

Photo: A&P Nutrition

Could you provide some insight into your current organizational structure in global markets? As you move forward as A&P Nutrition, do you plan to make any changes to this international setup?

A&P Nutrition operates through a globally distributed, locally rooted structure with centralized leadership for the feed additive business. The integration of agromed and PATENT CO. has led to aligned sales organizations, a unified market approach, and a strong technical team supporting customers across more than 50 countries. Moving forward, we do not anticipate major structural changes, but we will continue refining and strengthening our international setup. This includes expanding customer-facing capabilities, enhancing technical and analytical services, and selectively growing our presence in key regions. Any evolution will follow the same bottom-up, people-driven approach that guided our integration, ensuring we remain globally coordinated, locally relevant, and deeply connected to our customers' needs.

How will this restructuring and rebranding impact your market presence? Which factors do you believe will most strengthen your competitiveness in the global arena during this process?

The restructuring and rebranding significantly strengthens our global market presence by uniting the complementary strengths of agromed and PATENT CO. under one coordinated, centrally managed structure. What truly elevates our competitiveness is the combination of our holistic portfolio, our strong technical and analytical expertise, and our shift toward solution-driven, customer-specific support.

We are certainly not stopping at our current problem-solving capabilities. A major part of building the A&P Nutrition brand was defining a clear business strategy, and this process has given us a precise roadmap for the future — including the key projects where we plan to invest. For us, this means continuous improvement and long-term relevance in the market. For our customers, it means a steady flow of fresh, up-to-date solutions that address their evolving needs. This commitment to ongoing development is what ensures we remain a reliable and forward-thinking partner.

You noted that your portfolio has been "updated and expanded" following the merger. What innovations can customers expect regarding products, technical services, and analytical support in the coming period? How will the rebranding drive innovation and growth?

Our R&D and innovation pipeline is driven by two main streams: continuous improvement of our existing products and the development of entirely new solutions. Ongoing enhancements are closely linked to our mycotoxin management portfolio, where we are enriching our approach and consistently elevating product performance.

At the same time, we are investing in two highly promising areas: alternative protein sources, and probiotics and postbiotics. I am particularly excited about these developments, as they have the potential to significantly enhance efficacy while supporting animal stability, resilience, and overall health.

What key trends do you think will stand out in the animal nutrition and feed additives market in 2026? In light of sustainability goals, evolving regulations, and economic pressures, what do you believe will be the industry's greatest challenge?

The animal nutrition sector is advancing across multiple interconnected innovation frontiers with the potential to significantly transform production in the near future. Key developments include:

• Alternative proteins that break the soy - fish meal paradigm - such as precision fermentation creating animal-identical proteins with net-zero carbon impact, insect protein scaling to 0.5–1.5 million tons annually, and microalgae delivering 55–76% protein with added bioactive compounds - thereby decoupling animal production from traditional agriculture's environmental footprint.

• AI-powered precision nutrition is shifting feeding strategies from standardized herd approaches to individualized regimes, achieving 5–10% milk yield increases, reducing feed costs, and identifying high-methane-emitting animals with 80% accuracy.

• Gut health revolution, driven by pro- and postbiotics, is expanding into a $6.5 billion market by 2032, enhancing nutrient absorption by 15–20% and replacing antibiotics,

• Methane reduction solutions such as 3-NOP (28–36% reduction), red seaweed (up to 98% reduction), and plant extract mixtures are gaining regulatory approval, particularly in Europe and North America.

The convergence of these innovations - alternative proteins, AI, blockchain, and microbiome-targeted additives creates integrated systems that simultaneously address productivity, sustainability, animal welfare, and climate mitigation. While the feed additives market alone will reach $48 billion by 2030, the larger opportunity lies in systems-level transformation that enables agriculture to feed a growing population within planetary boundaries.

A&P Nutrition is part of transformation towards more sustainable and balanced production models. Through our portfolio, we contribute practical solutions that improve efficiency — enabling producers to achieve greater output with fewer inputs, while protecting animals from added stress.

Finally, if you had to define A&P Nutrition in just three words, what would they be? How do these three words encapsulate both the brand's current state and its vision for the future?

If you were to ask me to describe our business in three words I would say Improving animal performance – as this is more than our slogan, it is our purpose, promise, and, tomorrow, it will become our legacy. But if we talk about the brand, I choose Trust, Excellence, and People.

TRUST is the foundation we build our relationships on – both internally and externally. We are committed to open communication and transparency, creating long-lasting partnerships grounded in mutual understanding and respect.

EXCELLENCE defines everything we do. We challenge ourselves, commit to sustainable performance and growth, and take ownership of our results. Excellence is not only how we design our solutions; it is a mindset we cultivate within the organization and a promise we consistently deliver to our customers.

PEOPLE are at the core of our business, both internally and externally. As a customer-focused brand, we prioritize our customers' needs above all and invest in partnerships created by people, for people. At the same time, our people in our team have played a crucial role in building the A&P Nutrition brand and they continue to be the main driving force behind our success.

Livestock Industry Under Climate Pressure: IS NUTRITION THE MOST EFFECTIVE WAY TO REDUCE METHANE?

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Escalating climate pressure is forcing the livestock industry to rethink not only its production models but also its nutritional strategies. Enteric methane emissions from ruminants have moved to the center of climate policy due to their high warming potential in the short term. But can the fastest and most actionable impact on methane reduction truly be achieved through nutrition? Science-based approaches, diverse solution models, and field applications are making the answers to this question increasingly clear.

By Derya Gulsoy Yildiz

The animal production industry is at a critical turning point in the struggle against the global climate crisis and the pursuit of sustainability goals. Enteric methane emissions from ruminants, in particular, hold a significant share of global greenhouse gas inventories. Because methane possesses a very high global warming potential in the short term, its reduction has become a strategic priority for climate targets. However, controlling these emissions is no longer viewed merely as an environmental responsibility; it has also emerged as a strategy for maintaining efficiency in the face of regulatory compliance and tightening profit margins. For these reasons, methane reduction is now one of

the top priorities for policymakers, consumers, and stakeholders across the animal production chain.

Jason Jeong-Hoon Kim, Global Sustainability Lead for Ruminants at Cargill, explains the impact of methane on the climate system and why it has become a priority target: "Methane, the second-largest contributor of greenhouse gases, originates largely from enteric fermentation of ruminants and is expected to rise with increasing global demand for beef and milk. Methane has a high global warming potential over short timeframes — more than 80 times stronger than carbon dioxide (CO_2) over 20 years. However, methane breaks down relatively quickly in the atmosphere, with a lifespan of about 12 years. Its warming effect peaks early and then declines sharply, nearly disappearing within a few decades. CO_2 doesn't break down quickly; instead, it accumulates in the atmosphere. Even after 100 years, CO_2 emissions still contribute to ongoing warming. Therefore, while CO_2 reduction is essential for long-term climate stability, methane mitigation can yield rapid climate benefits, making it a strategic target for short-term climate action."

Drawing attention to the role of agriculture in global methane emissions, **Steve Meller, CEO and Founder of CH4 Global**, states: "Agriculture is the largest contributor of methane emissions globally, which is why methane emissions from animal production have become increasingly important to governments around the world. Enteric methane is the largest contributor."

Gianluigi Sgarbi, COO/CFO and Partner at Vetos Europe, highlights consumer expectations and the perceived environmental role of livestock farming: "Even if the dairy and beef cattle sectors play a marginal role in the carbon footprint pressure, as shown by precise and consistent numbers at world level, the consumers appreciate that their food is as sustainable as possible or, better, that improves the environment. Specifically, approximately 14.5% of global greenhouse gas (GHG) emissions are attributable to livestock production, with fluctuations depending on the continent considered,

Jason Jeong-Hoon Kim
Cargill

and therefore the system and level of development of its livestock farming. Of this 14.5%, a large portion derives from rumen methane emissions, which represent over 39% of the total (FAO 2023). Methane is considered a stronger pollutant than carbon dioxide even if this theorem is now changing with new metrics that consider the atmospheric lifetime, 10 years for methane versus 1000 years for carbon dioxide. However, if it is possible to make dairy and beef cattle farming more virtuous, it must be done, and reducing methane is an easy and effective way."

STRATEGIES FOR REDUCING METHANE IN RUMINANTS

Today, the most widely accepted strategy within the livestock industry for mitigating methane emissions is focusing on nutrition. Ruminant feeding strategies stand out as a primary solution area due to their potential for rapid impact, feasibility in the field, and their ability to be integrated alongside production efficiency.

Pointing out that managing methane emissions from cows could be part of the solution to mitigate global warming in the short-term, **Jason Jeong-Hoon Kim** shares the following regarding methane reduction strategies: "Diverse strategies have been studied to reduce emissions of methane from ruminants, including increased production efficiency, nutritional modifications, genetic selection, vaccination, wearable technologies, and microbiome ma-

Steve Meller
CH4 Global

Gianluigi Sgarbi
Vetos Europe

nipulations. Nutritional modifications and increasing production efficiency have been a significant focus in animal nutrition due to their rapid effects, benefits for farmers and the environment, and relatively easy application."

Evaluating the topic within the context of regulations and practical applications, **Steve Meller** draws attention to natural solutions, stating: "Mitigation can be achieved simply by feeding ruminants natural solutions such as whole *Asparagopsis*. As a natural solution, governments don't have to work to reverse worrying greenhouse gas emissions, they're simply preventing the greenhouse gasses from being emitted in the first place. There are limits to the ability of any farmer to reduce emissions – whether it be solar panels or increasing energy efficiencies, carbon farming or sinks, or even electric farm machinery. However, introducing methane-reducing feeds, which are low-cost and highly-efficient, create a simple answer and enable farmers to meet increasingly-stringent regulations in different countries by tackling one of the largest sources of farm emissions."

Reminding us that as the population grows, the demand for beef and dairy will continue to rise, **Meller** states that a remarkable 90% reduction in methane is possible. He explains: "To prevent agricultural emissions increasing, we can act now. *Asparagopsis* has been proven in various studies to reduce methane emissions by up to 90 per cent, by feeding cows *Asparagopsis*-based feeds consisting of as little as .5 per cent of their daily diet. This is a low-cost, natural solution which can support farmers to also earn a premium for providing low-emissions beef or milk to the market."

Similarly, **Gianluigi Sgarbi** touches upon natural products, stating: "Some natural products are able to modulate methane emission at rumen level without impairing animal productivity and, much more important, animal welfare. Indeed, it is essential that this reduction is, first of all, achieved by natural products, and that it is not excessive, no more than 25%, to avoid compromising cattle health and performance."

HOW DOES NUTRITION CONTRIBUTE TO METHANE REDUCTION?

Nutritional solutions for mitigating methane emissions consist of various strategies targeting different biological mechanisms. These solutions range from approaches that directly modulate rumen fermentation to those that indirectly reduce emission intensity by improving feed efficiency.

Jason Jeong-Hoon Kim classifies nutritional strategies according to their mechanisms as follows: "Nutritional strategies/solutions to mitigate ruminant-derived methane are primarily defined by their modes of action and can be grouped into three broad

categories: hydrogen sinks, inhibiting the methane-forming enzyme, and reducing or suppressing methane-generating microorganisms. Because hydrogen produced during fermentation is a key precursor for methane, diverting hydrogen away from methane formation represents a central mitigation strategy. This can be achieved by increasing propionate, a hydrogen sink, through increasing production efficiency or by supplying alternative hydrogen sinks, such as nitrate. Once consumed by cows, nitrate is rapidly converted into ammonia, consuming hydrogen that otherwise supports methane-generation. This competitive mechanism has shown to reduce methane by up to 20% without negatively affecting productivity. The second approach targets methane-forming pathways by inhibiting enzymes used by methane-generating microorganisms. Compounds such as 3-nitrooxypropanol (3-NOP) and bromoform of red seaweed (*Asparagopsis*) can inhibit the enzyme with reported methane reductions of 30% or more. The third strategy aims to directly suppress methane-generating microorganisms by using essential oils, unsaturated fats, or vaccines. Although methane reductions are generally modest (5-10%) in limited trials, these approaches may offer simpler and lower-cost applications. Overall, careful long-term evaluation is essential to ensure animal health and performance."

