Feed Additive

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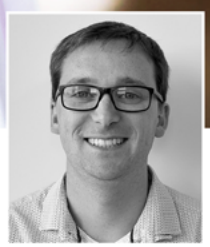
Issue Focus:
Antibiotic-Free Production & Immunity Development

Market Report:
Global Feed Amino Acids Market



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EDITOR

Derya YILDIZ

A new year and sustainable future - one step further...

A new year means new beginnings and new opportunities. For the animal nutrition industry, this may mean reviewing current practices and adopting more sustainable, ethical and efficient methods. The challenges that the animal nutrition sector has had to overcome in recent years have increased considerably. But the industry is ready to meet these challenges with an extremely strong capacity for adaptation and innovation. So, as we enter the new year, it makes perfect sense for the industry to use these past experiences and challenges as a stepping stone to build a better future. Because transformation is inevitable for the industry. It is obvious that at the center of this transformation there will be more sustainable feeding methods and lower environmental impact for animal health and welfare. Antibiotic reduction is also an important part of the sustainability strategy and this transformation process.

The use of antibiotics, which are used to protect animal health and prevent diseases, as growth promoters or excessive use in treatment and care, causes antibiotic resistance to increase day by day. This is an extremely serious potential threat to human health. Therefore, keeping the use of antibiotics in the livestock sector at the lowest possible level is vital to prevent the spread of this resistance.

Of course, there are ways to reduce the use of antibiotics in the livestock sector. For example, one of the most important is to prevent diseases before they start. Strengthening the immunity of animals and providing them with a healthy environment can prevent the start and spread of diseases and reduce the need for antibiotics. In case of illness, alternative treatments are offered as an important solution. For this purpose, many alternatives such as probiotics, prebiotics, phytogenic feed additives are offered today.

If you are looking for antibiotic reduction strategies, strengthening the immune system of animals and alternative solutions for treatment, you can review this issue of our magazine. Enjoy your reading!

Wishing you a happy and peaceful New Year!

See you in the next issue!

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ANTIBIOTIC REDUCTION PROGRAMME

Selko®

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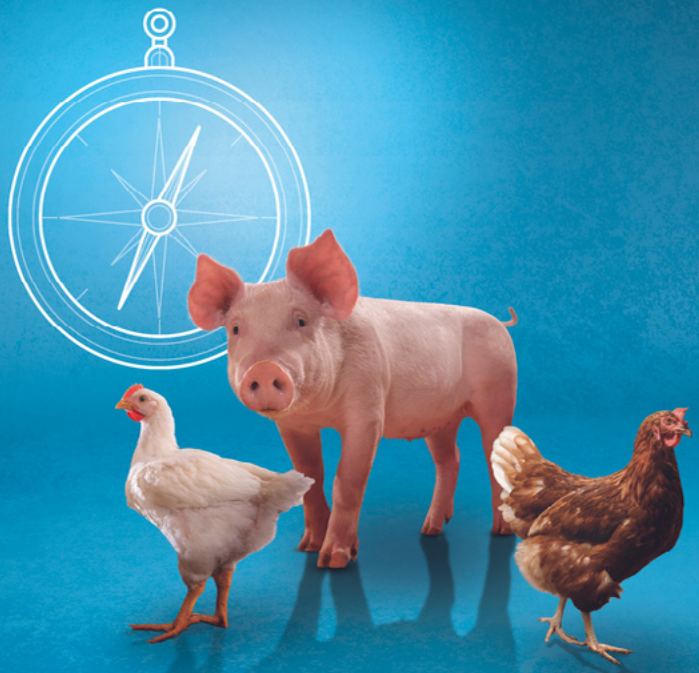

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ADM acquires PT Trouw Nutrition Indonesia

ADM, one of the global leaders in human and animal nutrition, announced that it reached an agreement to acquire PT Trouw Nutrition Indonesia, a subsidiary of Nutreco and a leading provider of functional and nutritional solutions for livestock farming in Indonesia.

Incorporated in 2007, PT Trouw Nutrition Indonesia is a leading premix manufacturer, providing innovative and comprehensive nutrition solutions for the animal industry. Their premix production facilities feature full automation solutions with intelligent process optimisation, and they are industry 4.0-ready with professional project management and execution.

With the planned acquisition, ADM will be strengthening its premix and feed additives & ingredients (FA&I) business and strategically positioning itself to meet the anticipated market growth to sustain the rising demand for protein. The acquisition encompasses two premix production facilities—known as the Pasuruan site in Surabaya and the Cibitung site in Jakarta—as well as laboratories, warehouses, and offices across Indonesia.