Approaching methane reduction in conjunction with productivity and animal welfare, **Gianluigi Sgarbi** explains appropriate nutritional strategies as follows: "Methane emissions must be related to productivity, and, therefore, efficiency is the key. For this reason, nutrition must aim to maximize animal welfare and, with it, productivity. To reach this target, the use of a balanced diet and high-quality and healthy feed are the primary objectives, which should then be complemented by strategies aimed at maximizing digestive efficiency. In this regard, influencing the various metabolic pathways in the rumen and adequately reducing methane production, which represents an energy loss, are proven to be successful strategies. In this regard, scientific research has provided not only specific recommendations for nutrition and formulation, but also truly effective additives, buffers, pre-, pro- and post-biotics, to which our pool of essential oils, tannins and bioflavonoids are now added due to the positive effects on rumen and animals' health."

Focusing on feed additives as a methane-reducing nutrition strategy, **Steve Meller** emphasizes *Asparagopsis* – the core area of expertise for CH4 Global – and states: "We have found the most effective solution to be whole, dried *Asparagopsis*, fed to cows at .5 per cent of their daily rations. Our work has focussed on how to deliver a product that ensures

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consistent efficacy, stability, palatability and ease of integration into existing farm operations. We have formulated our product Methane Tamer to stabilize the key components in *Asparagopsis* – especially bromoform - and to ensure cattle will eat the product as part of their daily rations. We started with cattle in feedlots, as humans control everything that cattle eat. Our product is designed so it can be easily mixed into daily rations. It can also be easy to control when fed to dairy cattle as part of their daily TMR. Our research has shown that *Asparagopsis* is palatable when dried and mixed with natural additives, such as molasses. We know that consumers do not want to buy food products – whether they be dairy or beef – if the cow has been fed chemicals or extracts. Farmers are also leaning towards feeding their cattle natural products that are chemical-free."

COMPANY-SPECIFIC SOLUTIONS AND TARGETED MECHANISMS

Today, many companies have developed unique nutritional solutions targeting different biological processes for methane reduction. These solutions exert their effects through mechanisms such as rumen fermentation, hydrogen sink, microbial populations, and feed efficiency.

Jason Jeong-Hoon Kim summarizes the approach of **Cargill ANH**, which integrates methane reduction within a framework of animal performance, health, and safety: "Cargill Animal Nutrition & Health (ANH) addresses methane from ruminants through a combination of direct nutritional solutions and indirect productivity-driven strategies, under our ruminant sustainability platform called ReaCH4Reduction™. The platform aims to reduce both absolute emissions and methane intensity while safeguarding animal health, performance and farmer profitability. The primary direct methane-mitigation solution ANH developed with years of research is SilvAir™, a patented feed material solution designed to function as an alternative hydrogen sink in ruminants. In a recent meta-analysis published in the Journal of Dairy Science, SilvAir has been shown to reduce methane emissions by up to 20% without adverse impacts on animal performance. In addition, SilvAir™ provides nitrogen and available calcium to a cow's diet. ANH also supports indirect methane-intensity reduction through advanced nutrition optimization. Solutions such as Dairy MAX™ and Beef MAX™ balance dietary protein fractions and energy supply to reduce waste losses, thereby lowering methane emissions per unit of milk and meat produced. Across all approaches, ANH applies a holistic framework that integrates methane reduction with animal performance, health and safety. By linking mitigation to improved feed effi-

ciency. milk and growth productivities, combined with nutritional and performance-driven strategies, ANH aims to deliver emission reductions while supporting sustainable, high-performing livestock systems for farmers and food companies."

Focusing on bromoform, a prominent compound in methane reduction, CH4 Global stands out with an additive based on *Asparagopsis*, a red seaweed containing this compound. **Steve Meller** emphasizes CH4 Global's product-driven approach: "CH4 Global grows *Asparagopsis*, which is a native seaweed to southern Australia. Our Methane Tamer product consists of whole, dried *Asparagopsis*. When fed to cattle at just .5 per cent of their daily rations, it has been found to reduce methane emissions by up to 90 per cent.

Methane Tamer prevents methanogenesis, the microbial production of methane in rumen. Our study results have shown that feeding Methane Tamer to feedlot cattle as part of their daily diet reduces the feed energy lost to methane production resulting in feed efficiencies, with feedlot cattle putting on more weight with the same feed. We are currently working on dairy and other trials."

Vetos Europe was recently named the "Best Company in Carbon Reduction within the Beef Industry" at the World Finance Carbon Awards 2025. At the heart of this award was Anavrin, Vetos Europe's flagship solution reported to provide measurable and verifiable methane reduction. **Gianluigi Sgarbi** focuses on this solution, stating: "Anavrin, a specific and carefully selected blend of essential oils, tannins and bioflavonoids, was developed to support and improve the ruminal functions, while modulating methane production. In particular, the essential oils contained in Anavrin play an important role in the kinetics and activity of certain bacteria, while tannins have positive effects on protein metabolism and inflammation, and bioflavonoids as antioxidants. By keeping a stable ruminal environment, enhancing the total volatile fatty acid production, especially of propionate instead of acetate, and controlling the growth of methanogenic bacteria, Anavrin improves ruminants' zootechnical performance while curbing methane emissions. The findings, published in peer-reviewed scientific journals, consistently confirm that Anavrin reduces methane emissions from enteric fermentation (from 13% up to 23%), improves production performance in dairy cows (+3.2% to 3.8% in energy and protein corrected milk), and beef cattle (+5.5% to 6% in average daily gain), feed efficiency (by 6% to 8% in beef and dairy), and also health and welfare in some studies. Anavrin technology is grounded in rigorous scientific validation over the past several years by research institutions and universities through both *in vitro* and *in vivo* and studies, even under different production systems, animal types and environmental conditions. In all the studies methane mitigation was associated with an improvement in production performance, fundamental point to be really sustainable and in line with the demand of animals' protein that will characterize the near future."

HOW CAN METHANE REDUCTION EFFICACY BE MEASURED AND TRUSTED?

In recent years, many different solutions and product options for methane reduction in ruminants have been developed, and development continues. But how should the efficacy of these solutions be measured? How do we decide which standards and solutions to move forward with? Experts believe that methane reduction should be evaluated not just through emission outputs, but alongside animal performance, health, and economic returns. The need for measurement technologies and standardization is critical for reliability and widespread adoption in this field.

Jason Jeong-Hoon Kim emphasizes the importance of measurement and standardization: "Strong scientific evidence is the foundation of credibility. Controlled animal trials conducted under industry-relevant feeding and management conditions with reliable measurement technology, such as GreenFeed, supported by peer-reviewed publications, are essential for evaluation. Further, efficacy of nutritional solutions for methane reduction should be evaluated using a holistic, system-based framework

that extends beyond single-point emission outcomes. Robust assessment must integrate biological validity, animal performance, health and safety, and economic return. Methane results should therefore always be interpreted alongside dry matter intake, methane yield and intensity, feed efficiency, and key performance indicators, to ensure mitigation doesn't compromise productivity or health/safety. For large-scale continuous evaluation, a systematic on-farm measurement system should be developed for traceability and access to reliable activity data with standardized processes. ANH values science-backed proven solutions and underscores the need for greater standardization in how methane-reduction efficacy is assessed and reported to improve transparency. It enables fair comparison among technologies and accelerates adoption by farmers and food company partners."

Steve Meller highlights the farmer's perspective: "For any farmer, animal health is a priority. We are working with farmers on a daily basis to evaluate everything from weight gain to milk production volumes, feeding efficiencies and general animal health and happiness. No farmer would feed a supplement to their cows which would reduce milk volumes, affect taste, weight or the quality of their beef. So while emission reductions are important, they must be considered in the context of animal health and productivity. Any evaluation would need to focus on measures which result in positive outcomes for farmers, whether that be feed efficiencies – and therefore cost savings – or increasing milk volumes, weight gain, or increased marbling scores. Farmers need to be profitable, otherwise international industries and food chains will collapse. If we can support farmers to save costs through feed efficiencies, mitigate climate change, claim carbon credits or achieve a premium for their product due to their efforts to make a positive change, the farming industry should be able to prosper."

Gianluigi Sgarbi expresses the need for scientific validation and certification as follows: "In the article "Feed additives for methane mitigation: Recommendations for testing enteric methane-mitigating feed additives in ruminant studies" published in the Journal of Dairy Science in 2024 (https://doi.org/10.3168/jds.2024-25050), clearly comes that there are only three technologies to evaluate scientifically the methane reduction, the respiration or metabolic chambers, the GreenFeed system, and the sulfur hexafluoride method, and these technologies must be used to certify the effect of a methane mitigator additive and thus his efficacy, also on the production performance. It is also important to emphasize that the results of scientific research must be welcomed with confidence by the production sector and related industries, especially when the additive's effectiveness is further certified by programs such as the Verified Carbon Standard (VCS) for GHG reductions. Too often, both in livestock farming and in industry, further attempts to verify what is already established and proven effective only increase the risk of confusion and uncertainty. Research is an extremely difficult and complex field and therefore must be entrusted to researchers equipped with the appropriate skills and tools."

CONCLUSION: EFFICIENCY, WELFARE, AND CLIMATE IN THE SAME EQUATION

The reduction of methane emissions in livestock is not merely an environmental responsibility; it has emerged as a field of transformation directly linked to efficiency, animal welfare, and economic sustainability. Nutritional solutions, with approaches centered on rumen biology, offer the potential to provide significant short-term climate gains while delivering actionable solutions without compromising production performance. In a world where the demand for animal protein continues to rise, science-based, measurable, and standardized nutritional strategies play a key role in ensuring the industry remains both aligned with climate goals and economically viable.

Reducing methane emissions does more than contribute to climate targets; it also offers tangible benefits in terms of animal health, productivity, and farmer profitability. Through natural feed additives, balanced rations, and innovative nutritional solutions, the livestock industry has the opportunity to advance toward a more sustainable and low-emission production model.

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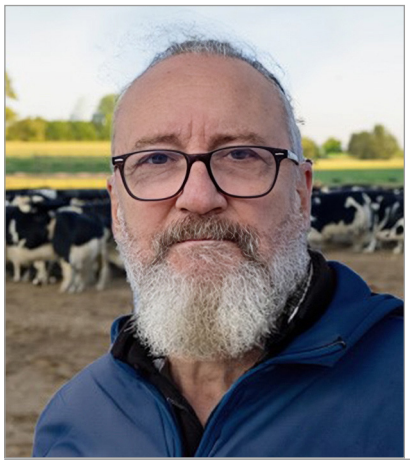


DDGS AS A POSTBIOTIC FEED INGREDIENT IN DAIRY COWS

Dr. Alvaro Garcia
Feeds Specialist and Nutritionist
Dellait Animal Nutrition and Health

Intestinal barrier integrity plays a central role in the health and productivity of lactating dairy cows, particularly during periods of heat stress and metabolic strain. Distillers dried grains with solubles (DDGS), traditionally valued for their protein and energy contribution, also deliver fermentation-derived bioactive compounds. These components position DDGS as a potential postbiotic feed ingredient, with implications for gut permeability, immune activation, and oxidative stress regulation in dairy nutrition.

Intestinal barrier integrity is a key determinant of productivity and health in lactating dairy cows because it governs the balance between nutrient absorption and immune exclusion. The intestinal epithelium must permit efficient uptake of water, electrolytes, and nutrients while preventing translocation of luminal antigens, toxins, and microbial products into circulation. When barrier function is compromised, the resulting increase in intestinal permeability, commonly referred to as leaky gut syndrome, is associated with immune activation, oxidative stress, reduced feed efficiency, and lower milk yield, particularly during periods of heat stress and early lactation.

Distillers dried grains with solubles (DDGS) are widely used in dairy rations due to their favorable protein, energy, and phosphorus content, yet their effects on gut function are inconsistently described. This variability reflects the complex nature of DDGS, which concentrate not only nutrients but also fermentation-derived microbial residues, unsaturated lipids, fiber fractions, and, in some cases, mycotoxins from the parent grain. We recently proposed that DDGS can be viewed as a functional food postbiotic because they supply non-living, microbial-derived bioactive components generated during fermentation and processing rather than live microorganisms. This framework encourages evaluation of DDGS beyond nutrient supply and toward their potential effects on immune signaling, microbial ecology, and intestinal barrier function.

Specifically, this article links DDGS composition to the epithelial mechanisms that maintain or disrupt barrier integrity using the tight junction model illustrated in the accompanying figure.

TIGHT JUNCTION ARCHITECTURE AND BARRIER FUNCTION

The tight junction model illustrated in the accompanying figure below shows how epithelial barrier selectivity is maintained under homeostatic conditions and how oxidative and inflammatory stress can shift the system toward increased permeability. Tight junctions seal the apical lateral membranes of adjacent epithelial cells and collectively

form the zonula occludens, a gasket-like structure that defines the paracellular pathway. Under normal conditions, this pathway permits controlled passage of water and small ions while restricting larger solutes and luminal macromolecules.

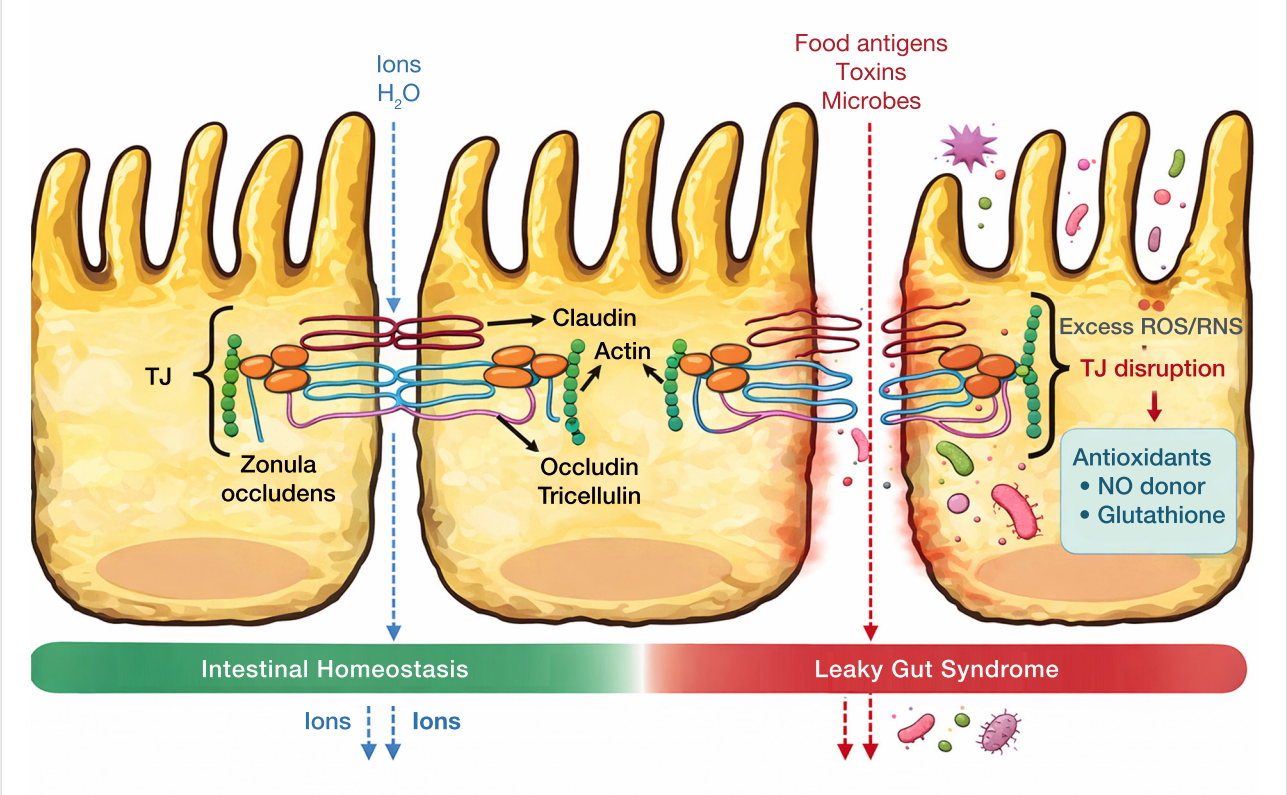
Barrier selectivity is governed primarily by transmembrane tight junction proteins. Claudins are the principal pore-forming components and determine ion selectivity and paracellular permeability based on isoform expression and junctional organization. Occludin contributes to junctional stability and stress responsiveness by regulating tight junction assembly and maintenance, while tricellulin is concentrated at tricellular junctions where three epithelial cells meet, sealing structurally vulnerable sites that would otherwise permit macromolecule leakage.

These proteins are anchored intracellularly to the actin cytoskeleton through adaptor proteins of the zonula occludens family. This cytoskeletal linkage allows tight junctions to respond dynamically to mechanical strain and intracellular signaling but also renders barrier integrity sensitive to cytoskeletal contraction or disorganization.

TRANSITION FROM INTESTINAL HOMEOSTASIS TO LEAKY GUT SYNDROME

Leaky gut syndrome emerges when oxidative and inflammatory stress disrupt tight junction structure and regulation. Excess reactive oxygen species and reactive nitrogen species (ROS and RNS) are central drivers of this transition. Oxidative and nitrosative stress alter signaling pathways that regulate tight junction protein trafficking, leading to internalization or redistribution of claudins and occludin away from the apical membrane and weakening their anchorage to actin. Concurrently, stress-induced cytoskeletal contraction widens paracellular spaces and compromises junctional cohesion.

Disruption of tricellulin localization further increases permeability at tricellular contacts, disproportionately facilitating passage of larger luminal antigens. Once barrier integrity is reduced, food antigens, toxins, and microbial products translocate across the epithelium and activate mucosal immune cells, amplifying inflammatory signaling and ROS production. This self-reinforcing cycle sustains tight junction disruption and perpetuates the leaky gut state.



Antioxidant systems modulate susceptibility of the epithelial barrier to oxidative stress. Glutathione serves as a primary intracellular antioxidant that neutralizes reactive species and protects tight junction proteins from oxidative modification, supporting maintenance of junctional localization and structure. Nitric oxide signaling contributes to epithelial perfusion and cellular communication under physiological conditions, but dysregulated nitric oxide metabolism promotes RNS accumulation and barrier dysfunction. Nutritional strategies that sustain antioxidant capacity therefore influence whether oxidative stress reaches a threshold sufficient to disrupt tight junction integrity.

DDGS AS A POSTBIOTIC FEED INGREDIENT IN DAIRY COWS

DDGS contain fermentation-derived residues from yeast and microbes generated during ethanol production, including cell wall-associated polysaccharides and other microbial-associated molecular patterns capable of interacting with host immune pathways and microbial communities. Although DDGS do not deliver live microbes and therefore are not probiotics, they can act as postbiotic-like inputs by supplying microbial-derived bioactive components that influence host physiology.

In dairy cows, fermentation products from Saccharomyces cerevisiae have been shown to stabilize microbial ecosystems and attenuate inflammatory responses during rumen and gut stress challenges. These findings support the biological plausibility that fermentation-derived bioactives can modulate microbial dynamics in ways that indirectly support barrier stability. However, DDGS differ from standardized fermentation products in that their composition varies substantially with processing history, storage conditions, and grain quality. As a result, the postbiotic hypothesis for DDGS is strongest when ingredient quality is consistent and does not introduce competing oxidative or toxic stress.

QUALITY-DEPENDENT RISK FACTORS LINKING DDGS TO BARRIER DISRUPTION

The potential barrier risks associated with DDGS are primarily quality dependent and map directly onto the oxidative mechanisms depicted in the tight junction model. High unsaturated lipid content can increase oxidative load when DDGS are heat damaged or poorly stored, promoting lipid peroxidation and epithelial oxidative stress. Oxidized lipids increase the likelihood of tight junction protein redistribution and cytoskeletal disruption.

Mycotoxins represent a second major risk factor. Because DDGS can concentrate mycotoxins from the parent grain, compounds such as deoxynivalenol may be present at biologically relevant levels. Deoxynivalenol is a well-documented epithelial stressor and tight junction disruptor, particularly under concurrent stress conditions such as heat stress or dietary acidosis. Dietary context further modulates risk, as highly fermentable diets and subacute ruminal acidosis shift microbial fermentation and inflammatory signaling, increasing susceptibility to permeability disturbances.

QUALITY AND INCLUSION BOUNDARIES FOR POSTBIOTIC PLAUSIBILITY

The postbiotic interpretation of DDGS depends on whether fermentation-derived residues are delivered without introducing oxidative or toxic stress sufficient to override barrier-supportive mechanisms. Lipid oxidation provides one functional boundary. Peroxide value serves as a practical indicator, with low values consistent with minimal oxidative burden and values approaching or exceeding approximately 20 mEq O_2/kg fat indicating substantial oxidation that reduces the likelihood of postbiotic-like effects.

Mycotoxin contribution represents a second boundary. When DDGS inclusion materially elevates total ration mycotoxin concentrations toward established guidance levels for dairy cattle, barrier disruption mechanisms are likely to dominate, making a postbiotic interpretation biologically implausible.

Postbiotic plausibility also depends on inclusion rate. Because DDGS are not standardized fermentation products, sufficient dietary inclusion is required to deliver a consistent quantity of fermentation-derived residues. In lactating cows consuming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25 to 30 kg of dry matter per day, inclusion rates of approximately 10 to 20 percent of diet dry matter, corresponding to roughly 3 to 6 kg per cow per day, represent the most plausible range for DDGS to exert postbiotic-like effects when quality is high.

CONCLUSION

Leaky gut syndrome in dairy cows reflects disruption of tight junction protein organization, cytoskeletal anchoring, and redox balance. Claudins regulate selective paracellular permeability, occludin supports junctional stability and stress responsiveness, and tricellulin seals tricellular sites that otherwise permit macromolecule leakage. Excess ROS and RNS disrupt these proteins and their linkage to actin, widening the paracellular space and enabling translocation of luminal antigens, toxins, and microbes.

Within this mechanistic framework, DDGS should be regarded as a conditional functional ingredient in dairy diets. When sourced and handled to minimize oxidative damage and mycotoxin burden, and when included at appropriate rates in balanced rations that support antioxidant capacity, DDGS may contribute to microbial and immune stability consistent with a postbiotic framework. When these conditions are not met, oxidative and inflammatory pressures are more likely to dominate and promote the tight junction disruption processes associated with leaky gut syndrome.

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WHAT WILL DEFINE 2026 FOR ANIMAL PROTEIN AND NUTRITION MARKETS?

As animal protein and nutrition markets move into 2026, slowing production growth, geopolitical uncertainty, and evolving cost structures are reshaping global supply chains. From feed economics and trade policy to disease risk, sustainability, and consolidation, the year ahead will demand greater agility and strategic focus. **Hamlet Protein CEO Erik Visser** outlines the key forces expected to define 2026 and their implications for animal protein and animal nutrition markets worldwide.

GEOPOLITICS: RISKS REMAIN

After the initial shock of the 2025 US trade policies, the markets seem to have stabilized. Do not be fooled by that, as geopolitical risks will remain significant and disruptions can flare up anytime. The question is no longer whether the US will use tariffs as a political tool, but to what extent, and what the knock-on effects of those tariffs will be.

A challenge to the so-called “reciprocal" tariffs on goods from individual countries and for levies imposed on China, Canada and Mexico tied to the flow of fentanyl into the U.S. was argued before the U.S. Supreme Court in late 2025, and a decision is expected in early 2026. Watch especially for the impact of the US – China trade relation on soy- and pork exports from the US, and its implications for global markets. The current trade agreement will expire in the second half of 2026 and, combined with the US midterm elections coming up in November, this may be enough motivation for the current US administration to reach a deal with China.

The free trade deal with the two largest U.S. trading partners - Canada and Mexico - is up for review in 2026 amid uncertainty over whether the US will let the pact expire or try to renegotiate key provisions. The European Union will assess its trading relationship with China, and tariffs or other measures will be considered as options to address the growing imbalance in their trading ties.

GLOBAL ECONOMY: WATCH AI, CHINA, AND US

Current projections will see 2026 deliver stronger economic growth than expected earlier: +3%, mostly driven by China (+5%) and the US (+2.5%). Growth in the Eurozone will be more sluggish at +1.2%.

Watch out for the large stock that was built by US companies in 2025, to avoid the impact of increasing import rates, that reduced the inflationary effect of the US trade policies. If we see a delayed effect in 2026 – and that effect is strong enough - then this could impact growth rates.

Artificial Intelligence (AI) may not impact the real economy to the same extent it is already playing a role on the financial markets. Large investments and strong valuations will be affected in a possible market correction. At the same time advancing technology will impact labor markets and productivity and as such affect economic growth.

While China has grown to become a dominant player on the global political and economic stage, the less predictable US trade and foreign policies create an opportunity for the European Union – and the EURO – to grow its global influence.