"This acquisition will complement our regional footprint and will represent a step forward in achieving our vision of leading the animal nutrition industry," said Gerald Wilflingseder, president of ADM's animal nutrition business in APAC.

In addition, Dr. Pierre Domps, general manager of animal nutrition Indonesia at ADM, commented, "Our commitment extends beyond products and solutions; we strive to provide a spectrum of services. We will provide customised solutions and services backed by international technical expertise and support from our lab services."

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Arla Foods Ingredients harnesses upcycling power of insects

Arla Foods Ingredients teamed up with ENORM, Northern Europe's largest insect farm, in a partnership that will significantly reduce food waste.

Delactosed permeate (DLP) is a residual dairy stream generated in large volumes during lactose production. Most DLP is currently used as material for biogas production, which is a less preferable option than reusing it for animal feed according to the food waste hierarchy set out in the EU's Waste Framework Directive.

Arla Foods Ingredients has long been investigating ways to address this challenge, but DLP's composition has previously made it difficult to use in traditional animal feed. This is about to change thanks to the larvae of the black soldier fly. Currently used by ENORM for animal feed, they also offer huge potential as a healthy and sustainable source of protein for humans.

Having developed the capacity to turn DLP into nutritious feed for larvae, Arla Foods Ingredients has been supplying ENORM with DLP for trial production for several years. However, ENORM opened a major new facility on December 6 in Flemming, Denmark, and is gearing up for full-scale production.

As a result, the amount of DLP that Arla Foods Ingredients supplies to ENORM will increase substantially – to 15 truckloads a week in early 2024. When the new facility is up and running, it will be able to produce 100 tonnes of larvae daily – enough for more than 10,000 tonnes of insect meal.

Read more>>

dsm-firmenich receives UK approval for Bovaer

dsm-firmenich, the leading innovator in nutrition, health, and beauty, announced that it received market authorisation for Bovaer® in the United Kingdom. Bovaer® is a feed additive that effectively and immediately reduces methane emissions from cattle, with an average reduction in dairy cows of 30%. This is the first authorization by the UK for a feed additive targeted at an environmental benefit.

According to dsm-firmenich, with this latest authorisation, English, Welsh, and Scottish dairy farmers will now also have a scientifically proven solution available to lower their carbon footprint significantly and reliably. For the entire dairy value chain, including supporting processors, retailers, and the food services sector, it means scope 3 emissions of dairy can be lowered by 10-15% CO_2 equivalents per litre of milk. Additionally, it will help the UK deliver on the commitments of the Global Methane Pledge and the Climate Change Act.

"At dsm-firmenich, we are excited about gaining another market authorization this year. It demonstrates the global relevance and potential of Bovaer®. Personally, I'm exceptionally delighted, as we are building a world-scale production plant for Bovaer® in the UK to help support global sales. Construction on the new plant is well underway in Dalry, Scotland, to become operational in the course of 2025," said Mark van Nieuwland, Vice President Bovaer®.

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Denkavit acquires Volac Milk Replacer business

The Dutch Denkavit Group and UK-based Volac International Ltd. reached an agreement for the acquisition by Denkavit of the Volac Milk Replacer business. This acquisition was a strategic decision for both parties, based on a strong wish to work with a partner with similar ambition and values to take the Volac Milk Replacer business to the next level.

"Our Milk Replacer business is something we can be hugely proud of. We want that business to continue to flourish. As our portfolio of products in Volac Animal Nutrition expands further into the feed additives area following the successful acquisition of Micron Bio-Systems in 2021, we want to build on the synergies this brings. We have made the decision to sell our Milk Replacer business to a leading player in that market who can give it the focus it deserves," said David Neville, CEO of Volac International Ltd. "It was hugely important to us to sell to a company with similar ambition and values. We have enjoyed a healthy relationship with Denkavit over the years and look forward to this new chapter and seeing them take the Milk Replacer business to the next level."

Erik Buys, CEO of Denkavit, added, "We are very excited to announce this important step for us. The Volac products impress us, and we believe them to be a valuable addition to our portfolio, as they are renowned for superior quality and therefore fit seamlessly into our group. This acquisition strongly supports our ambition for global leadership in the calf milk replacer industry, bringing us a strong position in the UK and Irish markets."

Products for the home markets of the UK and Ireland will continue to be supplied and blended by Volac as part of the deal, and as such, will remain partners in this regard.

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Adisseo opens its new European R&I Centre, ELISE

Adisseo, one of the major players in the global feed additives market, officially opened ELISE (for European Lab for Innovation, Science & Expertise) in Lyon, France, three years after the start of the project to gather Research and Innovation teams within a European research centre.

In a new building designed according to the needs and constraints of R&I activities, ELISE now hosts Research and Innovation activities in the fields of process chemistry, process engineering, analysis, and nutrition research - that's to say 100, people.

The choice of this location near the city of Lyon, in the heart of the Chemistry Valley, close to universities, and connected to technological partners in the Auvergne-Rhône-Alpes region will encourage network projects and develop synergies.

"This grouping of R&I teams will make it easier to adapt to increasingly rapid changes in our

sector, to answer the challenges of tomorrow's agriculture and food, and to attract the best researchers who will strengthen the teams' skills in France," stated Adisseo.

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Anpario and Saife Vetmed India celebrate new partnership in India

Anpario plc, an independent international manufacturer and distributor of natural animal feed additives, signed a new manufacturing partnership agreement with New Delhi-based Saife Vetmed India Pvt. Ltd.

In the last 10 years, economic development in India has seen a regular year-on-year growth of 6% of GDP; consequently, the market is attracting significant interest from international producers of feed ingredients. India is the second largest producer of eggs in the world behind China, the eighth largest producer of chicken meat, the largest producer of milk, contributing 24% of all the milk produced in the world, and the second largest producer of shrimp behind Ecuador.

Saife Vetmed, based in New Delhi, has successfully represented Anpario's flagship product, Orego-Stim, in India since 2008. Orego-Stim, developed and manufactured by Anpario, is the leading phytogenic feed additive formulated from a unique source of 100% natural oregano essential oil and is proven to support profitability, health, and performance in all species, according to the company. Changes to production practices and a greater focus on sustainable solutions to drive healthy, profitable

growth, combined with improved access to the market over the last 2 years, have almost tripled Orego-Stim sales, and the partnership is ready to move to the next level.

Andrew Jackson, Commercial Director at Anpario, commented, "We believe it is the right moment to increase our focus on India and capitalise on the opportunity such a significant market represents to Anpario."

"India is a significant opportunity, but it is also a considerable challenge. To be successful in such a goliath of a market, we need a stable and knowledgeable partner. In Saife Vetmed, we believe we have found that partner," Jackson continued.

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Trouw Nutrition to share its scientific research at IPPE Expo

Trouw Nutrition, Nutreco's livestock feed business line, is sharing scientific research and unveiling nutritional technologies to support poultry production during the International Production & Processing Expo (IPPE), 30 Jan. to 1 Feb., in Atlanta, GA, U.S.A. Three International Poultry Scientific Forum presentations and an IPPE TECHTalk offer new insights from poultry research initiatives, including trials studying the effects of phytogenic ingredients, trace mineral sources, and organic acid supplementation on flock performance and farm economics. Visitors to the Trouw Nutrition booth (A823) can also learn about advanced technologies to support the production of safe, high-quality feed.

Remarking on Selko and Trouw Nutrition's presence at IPPE, Jaco Eissen, Global Manager Monogastric at Trouw Nutrition, stated, "Poultry producers have to deal with continuously changing circumstances that are influencing their business in 2024. Science-based insights can help producers and nutritionists make decisions that benefit their flocks and their farms."

Read more>>

Skretting introduces Nutra Terra, new generation of hatchery feed

Skretting, one of the world leaders in the manufacture and supply of aquaculture feeds, introduced Nutra Terra, a novelty in hatchery feed with documented high performance and reduced emissions. Trials show a reduction in emissions of phosphorus and zinc from faeces of up to 30%, while fish fed with Nutra Terra have significantly better growth and a lower feed factor.

Nutra Terra represents Skretting's largest innovation in grower feed for juvenile fish in over a decade. All available knowledge and research have been gathered to develop a new and optimised feed recipe, according to the company's statement. The result is a feed that provides better performance while reducing emissions from the fish and making better use of raw materials in the feed.

The company believes that the key to success lies in raw materials. Skretting explains that Nutra Terra contains smaller amounts of limited raw materials,

such as fishmeal and phosphorus, compared to conventional hatchery feeds. Part of the fishmeal is replaced with insect protein, which is part of the natural diet of salmon in the wild during this life stage.