ANIMAL PROTEIN: SLOWING GROWTH

Growth in animal production will slow down in 2026 to less than 0.5%. While poultry and aquaculture will continue to grow, swine and ruminant production will stabilize or show a slight decline. Producers will face tighter margins due to disease, higher trade costs, and trading down by price-sensitive consumers. Efficiency will be the name of the game, and nutrition will play a key role in reaching the animal's genetic potential.

Erik Visser
Hamlet Protein

MARKETS: MIXED PICTURE

The global demand for animal protein is being supplied through local production and imports. Disease outbreaks, regulation, and trade policies are key factors in determining where production will take place. Whenever a market disruption takes place, one of the competing export blocks will quickly step up production volumes to benefit from the emerging opportunity.

Europe will see pork and poultry production grow, but political pressure on agriculture may cause volumes to shift from NWE to CEE. North America will see modest growth in swine, while poultry will accelerate. Southeast Asia is set to deliver increased pork production, but African Swine Fever remains a challenge. Poultry production will see strong growth.

Following government mandated herd contraction at the end of 2025. China will see its swine production decrease, South America will see growth across all species, primarily driven by Brazil. The EU-Mercosur interim trade agreement may create growth opportunities for beef and poultry exporters. Multinational companies that offer a diversified product portfolio, service a broad range of species, and have market share in all regions, are best posi-


Source: Created by AI

tioned to deal with changing market conditions and shifting consumer preferences.

FEED COSTS: STABLE

Feed costs can account for up to 70% of total production costs, that is why it is such an important KPI to track. An intensification of the La Niña phenomenon could reduce crop yields in South America – particularly soy and maize – and impact anchovy fishing in Peru, which is essential for producing fishmeal and fish oil.

Feed costs are expected to remain stable, or trend moderately lower, in 2026, allowing producers to invest in specialty ingredients and feed additives inclusion to drive the health and performance of their animals. A potential risk could come from deteriorating trade relations between EU or US on one side and China on the other side. As China produces more than 70% of the world's vitamins, and many critical amino acids, including more than 75% of the world's lysine and more than 25% of methionine, access to Chinese suppliers is critically important for feed producers.

SBM: STABLE

Soybean Meal (SBM) has evolved from a traditional agricultural crop into a global strategic instrument. Although production reached record levels in 2025, pricing not only relates to available quantity, as politics, sustainability, and traceability are becoming ever more important.

China is by far the biggest importer of soybeans and has a large crushing capacity. The trade relation with the US will determine whether their volume will be sourced from the US or Brazil. After China, Europe is the largest importer of soybeans and SBM, predominantly from South America. The EU's own soybean harvest, all of it non-GM, is insufficient to serve the demands from the industry.

The implementation of the EUDR, the strategic restructuring of U.S.–China trade relations, US and Brazilian biofuel policies, US farm subsidies, and logistical pressures in South America will define the soybean meal markets in 2026. Our current view is for price levels to remain stable in 2026.

OCEAN FREIGHT: LOW PREDICTABILITY

After years of unprecedented supply chain disruption – from the Covid-era chaos to the Red Sea crisis distortion – stability is not yet in sight. 2026 will see a strong influx of new vessels, increasing the global fleet capacity by as much as 5%. At the same

time, the potential reopening of the Suez Canal will lead to short-term disruption. Couple that with the unpredictable nature of tariffs and volatility in pricing and availability is going to be the only certainty in the new year.

ENERGY COSTS: DOWNWARD TREND OIL & GAS

Gas and electricity are important cost factors in the production of fertilizers – resulting in an indirect impact on feed costs – and in the production of animal nutrition and feed specialties. Oil is an important driver for transportation costs and to produce certain feed commodities. 2026 will see pressure on oil and gas prices due to expected oversupply. Oil because of OPEC ending its voluntary production cuts and gas due to new liquefied gas (LNG) capacity being brought on stream. Electricity pricing is expected to see an upward trend, following increased demand.

The ongoing war in Ukraine, an unstable ceasefire in the Middle East and the potential for further escalation in Venezuela will keep supply chains and energy security exposed to sudden disruptions. On the other hand, we could see Europe benefit from a cease to hostilities in Ukraine and normalization of energy supply from Russia.

While the energy transition advances, it does so at a slower pace following recent policy changes and lack of storage capacity in major markets. Still wind and solar energy are set to become ever more important in the energy mix.

LABOR MARKET: RISK OF SHORTAGE OF SKILLED WORKERS

In 2026 the industry's work force will continue to shrink. A rising number of retirements, slowdown in attracting new talent, and restrictive migration policies will put pressure on animal protein and animal nutrition producers alike. Automation may be part of the answer, but the industry will need to focus on highlighting the importance of producing safe feed for food and how young professionals can contribute to feeding a growing global demand. Feed mills, farms, and integrators alike should have a strategy in place to cover their future work force, invest in hiring, training, and retaining skilled workers, and offer compensation packages that allows them to compete with other industries.

DISEASE OUTBREAKS: IMPACT CONTINUES

Where, and to what extent, diseases will affect markets, is impossible to predict. That we will experience disease outbreaks in 2026, and that this will affect animal protein supply chains should be considered a certainty. Outbreaks in local markets will disrupt export flows, drive up costs for producers and impact price levels. African Swine Fever (ASF) and Avian Influenza (AI) will be the most widespread diseases that will impact local and export markets. Combined with emerging diseases like New World Screwworm, Foot and Mouth Disease and Bluetongue, the risk of these outbreaks will drive increased bio-security measures.

REGULATION: MAJOR POLICIES UNDER REVIEW

The implementation of the European Deforestation Regulation (EUDR) was delayed by another twelve months in December 2025. The legislation targets seven key commodities, amongst which cattle and soy are directly related to animal protein and animal nutrition. On April 30th, the EU will review reporting demands under the EUDR, and during the year a clearer timeline for its implementation is expected to be confirmed. An important adjustment that has been announced already is that the responsibility for EUDR compliant sourcing will be limited to the company that introduces SBM on the European market.

In the US, the Innovative Feed Enhancement and Economic Development (FEED) act is pending in Congress with bipartisan support. The legislation aims to modernize the current FDA's regulatory framework to allow approval of feed ingredients offering benefits beyond basic nutrition. This will mean a huge step forward for US manufacturers and importers alike, to communicate more effectively on the health and performance impact of feed additives.

The use of medication in feed formulations in general, and antibiotic growth promoters (AGP) in particular, will be subject to ever increasing regulation. As there is no single product that can replace antibiotics, a multi-faceted nutritional approach will be needed to drive animal health and performance. Regulatory frameworks will provide growth opportunities for feed additives and specialty ingredients producers.

SUSTAINABILITY: A STRATEGIC PILLAR

Sustainability is no longer a nice-to-have, but a must-have throughout the supply chain. That does not mean all sustainability efforts can be monetized. Customers will select suppliers based on sustainable practices, without necessarily paying a premium. Animal protein producers will increasingly focus on optimizing feed for better efficiency, reducing their environmental impact, using alternative ingredients, and improving animal health and welfare. At the same time, risk management is becoming a more important element in sustainability practices, as future investments will increasingly take climate change into consideration.

Finally, regulatory demands will force producers to integrate sustainability policies in their strategic planning.

MERGERS & ACQUISITIONS: INCREASED DEALMAKING

Expect an increased M&A activity in 2026, after several years of limited deal making in animal nutrition and animal protein markets. Multinational companies and private equity (PE) seeking scale and efficiency will focus on sustainability, technological integration, and strategic consolidation.

Large, integrated companies are looking to streamline their portfolios, divesting non-core animal nutrition assets to focus on areas where they have a stronger, more competitive position. Private equity firms are actively deploying capital and consolidating mid-sized suppliers of specialty additives, attracted by the sector's resilience and consistent growth. And inorganic growth by current midsize players to expand geographically, add technology, or drive portfolio diversification will further boost M&A activity.

Large transactions, like the planned sale of DSM-Firmenich's animal nutrition division, may accelerate further consolidation in the industry.

ARTIFICIAL INTELLIGENCE (AI): EVOLUTION NOT REVOLUTION

Artificial intelligence (AI) in animal protein and animal nutrition production will be a matter of evolution not revolution, as implementing it in a conservative business environment like ours is likely to be challenged by farm managers and nutritionists alike.

We do expect an increased focus on using data from multiple sources to create tailored and optimized diets for different animal species and monitoring of individual animal feeding behaviors for early detection of health- or nutrition challenges. At the same time AI will be applied to support sustainability initiatives, like optimization of water and energy usage, reduction of waste, carbon footprint tracking and improved manure management for example.

HOW TO WIN IN 2026: AGILITY

The question is not if, but how much change will come our way in the coming year. On a global scale the demand for animal protein will continue to grow. People will continue to eat meat, milk, eggs and fish, and the industry will have to feed an increasing number of global citizens. What protein source they will prefer, and where that is being produced, will directly impact the sourcing of animal nutrition and feed additives. Geo-politics, consumer preferences, animal diseases, and regulation are just a few elements that will play a role in shaping the markets in the coming year.

Future success will depend on adaptability and agility, so the winners of 2026 will be the companies that respond quickly and decisively to changing circumstances.


Source: tuaindeed | Shutterstock

HAMLET PROTEIN: INNOVATION AND MARKET SHARE GROWTH

In 2026 Hamlet Protein will continue to deliver best in class solutions for young animal nutrition. We are optimistic about achieving further growth across regions in the new year, as we see an increasing focus on early life feeding to reach the animal's genetic potential.

The SSP market size is estimated at 1.6Mmt, and will continue to grow at an average of 3% - 4% year on year. Macro-economic drivers such as a growing world population, increased regulation, and further market consolidation support this market growth. Hamlet Protein will not only replace other vegetable protein products but take share of animal protein diet sources like plasma and fish meal to further increase our volumes. Fish meal supply is expected to remain tight in 2026, with elevated price levels as a consequence. Porcine plasma will face price volatility and upward price pressure due to supply contraction.

We will follow up on our unique research on protein kinetics – that showed that Hamlet Protein has the fastest available vegetable protein in the market - and define how the speed of digestion can be used to optimize feed formulations. In the second half of last year, we released exciting trial results in dry calf starter feeds. We will use those to further grow our presence in ruminant markets. In the poultry segment we will look at layers and turkeys for further growth.

Hamlet Protein is renowned for our work in piglets, which has helped us create strong relationships in the swine industry over the years. In response to increasing concerns from the industry on sow KPI-s, we will cooperate with swine producers to run trials targeting a reduction in sow mortality. Sustainability remains a cornerstone of our strategy. At the end of 2025 we completed our Life Cycle Assessment (LCA) and joined the Science Based Targets Initiative (SBTi), which provides us with a clear roadmap for 2026 and beyond.

Hamlet Protein will continue to invest in people, products, production, and processes to maintain its leading position in specialty soy proteins, and work alongside our distribution partners to grow in export markets.

Source: Created by AI

INSIDE THE GLOBAL FISHMEAL AND FISH OIL MARKET: **Demand Growth Meets Limited Supply**

The global fishmeal and fish oil market is expanding under the influence of demand from aquaculture, animal nutrition, and the pet food sectors. Conversely, the supply side is constrained by limited ingredient resources, fishing quotas, climate fluctuations, and sustainability pressures. This imbalance between supply and demand increases price volatility, placing supply chain management, alternative ingredients, and efficiency-oriented solutions at the center of the sector agenda.

By Derya Gulsoy Yildiz

Today, the global livestock sector is increasingly compelled to adopt a strategic feeding approach due to rising demand for animal protein, cost volatility in feed ingredients, and pressure for sustainability. It is not only the nutrient content of feed ingredients that has become decisive in the sector's decision-making processes, but also supply security, environmental footprint, and global trade dynamics. In this environment, ingredients with high nutrient density and functional benefits lie at the heart of performance and efficiency targets.

In this framework, the fishmeal and fish oil market sits at the intersection of animals' biological and physiological nutritional requirements and a global supply structure based on

limited natural resources. Demand for these ingredients remains high, particularly in aquaculture and performance-oriented livestock systems. However, environmental factors, fisheries policies, and competition from alternative protein and lipid sources directly impact the production volumes, prices, and trade flows of these materials. This elevates fishmeal and fish oil beyond being mere feed inputs, turning them into strategic global commodities.

USE OF FISHMEAL AND FISH OIL IN ANIMAL FEED

Fishmeal is a high-quality protein feed ingredient, generally obtained from ingredients not consumed by humans or from by-products of fish processing. Thanks to its high digestibility and balanced amino acid profile, it supports growth and performance, particularly in young animals, and contributes to a healthier development process by supporting the immune system.

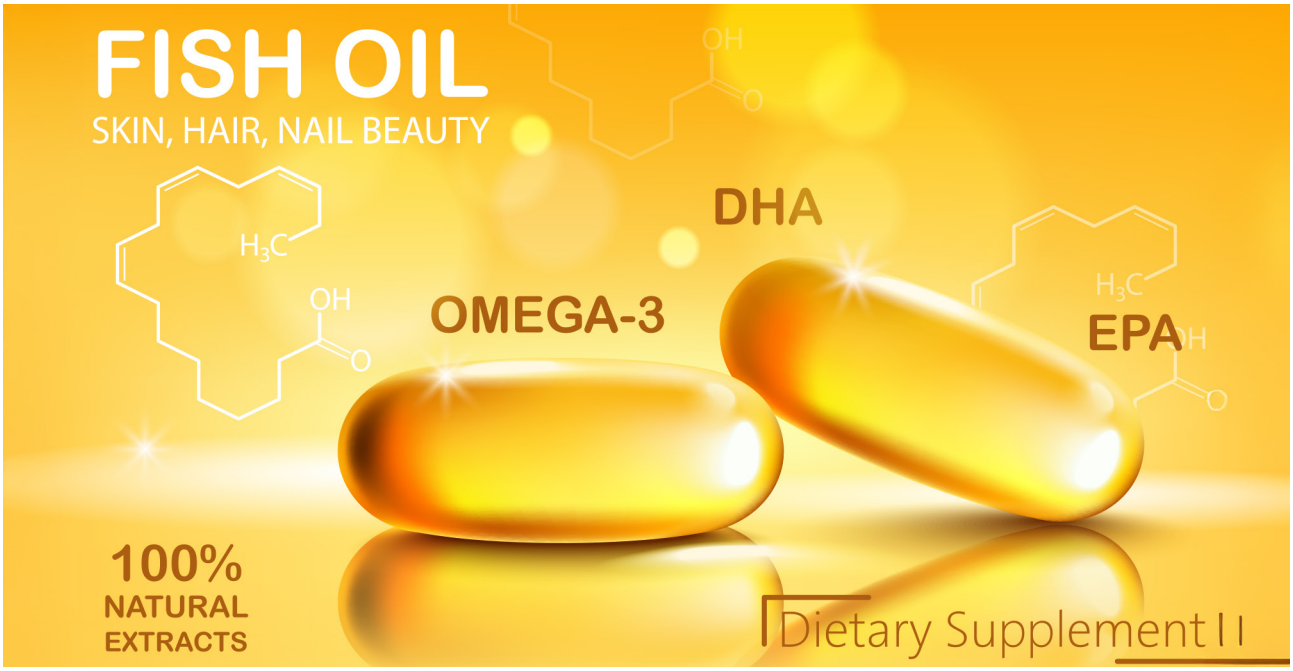
Fish oil, on the other hand, is the lipid fraction separated during fishmeal production and is rich in long-chain omega-3 fatty acids (EPA and DHA). Since these fatty acids can only be synthesized at limited levels within the animal body, they must be provided externally through feed. In addition to its high energy content, fish oil plays a vital role in animals' immune responses, cellular functions, and anti-inflammatory mechanisms. In aquaculture, it contributes to maintaining the natural fatty acid profiles of the fish.

In conclusion, fishmeal and fish oil stand out in animal nutrition not only as sources of protein and energy but as functional feed ingredients that support animal health and enhance performance and efficiency. Adding these components to rations in balanced and correct proportions according to the species and status of the animal positively affects both production performance and final product quality.

CURRENT MARKET SIZE AND GROWTH EXPECTATIONS

The global fishmeal and fish oil market is emerging as a strategic growth area, driven by aquaculture and animal nutrition applications, as well as the increase in omega-3 and nutraceutical (dietary supplement) use for human nutrition. Conversely, limited ingredient supply, environmental regulations, and regional production differences complicate the market's growth dynamics. Therefore, projections from various research organizations regarding market size and growth expectations provide important indicators that evaluate both demand expansion and supply constraints.

For instance, in a recent market report by Future Market Insights (FMI), the global fishmeal and fish oil market is estimated to have reached a size of approximately USD 8.8 billion as of 2026. The report forecasts that this market will grow at a Compound Annual Growth Rate (CAGR) of approximately 7.5%



during the 2026-2036 period, reaching approximately USD 18.2 billion by 2036. The primary driver for this growth is cited as the increasing demand for high-quality protein and functional oils, especially in aquafeed and animal nutrition applications.

Mordor Intelligence, which stated that the global fishmeal and fish oil market had a size of USD 9.5 billion in 2025, estimates that the market will reach approximately USD 10.01 billion in 2026. This report predicts that the market will grow at a CAGR of approximately 5.33% during the 2026-2031 period, reaching approximately USD 12.97 billion by 2031.

Another report on the global fishmeal and fish oil market is from Research and Markets. This report, dated January 2025, estimates the market was approximately USD 10.33 billion in 2024 and reached the USD 11 billion level in 2025 with a CAGR of 6.5%. The report further forecasts that the market will grow at a CAGR of around 7% during the 2025-2029 period, reaching approximately USD 14.44 billion by 2029.

These three market analyses, which provide different estimates, reveal that the global fishmeal and fish oil market has shown growth within a CAGR range of 5% to 8% in recent years. While the current market volume is estimated to be in the USD 8 to 11 billion band according to the reports, it is projected to reach between USD 12 and 18 billion within the next 5-10 years. These varying projections reflect changing growth expectations depending on heterogeneous demand sources, regional dynamics, and product applications (animal feeds, nutraceuticals, functional foods, etc.).

FACTORS SUPPORTING MARKET GROWTH

The global fishmeal and fish oil market possesses structural growth potential driven by rising demand, despite a supply structure dependent on limited natural resources. The use of these components as feed ingredients is increasing daily, particularly in aquaculture, pet food, and livestock sectors. However, in the fish oil segment, the livestock sector is in competition with human consumption. The widespread use of omega-3-based products in human nutrition is among the other fundamental elements shaping the long-term growth dynamics of this market. The primary factors supporting market growth are summarized below:

1. Growth of Global Aquaculture

Aquaculture constitutes the largest end-use area for fishmeal and fish oil. According to FAO data,

global aquaculture production has been increasing steadily in recent years, surpassing traditional fishing in many regions. The goals of high performance, healthy growth, and product quality in farming systems ensure that fish meal and fish oil retain their strategic role in feed formulations. This ensures that demand remains strong, particularly in salmon, trout, and marine fish farming.

2. Trend Toward High Nutrient-Density Ingredients in Animal Nutrition

Due to rising production costs and sustainability pressures, the global livestock sector is turning toward more efficient and nutrient-dense feed solutions. Fishmeal meets this need with its high digestible protein content and balanced amino acid profile, while fish oil provides long-chain Omega-3 fatty acids. The preference for these ingredients, especially in young animal nutrition, breeding stocks, and performance-oriented production systems, stands out as a significant factor supporting market demand.

3. Increasing Awareness and Demand for Omega-3 Fatty Acids

Fish oil is one of the most important natural sources of long-chain Omega-3 fatty acids such as EPA and DHA. Scientific findings regarding the positive effects of these fatty acids on animal health, the immune system, and product quality are boosting demand in both animal nutrition and human nutrition applications. This trend positions fish oil not only as an energy source but also as a functional ingredient, increasing its market value.

4. Widespread Adoption of Functional and Performance-Oriented Feed Formulations

In the animal nutrition sector, feeds are increasingly evaluated within a "functional" framework. There is growing demand for ingredients that support parameters such as growth performance, immune response, stress tolerance, and product quality. Fishmeal and fish oil are among the cornerstones of this functional approach and remain indispensable, particularly in high-value-added production systems.

5. Rising Demand for Animal Protein in Emerging Markets

Population growth, urbanization, and rising income levels in regions such as Asia-Pacific, Latin America, and Africa continue to drive the consumption of animal protein. This situation, which supports both aquaculture and intensive livestock systems, indirectly strengthens the demand for fishmeal and fish oil. Many market reports emphasize that these regions will be the main drivers of global growth.

6. More Effective Utilization of Fish By-products

Within the scope of sustainability-oriented production approaches, the more effective use of by-products from the fish processing sector in fishmeal and fish oil production is being encouraged. This trend increases resource efficiency and contributes to the long-term sustainability of the market by reducing environmental pressures. The spread of by-product-based production models also strengthens the social and environmental acceptance of the sector.

When all these factors are considered together, it is evident that growth in the global fish meal and fish oil market is based not only on volume increases but also on the rising functional and strategic value of the products. The increase in demand ensures that the market retains its medium- and long-term growth potential despite limited supply conditions.

FACTORS RESTRAINING MARKET GROWTH

While the global fishmeal and fish oil market has strong demand dynamics, it faces structural constraints because production is largely limited and dependent on natural resources. Environmental pressures on fishing activities, regulations, and increasing competition from alternative ingredients are among the key factors limiting the market's growth rate.

The main factors restraining market growth on a global scale are summarized below:

1. Limited Ingredient Supply and Natural Resource Dependency

Fishmeal and fish oil production relies heavily on marine fisheries and specific species (especially anchovy, sardine, and herring). The biological capacity of these resources is limited, and the risk of overfishing prevents expansion in production volumes. In many regions, the implementation of fishing quotas and stock conservation policies stand out as fundamental structural factors restricting supply growth.

2. Climate Change and Fluctuations in Ocean Conditions

Although they have global impacts, climate events such as El Niño and La Niña significantly affect fish stocks, particularly along the South American coast (specifically the Peru-Chile line). These climate events, defined by abnormal changes in surface temperatures in the Equatorial Pacific Ocean and accompanying atmospheric circulation differences, can lead to severe year-on-year fluctuations in fishmeal and fish oil production by limiting the distribution and catchability of fish populations. This creates uncertainty in the supply chain and negatively impacts market stability.

3. Environmental Regulations and Fisheries Policies

Strict regulations implemented in many countries in line with sustainable fishing goals indirectly limit fishmeal and fish oil production. Fishing bans, seasonal restrictions, quota systems, and certification requirements can increase costs while keeping production volumes under control. Environmental policies, particularly in the European Union and Latin America, cause structural pressures on the supply side.

4. High Volatility in Ingredients and Finished Product Prices

Fishmeal and fish oil prices are extremely sensitive to the supply-demand balance. Depending on fishing seasons, climate conditions, and regulations, serious price fluctuations can occur in short periods. This volatility reduces cost predictability for feed manufacturers and farmers, limiting demand—especially in price-sensitive markets.

5. Increasing Competition from Alternative Protein and Oil Sources

Demand for alternative ingredients such as plant proteins, insect meal, single-cell proteins, and algae-based Omega-3 sources is rising rapidly for both cost and sustainability reasons. As these alternatives become more accessible through technological progress, they may limit the share of fishmeal and fish oil in certain feed formulations. Increasing inclusion rates of fishmeal substitutes, particularly in aquafeeds, puts pressure on market growth.

6. Ingredient Competition Between Human Consumption and the Feed Industry

Fish oil is considered a high-value-added ingredient for Omega-3 and nutraceutical (dietary supplement) products for human nutrition. This leads to a competition for limited fish oil supply between the feed industry and human nutrition. Supply shifting toward high-value-added segments can negatively affect accessibility and price stability in the animal nutrition sector.

7. Social and Environmental Sustainability Pressures

Fishmeal and fish oil production is closely monitored by NGOs and the public due to environmental impacts and pressures on marine ecosystems. Potential negative perceptions regarding sustainability are influencing the procurement policies of large food and feed companies, increasing requirements for certification, traceability, and reporting. This represents an additional cost and operational burden for producers.

Despite strong demand, the global fish meal and fish oil market faces structural constraints due to natural limitations on the supply side, environmental pressures, and the rise of alternative solutions. These factors are emerging as elements that limit the growth rate and cause fluctuations rather than completely halting the market's growth. The market's development in the coming period will depend on sustainable production models, more effective use of by-products, and how competition with alternative sources will be managed.