"Validation trials show a 7% increase in growth and a 4% lower feed factor in fish fed with Nutra Terra. It is gratifying to see such good performance numbers while reducing the need for limited raw materials," says Marcus Søyland, Head of Land Based in Skretting Norway.

Read more>>

Novozymes and Chr. Hansen announce name of future combined company

Novozymes and Chr. Hansen announced their future name, 'Novonesis'. The name reflects the beginning of an era of biosolutions where Novonesis will unleash the full potential of biological solutions and generate significant value for all stakeholders and society at large. The announcement of the name marks an important milestone towards uniting the two companies.

"Novonesis reflects where we came from, what we can achieve, and what we will become together. We are dedicated to harnessing the transformative potential of biology. Building on our legacy of developing innovative biosolutions, we stand ready to unlock unprecedented opportunities," said Ester Baiget, President and CEO of Novozymes. "In Novonesis, we will unite the brightest minds and the best science and technology in the field to help customers and businesses prosper while enabling them solve some of the greatest challenges we all face. We are here to start an era of biosolutions. That is why we have chosen to call our new company Novonesis, which means 'a new beginning'."

Cees de Jong, Chairman of Novozymes, added, "We developed the name Novonesis in close collaboration and dialogue between Novozymes and Chr. Hansen. It has been crucial to find a name that can be home to all our 10,000 employees, but even more importantly, the name should represent the future potential of biosolutions. We believe we have found that name in Novonesis. A name that reflects our immense commitment to making biological solutions play an even bigger role in our planet's future."

Read more>>

NAVIGATING POULTRY INDUSTRY CHALLENGES: Cargill's Innovative Solutions

Cargill, a prominent figure in the global poultry industry, stands out as a frontrunner navigating the industry's complexities through innovation and commitment. Yann Fournis, Cargill's Gut Health and Performance Poultry Category Lead, emphasizes the company's dedication to supporting live poultry producers across the entire production spectrum, from conception to consumption.

At the heart of Cargill's Animal Nutrition business lies a diverse array of feeds and feed additives, and analytical and digital solutions, all strategically crafted to enhance bird performance. Key among these are postbiotics, obtained from fermentation, which are crucial in nurturing a robust intestinal microflora, complementing nutritional support provided through their feeds.

In response to the industry's rising demands and the call to reduce antibiotic usage, Cargill plays a pivotal role. Their portfolio of nutritional solutions aims to bolster bird health while helping lessen reliance on antibiotics. Innovative technologies and key ingredients also serve to support help decrease health challenges and boost bird resilience.

Sustainability remains a key focus for Cargill in poultry production. Dia V™ MBPRO, an innovative product supporting feed conversion ratio (FCR), impacts weight gain and meat yield for broilers by enhancing nutrient absorption and microflora modulation.

Central to Cargill's animal welfare approach are postbiotics that adhere to ISAPP standards, supporting four critical health pillars: acquired immunity, innate immunity, digestive health, and intestinal microbiota balance.

Looking ahead to the 2024 International Production & Processing Expo (IPPE), Cargill plans to showcase an integrated portfolio model, spotlighting tailor-made solutions through innovative feed additives, technical services, and digital technologies, aimed at optimizing poultry production.

The much-anticipated IPPE 2024 will witness the unveiling of REVEAL™ Layers, a groundbreaking patent-pending NIR technology empowering producers to assess real-time body composition in poultry layers. This innovation promises to enhance laying persistency and profitability.

To gain deeper insights into Cargill's impactful solutions, industry professionals are invited to visit their booth at IPPE Hall A, booth A2233.

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Prices in dairy commodity market to rise in 2024

According to Rabobank's report titled 'Global dairy quarterly Q4 2023-Shifting to the next phase of the cycle', as 2023 draws to a close, the global dairy market continues to walk a tightrope of limited “new” milk and sluggish demand. Looking back on 2023, it is a story of soft global dairy commodity pricing due to weaker underlying fundamentals. Milk supply growth around the globe was underwhelming in 2023, with a brief return to growth for three consecutive quarters before lower milk prices, elevated costs, and weather disruptions put the brakes back on. The global markets patiently awaited the rebalancing of the Chinese market, only to experience the second consecutive year of large shortfalls in net dairy imports, according to Rabobank.

Rabobank forecasts that in 2024, the global market will transition to the next phase of the cycle. There is growing evidence that the bottom in the dairy commodity markets has passed, and the general trend is for prices to move higher through 2024.