GLOBAL MARKET STATUS BY SPECIES

The global fishmeal and fish oil market is among the primary sources of protein and fat used in animal feed. The market structure varies by animal species and is shaped by distinct usage profiles in aquaculture, poultry, swine, and other animal production systems. The current status and demand dynamics of the fishmeal and fish oil market by main animal species are discussed below:

Aquaculture

Aquaculture represents the largest global use of fishmeal and fish oil. Current sector data shows that the majority of fishmeal consumption occurs within the aquaculture sector. In this segment—which covers shrimp, salmon, trout, marine fish, and various freshwater species—demand is particularly concentrated in the Asia-Pacific region.

Fishmeal and fish oil are preferred in aquafeeds due to their high protein content, balanced amino acid profile, and the advantages offered by Omega-3 fatty acids (EPA and DHA). These properties support growth performance, feed conversion ratios, and overall animal health. Consequently, the aquaculture segment remains the primary source of demand for the fishmeal and fish oil market.

Poultry

While the use of fishmeal and fish oil in poultry feed has a more limited share compared to aquaculture, it maintains its importance in specific applications. Fishmeal is utilized as a high-quality protein source, especially in starter periods, breeding flocks, and performance-oriented production systems. Fish oil is used in formulations aimed at producing Omega-3 enriched meat and eggs in poultry. However, cost pressures and the proliferation of plant-based alternatives keep usage rates controlled in this segment. Despite this, the poultry sector continues to be a stable demand area for fish meal and fish oil.

Pig

Fishmeal usage in pig farming has declined to more limited levels compared to previous years. The widespread use of vegetable protein sources and


Source: Created by AI

synthetic amino acids has reduced the share of fishmeal in this segment. Nevertheless, fishmeal is still preferred—particularly during the weaning period and in young animal nutrition—due to its high digestibility and amino acid balance. The use of fish oil remains more limited in pig nutrition. Overall, the swine segment is positioned as a shrinking but not entirely disappearing demand area.

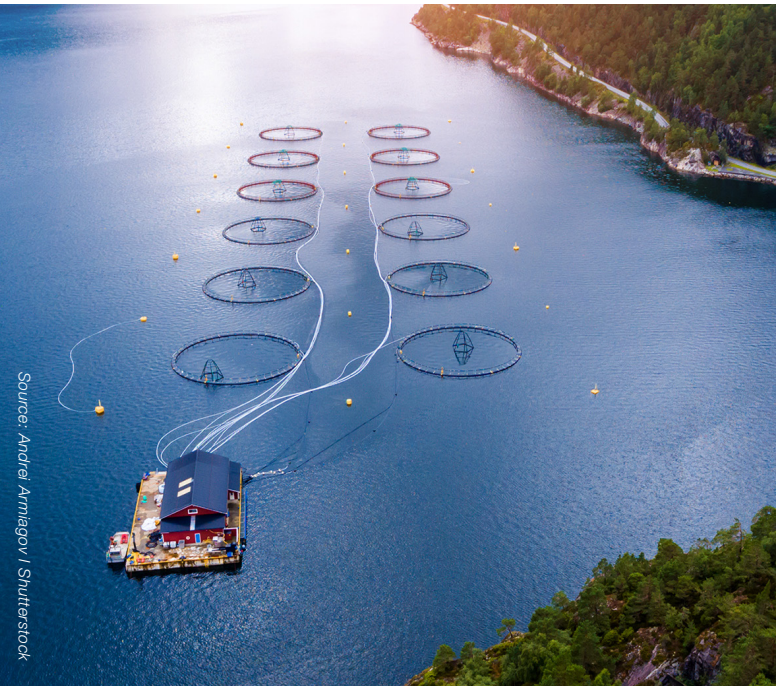
Ruminants

The use of fishmeal and fish oil in the nutrition of ruminant animals remains quite limited globally. Rations for these animals primarily rely on roughage and vegetable protein sources. However, in certain production models—especially for high-yielding dairy cows and specialized feeding programs—fish oil may be used for its fatty acid profile and metabolic support. Fishmeal is utilized in some special cases as a bypass protein source. Nevertheless, this segment remains a niche area within the total market.

Pets

Pet food stands out as a segment where fishmeal and fish oil are increasingly gaining value. Particularly in premium cat and dog foods, fishmeal is used as a high-quality and digestible protein source. Fish oil is preferred for its Omega-3 content, which supports skin and coat health, the immune system, and joint functions.

In addition, in specialized feed applications, fish meal and fish oil can also be evaluated for function-


Source: Andrei Armiagov / Shutterstock

al objectives such as coloration, stress tolerance, and product quality for specific species.

In summary, when viewed by animal species, the demand structure of the global fish meal and fish oil market is largely shaped by aquaculture. Poultry and swine segments offer more limited but stable demand, while ruminants and pet foods stand out as more niche applications.

REGIONAL MARKET STATUS

The global fishmeal and fish oil market is shaped by different dynamics depending on regional production structures, the development level of aquaculture, the scale of the feed sector, and regulatory frameworks. The Americas, Asia-Pacific, Europe, the Middle East, and Africa exhibit distinct characteristics on both the supply and demand sides. The regional outlook for the market is detailed below:

Asia-Pacific

The Asia-Pacific region stands out as the largest consumption center of the global fishmeal and fish oil market. The rapidly growing aquaculture sector in countries such as China, Vietnam, Indonesia, Thailand, and India forms the primary driver of regional demand. Fish meal and fish oil are used as critical feed components in shrimp and fish farming, supporting performance and survival rates. Increasing population, protein demand, and export-oriented production models make Asia-Pacific the engine of market growth. The region is also the main destination for fish meal and fish oil imports from Latin America and Africa.

The Americas

The American continent plays a strategic role in the global supply of fishmeal and fish oil, particularly thanks to South American countries. Peru and Chile meet a significant portion of global fishmeal and fish oil production and sit at the center of global exports. In North America, the market is shaped more by aquaculture, pet foods, and specialized feeding practices, and the region is notable for its demand rather than its supply. Overall, the Americas region continues to be one of the main regions determining the market's supply security with its strong ingredient infrastructure and advanced processing capacity.

Europe

Europe stands out as a mature region with high standards in the fishmeal and fish oil market. Countries such as Norway, Denmark, and Iceland play a significant role on both the production and consumption sides. In particular, the Norway-based salmon farming sector emerges as one of the primary sources of fish oil demand. Furthermore, sustainability, traceability, and environmental impact criteria are of paramount importance in Europe. This situation brings certified and responsible sourcing models to the forefront in the use of fishmeal and fish oil. The proliferation of plant-based and microbial alternatives causes growth in the European market to remain more limited and controlled.

Middle East

The Middle East region exhibits a structure that is largely dependent on imports for fishmeal and fish oil. Despite the limited natural resources in the region, increasing aquaculture investments—especially in the Gulf countries—support demand. In line with food security goals and the objective of increasing local protein production, Middle Eastern countries are prioritizing aquaculture projects. This leads to a gradual increase in the demand for fish-

meal and fish oil. Although the regional market is currently small in scale, it carries growth potential in the medium and long term.

Africa

Africa draws attention as both a producer and an emerging consumer region in the fishmeal and fish oil market. West African countries contribute to the global supply chain, particularly through production based on pelagic fish species. On the other hand, the expansion of aquaculture in Africa and the development of the local feed sector are also increasing domestic demand. However, infrastructure deficiencies, financing issues, and regulatory uncertainties are among the factors limiting market growth. Despite this, Africa is seen as a strategic region for the global fishmeal and fish oil market in the long run.

When evaluated on a regional basis, the global fishmeal and fish oil market has a demand structure centered in the Asia-Pacific, while the Americas stand out with strong supply capacity. Europe offers a mature market outlook shaped by regulations and a focus on sustainability. The Middle East and Africa, while currently holding limited shares, are among the regions with future growth potential due to increasing aquaculture investments.

MARKET COMPETITION AND SUPPLIERS

The global fishmeal and fish oil market exhibits a concentrated and supply-oriented competitive environment due to a production structure based on limited natural resources. Large-scale producers located in countries with strong fishing and processing infrastructure, such as Peru, Chile, Norway, Denmark, and Iceland, play a decisive role in the market. These companies achieve a strong market position through high-volume production capacities, integrated supply chains, and international sales networks.

Competition is shaped not only by price but also by security of access to ingredients, sustainability certifications (IFFO RS, MSC), traceability, and quality consistency. Especially in the aquafeed and Omega-3 focused human nutrition segments, functional and certified solutions stand out beyond standard products. In contrast, smaller regional suppliers operating in some emerging regions attempt to find a place in the market through cost advantages and flexible delivery structures. However, lack of quality standardization and supply continuity limits the competitive power of these players.

In the coming period, competition is expected to intensify further through by-product-based production models, the use of alternative ingredients, low-carbon-footprint supply chains, and long-term feed producer-supplier agreements. In this framework, fishmeal and fish oil are positioned not merely as feed inputs, but as strategic, regulation-sensitive global commodities whose sustainability must be proven.

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AFIA honors Jerry May with 2026 Friend of Pet Food Award

Jerry May, vice president of government and trade affairs at Freshpet, received the 2026 Friend of Pet Food Award from the American Feed Industry Association (AFIA). A leader in pet food nutrition, innovation and regulatory affairs, May received the award during the AFIA Pet Food Conference, held in conjunction with the International Production and Processing Expo.

"Jerry's influence on the pet food industry is both profound and enduring," said Constance Cullman, AFIA's President and CEO. "For more than three decades, he has helped shape science-based regulations, advance innovations that improve pet health and mentor countless professionals who now lead our industry. His commitment to collaboration, sound science and animal wellbeing exemplifies the spirit of this award."

May has spent more than 35 years shaping the global pet food industry through leadership roles with multinational companies focused on nutrition, research and development and regulatory affairs. Throughout his career, May has been instrumental in gaining approval for science-based health claims

and defending innovations supporting skin and coat health, mobility, cognitive development and healthy aging of millions of dogs and cats.

In recent years, May's regulatory leadership expanded into the growing "fresh" pet food segment, where he helped overcome domestic and international regulatory and export barriers. He also collaborated with industry partners, trade associations and government agencies to strengthen global regulatory alignment and expand U.S. pet food exports.

Read more>>

Alfa Laval and GA Petfoods strengthen partnership in premium kibble production

One of the global leaders in heat transfer, separation, and fluid handling solutions, Alfa Laval partnered with GA Petfoods to support the production of premium pet food. Based in Lancashire, UK, the family-owned pet food manufacturer supplies private-label pet food to hundreds of partners across the world, cultivating its recipes to offer industry-leading levels of fresh meat and fish content within its products.

Originally partnering with Alfa Laval over a decade ago, the ongoing collaboration sees GA Petfoods harness Alfa Laval's separation and heat transfer technologies to support efficient processing and higher fresh meat inclusion.

"What we're doing at GA Petfoods is driven by increasingly conscious pet owners across the world. Many are no longer content with an off-the-shelf, dry-rendered kibble that's lacking in flavour and nutritional value. Pet owners are now demanding the same standards for their companions' food as they are for their own, which means higher fresh meat inclusion," said Scott Morley, Head of Design at GA

Petfoods. "This is something that we have been pushing the boundaries of for many years, and Alfa Laval's kit has been central to taking this as far as we possibly can to extract every drop of value from our feedstocks."

Read more>>

Bioflytech leads AI-driven black soldier fly project

The biotechnology company Bioflytech, through its subsidiary Alfaprogal (Alternative Fats and Proteins of Galicia), is spearheading a European R&D&I project to develop an intelligent precision system that optimizes the industrial breeding of black soldier fly larvae (Hermetia illucens). This will enable Galicia to develop a new model of strategic livestock farming, an alternative to the traditional model that is more sustainable and technological, and which also promotes the circular economy.

"It will place the community in a privileged position to lead European production of a new generation of high-quality proteins and fats, as well as biofertilizers derived from black soldier flies, with applications in animal nutrition —aquaculture, pet food, poultry, and pork— as well as cosmetics, and pharmaceuticals, with great potential for business, growth, and the creation of jobs and wealth," explains Jesús Rodríguez, CEO of Bioflytech.

The project, a public-private partnership called IAPSI (Artificial Intelligence and Automation Applied to Sustainable High Added-Value Products from Insects), seeks to

Photo: Bioflytech

improve the efficiency, sustainability, and traceability of the breeding process for this species through the implementation of an artificial intelligence algorithm that centrally controls and modulates the feeding and environmental management of the larvae.

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MIAVIT contributes €5,000 to animal health and development work

The internationally operating family business MIAVIT handed over a donation cheque for €5,000 to the non-profit organisation Vétérinaires Sans Frontières Germany at its Berlin office. The donation complements the support for the Christmas campaign #WeihnachtenOhneHunger (Christmas Without Hunger), in which MIAVIT doubled donations up to €30,000 and, in recognition of its great success, contributed a further €5,000 at short notice. The donation represents a growing partnership and underlines the joint commitment to animal health, sustainable agriculture and global development work.

Beyond developing innovative animal health products, MIAVIT has been actively involved with the non-profit organisation Vétérinaires Sans Frontières Germany since 2024. The organisation is committed to improving animal health in large parts of East Africa, thereby making an important contribution to stabilising local livelihoods. MIAVIT particularly values the educational work and training provided on site – help for self-help.

'As a family business with over 60 years of history

in animal nutrition, we see it as our responsibility to make a social contribution that goes beyond economic activity,' says Dr Lea Middendorf, Head of Science to Business at MIAVIT. 'The partnership with Vétérinaires Sans Frontières Germany enables us to contribute our technical expertise while gaining new perspectives beyond our European point of view.' This engagement is particularly valuable for MIAVIT, as the company has been active in East Africa for years with a location in Kenya and can specifically strengthen its close ties to the region through its cooperation with Vétérinaires Sans Frontières Germany.

Read more>>

Benchmark Genetics and Nofima partner for sea lice resistance

Benchmark Genetics launched a new research and innovation project, LuseLess, in collaboration with the Norwegian research institute Nofima. The project addresses a major biological challenge in Atlantic salmon farming: sea lice.

Funded by NOK 10 million from the Research Council of Norway through an Innovation Project in Industry (IPN), LuseLess will run from January 2026 to December 2027. The project aims to develop new, scalable genetic tools that enable Atlantic salmon to better resist sea lice through selective breeding. Sea lice remain a major constraint on fish welfare, production efficiency and sustainability in salmon aquaculture. While the industry has developed a wide range of operational and technological measures to manage lice levels, long-term solutions may increasingly rely on fish that are more resilient.

LuseLess builds on an evolving approach that places greater emphasis breeding salmon with improved biological resistance. The project builds on insights from previous research from the project CrispResist, showing that Pacific salmon species possess cellular and genetic mechanisms that either reduce lice attachment or eliminate lice early after infection. By applying this knowledge to Atlantic salmon, the project seeks to identify new resistance phenotypes that can be incorporated into commercial breeding programmes.


Photo: Benchmark Genetics and Nofima

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Ecolex highlights partnership-based approach at South Asia workshop

Ecolex Animal Nutrition's "Partnering for Progress: South Asia" workshop, held in Bangkok on 19–20 January 2025, brought together distribution partners from across the region, along with consultants and collaborators active in animal agriculture. The event focused on partnership models, technical exchange, and approaches to sustainable innovation in the sector.

Referencing the importance of collaboration in addressing complex challenges, Ecolex outlined its intention to expand its role beyond the supply of feed additives toward a broader partnership-based approach. The company highlighted cross-sector cooperation as a key element in developing integrated solutions for animal agriculture.

"Ecolex recognizes it cannot address every animal health component of One Health alone. By teaming with specialized leaders in the critical One Health areas of farm management and biosecurity and hygiene, we seek to create integrated, real-world solutions that enhance farm efficiency, reduce antimicrobial resistance (AMR), and promote sustainable practices. We are proud to foster these vital partnerships that advance the livestock sector," said Edward Manchester, Global Commercial Director at Ecolex.


Photo: Ecolex Animal Nutrition

"Ecolex looks forward to formalizing these strategic partnerships in the near future that will offer not just products, but solutions, including training programs and testing services," noted Manchester. "We aim to deliver comprehensive solutions, creating real long-term value for our distribution partners and their customers across South Asia and beyond."

Read more>>

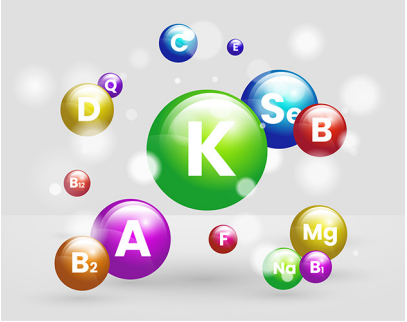
Vitamin and amino acid supply disruptions under spotlight in new IFEEDER reports

The Institute for Feed Education and Research (IFEEDER) announced the release of four species reports, detailing the nutrition and production impacts of vitamin and amino acid supply chain disruptions on four food animals (broiler chickens, laying hens, turkeys and swine). These reports stem from the larger report, "The Strategic Assessment on the Impact of Vitamin and Amino Acid Supply Chain Disruptions on U.S. Food Security," released in November 2025.

Each mini report, released during the International Production & Processing Expo (IPPE), distills how disruptions in access to essential feed ingredients could affect that species' health and productivity, producer viability and the broader U.S. food supply.

"These species-specific analyses help translate the broader findings of the strategic assessment into real-world implications for individual livestock sectors," said Lara Moody, IFEEDER's Executive Director. "Understanding the unique vulnerabilities and consequences for each species is critical to strengthening supply chain resilience and protecting U.S. food security."

While the original strategic assessment thoroughly outlines the



use case for eight vitamins and amino acids as well as the consequences of disruptions in the supply of these nutrients, the shorter reports enable companies, researchers, feed manufacturers and policymakers to hone the animals most relevant to their decision-making.

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Animal welfare rules drive cage-free transition in Indonesia

The Government of Indonesia issued Minister of Agriculture Regulation (Permentan) No. 32 of 2025 on the Implementation of Animal Welfare. This regulation serves as a key legal foundation to ensure that livestock management practices are aligned with animal welfare principles. In addition, it supports poultry production systems that meet animal welfare standards, including cage-free egg production systems.

The Director of Veterinary Public Health at the Indonesian Ministry of Agriculture, I Ketut Wiratha, emphasized that rising food demand requires livestock production systems that prioritize not only efficiency but also ethical principles. According to him, animal welfare is closely linked to livestock productivity, food safety, and public trust. He stressed that animal welfare is not merely a moral issue but an essential element in safeguarding food quality and ensuring the sustainability of the livestock sector. He also added that animal welfare forms part of Indonesia's global commitments under the One Health framework and

the Sustainable Development Goals (SDGs).

Wiratha further noted that public awareness regarding the ethical treatment of animals continues to grow, with consumers becoming increasingly critical of how animals are raised and slaughtered. Therefore, continuous education and sustained oversight along the entire food production chain are crucial to encouraging changes in attitudes and behaviors toward practices that place a greater emphasis on animal welfare, he explained during an online event on December 16, 2025.

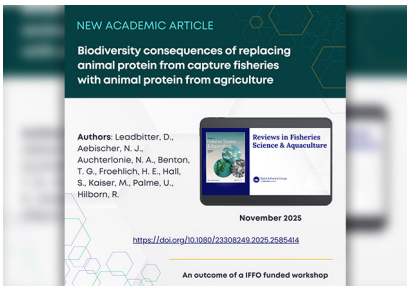
Read more>>

New research backs seafood's role in food security and biodiversity

IFFO, The Marine Ingredients Organisation, announced the publication of a new open-access paper led by Duncan Leadbitter (Australian National Centre for Ocean Resources and Security, University of Wollongong) in Reviews in Fisheries Science & Aquaculture. The paper is the independent outcome of a workshop funded by IFFO, bringing together leading scientists to explore the impacts of global food production.

"This peer-reviewed article underscores the essential role of responsibly managed fisheries in sustainable food systems and biodiversity protection. Despite their impacts, agricultural systems remain vital for feeding a growing population. However, more tools are needed to enable objective, localized comparisons between the biodiversity impacts of land-based animal protein production and marine fishing. With this in mind, IFFO has started a pilot project to transition current discussions to a biodiversity framework outlining indicators to measure impacts and guide decision-making," said Dr. Brett Glencross, IFFO's Technical Director.

Duncan Leadbitter, lead author of the paper, stated: "There are choices to be made as to how more food will be produced in the coming decades and what unintended land use and biodiversity consequences will be produced from these decisions. Replacing all animal protein from marine fisheries could require almost an additional



5 million km2 of land – larger than the extent of intact rain forest in Brazil. Replacing all fish products in aquaculture diets would result in the need for over 47 000 km2 of new land converted to agricultural production. Well-managed fisheries do not rely on fundamental changes to ecosystems in the way that agriculture does and there is lots of progress in improving fisheries management underway."

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AHNTI EU unveils 2026 Innovation Showcase Finalists

Innovation is reshaping the future of animal health, accelerating earlier diagnosis, improving welfare outcomes, advancing sustainability in food systems, and enabling new therapeutic and preventive solutions at scale. As global challenges continue to grow across companion animal care and livestock production alike, the need for breakthrough thinking and investable innovation has never been greater.

That is why AHNTI EU (Animal Health, Nutrition & Technology Innovation) announced the 2026 Innovation Showcase Finalists — a curated group of early-stage companies identified as the "ones to watch" across Nutrition, Diagnostics, Biopharma, and Technology. These finalists will take to the stage 2 March 2026 in London at Convene St Paul's, pitching live during AHNTI EU in front of an audience of 850+ industry leaders, investors, pharma, biotech, CDMOs, and strategic partners.

Selected by AHNTI's prestigious selection committee of investors and industry leaders, the finalists represent some of the most exciting emerging solutions in the market, each demonstrating strong potential to transform the animal health ecosystem and create meaningful opportunities for partnership and investment.

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AgriLivestock & Feed Taiwan 2026 to connect Asia's livestock sector

AgriLivestock & Feed Taiwan, part of Taiwan Smart Agriweek, one of Asia's dedicated events for livestock farming, returns to TaiNEX 1, Taipei, from 8-10 September 2026. The event brings together innovators and solution providers — from smart livestock systems and alternative feed and additives to livestock welfare enhancement for the poultry, dairy, and swine industries — connecting them with nutritionists, livestock farmers, feed milling companies, livestock feed manufacturers, and industry associations.

Building on recent momentum — with over 770 booths, 21,000 visitors from 69 countries, generating USD 88 million in procurement — the show continues to attract both local and international audiences, creating a platform to connect, engage and network across Asia's livestock and feed sector.

AgriLivestock & Feed Taiwan is held alongside the Animal Precision Nutrition International Forum Taiwan (organized by Chinese Society of Animal Science, the World Poultry Science Association Taiwan Branch), bringing


Photo: AgriLivestock & Feed Taiwan

together 18 industry speakers to share practical insights across farming practices, animal health, and nutrition management, while providing a networking platform for over 320 industry professionals to connect and exchange expertise.

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Registration opens for 31st FEFAC Congress in Bucharest

The 31st FEFAC Congress will take place on 20 May 2026 at the Hotel Intercontinental Athénée Palace in Bucharest, Romania, as part of a three-day programme organised in collaboration with ANFNC from 19 to 21 May. FEFAC, the European Feed Manufacturers' Federation, has announced that registrations for the congress are now open.

• On 19 May, the programme begins with the 13th ANFNC Annual Conference "FEED & FORESIGHT 2026 – Vision and Innovation Driving the Future of the Sustainable Feed and Meat Industry in Europe", bringing together Romanian and European feed sector representatives. Congress registration includes access to the ANFNC Conference, as well as the Welcome Reception and Festive Dinner in the evening, offering informal networking opportunities with policymakers, academic experts, and representatives from feed and livestock companies across Europe.

• On 20 May, the 31st FEFAC Congress will address the central theme: "European livestock sector – QUO VADIS? Outlook to EU livestock and feed production in the Circular Bioeconomy". Participants will hear from EU policymakers, as well as decision makers from value chain partners and international experts on topics such as key market trends and trade developments, innovation in animal nutrition, and policy incentives for circular feeding practices. The conference takes place at a pivotal time for the European feed and livestock sectors, as the EU is expected to publish the first report on the long-term strategy of the livestock sector, calling for a more competitive, sustainable, and resilient food system. The keynote address for the first expert panel on Agricultural Markets and Trade will be delivered by Pierre Bascou, Deputy Director General of DG AGRI at the European Commission. Among the high-level keynote speakers

and panellists, Elli Tsiforou, Secretary General, COPA COGECA, will join the first expert panel, and Koen van Dyck, Head of Unit, DG SANTE, will take part in the second panel on "How can feed additives support the transition to more sustainable livestock and aquaculture systems?".

• On 21 May, delegates can choose between a field visit to Constanța Port, exploring logistics, grain trade flows, and innovations in quality assurance practices, kindly hosted by Cargill; or a half-day visit offered by Bunge to an oilseed crushing facility, providing insights into industrial processes and operational best practices in the feed supply chain.

Read more>>

New teaching farm advances research-driven livestock education

PT Japfa Comfeed Indonesia Tbk (JAPFA), in collaboration with Universitas Hasanuddin (UNHAS), officially inaugurated a Closed House Teaching Farm facility located in Pattallassang District, Gowa Regency, South Sulawesi. This educational and research facility is the result of a strategic partnership between JAPFA and UNHAS, with a total investment of IDR 3 billion. Built on a 1,500 m² site with a capacity of more than 20,000 chickens, the facility is designed as a center for practical learning in modern livestock farming.

This collaboration originated from the signing of a Memorandum of Understanding (MoU) between JAPFA and UNHAS in mid-2024, as part of a synergy between industry and academia to create a more efficient and sustainable livestock farming ecosystem.

Rachmat Indrajaya, Director of JAPFA, said, "This teaching farm is part of our efforts to devel-

op modern livestock technologies based on research and education. We hope this facility will have a positive impact on improving the quality of education in Indonesia, particularly for UNHAS students, enabling them to become globally competitive future leaders."

The teaching farm facility is designed to support students' practical learning, covering livestock management, biosecurity implementation, animal health, and livestock business management. The application of a closed house system enables optimal environmental control through automated ventilation and temperature regulation, thereby improving feed efficiency, reducing livestock mortality rates, and minimizing production waste.

The Rector of UNHAS, Prof. Dr. Ir. Jamaluddin Jompa, M.Sc., emphasized that this collaboration marks an important milestone in strengthening the role of higher education institutions and the

Photo: PT Japfa Comfeed Indonesia Tbk (JAPFA)

private sector in preparing high-quality human resources. "This initiative not only supports the Tridharma of Higher Education, but also represents a shared commitment to producing graduates who are ready to face the challenges of the future livestock industry, while delivering tangible benefits to society," he said.

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Three Dog Brands expands its footprint in US with Kansas City facility

Three Dog Brands, makers of Three Dog Bakery® treats, announced a major expansion of its U.S. manufacturing and operations footprint with a new 87,000–square-foot facility in the Kansas City metro area. The multi-functional site aims to support increased production, packing, and distribution capabilities, while also serving as a central hub for the company's growing corporate leadership, operations, and support teams.

The new facility's expanded space and production capacity are intended to support growing national demand for premium dog treats. According to the company, its Three Dog Bakery treats continue to outpace category growth through innovation and an expanded assortment, with its momentum greatly strengthened by its entry into the meaty and protein segment through the recent launch of Three Dog Bakery's award-winning Bark'n Crunch!™ Chicken Chips.

"This new facility marks a pivotal investment in our long-term growth strategy," said Kristi Ross, Chief Executive Officer of Three Dog Brands. "Expanding our U.S. manufacturing footprint will increase operational

efficiency, strengthen our supply chain, and enhance our ability to serve our retail partners. The Kansas City region has been an exceptional home to grow our business, and this next step enables us to support innovation, jobs, and production at a much larger scale."

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Easy Bio expands North American footprint

South Korea's foremost nutrition company, Easy Bio took over U.S. feed additive company BioMatrix, reinforcing its push to expand in the North American market. The firm noted that the transaction was completed through its affiliate Pathway Intermediates USA, which acquired a 100 percent stake in BioMatrix located in Princeton, Minnesota.

Founded in 1997, BioMatrix has worked on functional feed additives designed to improve the efficiency of feed ingredients using polysaccharide-based coating technology. According to the statement, BioMatrix has also built strength in the companion animal additives market, leveraging accumulated distribution experience and local networks.

Easy Bio states that the acquisition aligns with its long-standing vision of promoting sustainable livestock production. Since its establishment in 1988, the Seoul-based company has focused on technological innovation in areas such as antibiotic alternatives, cost reduction, and gut health solutions for livestock.

"Lipidol Protect, launched in collaboration with BioMatrix in 2023, has drawn strong interest from local farms and business partners," said Eric (INHYUK) Kwon, Pathway USA CEO. "The acquisition of BioMatrix secures core coating technology that will serve as a foundation for broader

expansion not only in the U.S. but also in global markets."

Stevenson (IL HWAN) Hwang, EASY BIO CEO, also expressed high hopes for the acquisition. "We have steadily expanded our global business base through Pathway feed additive subsidiaries in six countries, including the United States, as well as Devenish North America," he said.

Read more>>

UC Davis receives largest-ever $120M gift to veterinary medicine

The University of California, Davis, announced the largest gift ever made to veterinary medicine worldwide: $120 million from philanthropists Joan and Sanford I. Weill through the Weill Family Foundation to support its top-ranked veterinary school.

In recognition of this commitment, the university has renamed the school the University of California, Davis, Joan and Sanford I. Weill School of Veterinary Medicine — or simply the UC Davis Weill School of Veterinary Medicine.

"UC Davis is home to one of the world's most outstanding veterinary schools and many of the brightest minds in animal and human medicine," said Sanford "Sandy" I. Weill, a long-serving member of the UC Davis Chancellor's Board of Advisors. "We are proud to support an institution where groundbreaking research and compassionate care

are prioritized together, and where discovery benefits both animal and human health."

The gift is one of the largest in university history. It will strengthen UC Davis' leadership in comparative medicine — the study of health and disease across species — and advance translational research initiatives for diseases such as cancer, neurological disorders and cardiovascular conditions that affect both animals and humans.

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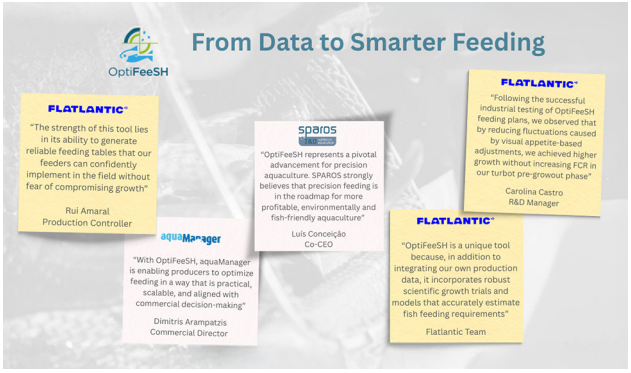
OptiFeeSH brings data-driven feeding to aquaculture

SPAROS and aquaManager announced the commercial launch of OptiFeeSH, a data-driven feeding solution designed to support optimized feeding strategies and growth planning in aquaculture operations, validated through commercial pilots in land-based and offshore systems.

Following a multi-year development and pilot phase, OptiFeeSH has demonstrated quantifiable benefits in commercial pilots conducted across land-based and offshore farming operations. According to a statement, in pre-growing phases, OptiFeeSH feeding plans achieved up to a 50% increase in biomass growth compared to baseline growth without the tool, while also delivering time savings for technical teams and improving growth predictability.

By enabling producers to move beyond trial-and-error feeding approaches, OptiFeeSH supports more balanced decisions across growth performance, feed efficiency, and profitability. The solution is jointly developed and co-owned by SPAROS and aquaManager and is now commercially available to farms of all sizes through a consulting-led deployment model, with the option for independent licensed use once internal capabilities are established.



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Novus data reveals trypsin inhibitor risks in global soybean meal

Soybean meal is a mainstay of poultry and swine diets worldwide, but variability in soybean quality creates hidden risks, both nutritionally for the animals and economically for producers. A new white paper from NOVUS draws on more than a decade's worth of data to explain why trypsin inhibitor (TI) in soybean meal is a persistent and often underestimated challenge in modern feed formulation.

"Soybean meal is the greatest protein contributor in most diets, yet its nutritional value is often assumed rather than measured," says Rasha Qudsieh, NOVUS Global Enzymes and Microbials Senior Manager. "Our data from more than 1,900 soybean meal samples globally shows that trypsin inhibitor levels are highly variable across regions, years, and processing methods, and even small increases in TI can negatively impact amino acid digestibility, feed efficiency, and animal performance."

Trypsin inhibitors are part of a plant's natural defenses that also interfere with protein digestion. While commonly associated with under-processed soy, NOVUS research found that TI can persist even in commercially processed soybean meal with measurable effects on gut health and growth in both poultry and swine.

"We've analyzed hundreds of soybean meal samples globally, creating an extensive database on trypsin inhibitors. We've also invested years developing practical methods to measure TI accurately," says Paula Fisher, NOVUS Analytical Services Senior Manager.

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Gambol Pet and Aker QRILL join forces in pet nutrition

Gambol Pet Food and Aker QRILL Company signed a global strategic cooperation agreement at the Gambol Pet Shanghai R&D Center. The partnership elevates their relationship from long-term supply chain cooperation to a strategic alliance, with a focus on pet nutrition innovation and sustainability.

Gambol Pet President Stephanie Du remarked that the company's rapid growth with brands like Myfoodie and Fregate is due to building products to world-class standards from day one. She added that partnering with Aker QRILL Company, known for its krill nutrition expertise and sustainable harvesting practices, was a natural alignment.

According to the statement, the strategic partnership will focus on three key areas:

• Joint R&D – Combining Aker QRILL Company's marine nutrition research and Gambol Pet's data-driven insights on pet behavior to develop exclusive nutrition solutions.

• ESG Collaboration – Promoting sustainability in animal welfare and marine protection across Gambol's supply chain.

• Brand Co-creation – Sharing a "science + sustainability" message with global consumers via joint initiatives.

During the signing ceremony, Bjørn Wallentin, Senior Vice President of Global Sales at Aker QRILL

Photo: Aker QRILL Company

Company, presented Gambol Pet with a symbolic invitation to participate in a future Antarctic initiative focused on penguin conservation. Stephanie Du accepted, stating: "Protecting the ocean is the most meaningful long-term commitment we can make—for pets and future generations. Gambol Pet is proud to stand alongside Aker QRILL Company as practitioners and advocates of marine ecological protection."

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Corel–Aqua Consortium alliance advances aquaculture health solutions

Corel Lifecare, a Mumbai-based aquaculture innovation company, announced a long-term Research and Development agreement with The Aqua Consortium, a premier strategic and technical organization serving the aquaculture industry and based in Switzerland. This strategic alliance aims to co-develop and deploy novel, farmer-first solutions addressing some of the most persistent biological challenges in the global aquaculture sector.

The partnership brings together Corel Lifecare's expertise in bio-formulations and rapid product development with The Aqua Consortium's deep technical capabilities and strategic industry oversight. The collaboration will focus heavily on creating safe, sustainable, and effective treatments for parasitic infestations and critical shrimp culture bottlenecks.

The partners stated that a primary focus of this R&D track is the development of next-generation management strategies for Copepod infestations,


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which currently cause significant economic losses globally due to mortality, reduced growth rates, and secondary infections.

The joint initiative will target two specific parasitic threats:

• Argulus (Fish Lice) in Indian Major Carps: Addressing the widespread infestation in freshwater farms—particularly affecting Rohu and Catla—to prevent ulcerative damage and improve marketability for farmers.

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Visitor registration for VICTAM International 2026 opens

The premier international event for animal feed processing, grain handling, and flour milling returns to Utrecht, the Netherlands, from June 2 – 4, 2026. VICTAM International 2026 will once again take place alongside GRAPAS Europe 2026 and VIV Europe 2026, bringing together the complete technology chain for feed production, milling and grain-based food processing. Together, these co-located exhibitions offer visitors access to the full spectrum of innovations across feed processing, nutrition, grain storage and handling, rice and flour milling, and industrial baking technologies, all under one roof.

Building on more than 60 years of industry expertise, VICTAM International 2026 brings together technology suppliers, producers, researchers, and decision-makers from around the world. The upcoming edition combines established solutions on the exhibition floor with forward-looking conferences and industry-driven knowledge exchange, reflecting both the heritage and the future direction of the feed industry.

As the dedicated event for the grain, milling, and flour processing industries, GRAPAS Europe 2026 will showcase the latest developments in milling technology, rice processing, grain handling, storage solutions, packaging and automation.

"VICTAM International 2026 builds on six decades of experience in feed technology while looking firmly ahead. Our goal is to connect proven processing solutions with future-focused innovation, knowledge, and collaboration," says Sebas van den Ende, General Manager of VICTAM.

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