Milk supply growth will be sluggish in 2024 across most export regions. Stock levels in the export regions are comfortable but not burdensome. This means that international dairy buyers must keep a close watch on supply availability amid structural weaknesses in production growth in some export regions. The New Zealand seasonal flush has passed with modest growth, and markets await seasonal increases from the Northern Hemisphere in 1H 2024.

The next phase of the demand story remains key to watch. It’s

a complex story of high dairy inflation, broader cost-of-living issues, and weak consumer confidence remaining on the horizon. Sluggish underlying dairy demand and changes in consumer purchases are impacting volumes in some economies and channels. Demand settings are on the mend, but market uncertainty remains due to rising unemployment in some economies. Its ongoing impact on consumer purchasing power will be a watchword for 2024.

Read more>>

Cal-Maine Foods acquires Tyson Foods' shuttered broiler processing assets

Cal-Maine Foods, Inc., the largest producer and distributor of fresh shell eggs in the United States, announced a definitive agreement to acquire a broiler processing plant, hatchery, and feed mill in Dexter, Missouri, that was recently closed by Tyson Foods, Inc. The company plans to repurpose the assets for use in egg and egg product production. Cal-Maine Foods expects to close the transaction in its third fiscal quarter.

Cal-Maine Foods will initially convert the broiler processing plant to an egg-grading facility. The company is excited about the growth prospects of this new operation and, subject to the completion of the transaction, anticipates making additional investments in the facilities and community and creating new jobs. Potential future expansion includes egg product processing capabilities, such as hard-cooked eggs. In connection with the acquisition, Cal-Maine Foods expects to enter into agreements with certain of Tyson’s former contract farmers to convert their operations to support Cal-Maine Foods’ cage-free, free-range, or pasture-raised egg production operations.

Commenting on the announcement, Sherman Miller, president and chief executive officer of Cal-Maine Foods, Inc., stated, “We are pleased to announce the proposed acquisition of the assets of Tyson’s former broiler processing facility in Dexter, Missouri."

Read more>>

Alltech Harvest Analysis: Weather conditions increase mycotoxin risk

Variable weather has once again dominated crop quality and mycotoxin contamination patterns in Europe, with a distinct split between northern and southern regions. The Alltech 2023 European Harvest Analysis has collected and assessed over 1,100 grain and forage samples from more than 20 different countries, and the results show an overall higher-risk mycotoxin year in Europe in 2023. While Europe enjoyed a reprieve this growing season from the extreme drought conditions of the past 2–3 years, rains that fell close to harvest in northern and western Europe caused delays in harvesting that created ideal conditions for mould and mycotoxin development.

The Alltech European Harvest Analysis, a decade-long initiative, is a comprehensive step in understanding the complexities of new-crop quality, mycotoxin prevalence and the threat that mycotoxins pose to animals and producers. To determine the most accurate representation of mycotoxin risk across Europe, Alltech has again collaborated with SGS, a global leader in mycotoxin testing and certification. Their expert testing, along with testing by the independently accredited Alltech 37+® laboratory in Ireland, which can detect up to 54 individual mycotoxins, has captured a highly accurate and robust set of new-crop mycotoxin data across 20 countries in Europe.

''In contrast to recent years, it is excessive rain rather than

drought that has been the primary driver of mycotoxin risk in Europe," said Dr. Radka Borutova, European technical support manager with the Alltech Mycotoxin Management team. "The delayed harvest in northern and western regions has created particular problems in small grains and forages across this region, while further south, corn crops have fared much better than last year, although, as we always try to highlight, low risk does not mean no risk."

Read more>>

Hungarian insect producer chooses Bühler for industrial insect plant

Hungarian insect producer Agroloop chosen Bühler's sophisticated insect growth system for its industrial black soldier fly plant. The facility will produce up to 4,000 metric tonnes of animal feed ingredients per year and will be built in Üllő, Hungary. Swiss technology group Bühler will deliver its proven crate-based nursery and rearing technology, which will enable a quick ramp-up of the plant for commercial production. By the end of 2024, Agroloop plans to launch its first products, contributing to a more sustainable animal feed value chain.

Following its foundation in 2017 and the successful operation of a pilot facility, Agroloop got the green light for the implementation of an industrial insect plant in Hungary in 2022. Now they have selected all execution partners and are working at full speed to construct the plant and get it operational. The insect facility will be realised in an existing building of the Aerozone Park in Üllő, which is located next to the Budapest Ferenc Liszt International Airport. The new plant, Agroloop, supported by Bühler insect technology expertise, will produce more than 25,000 metric tonnes of black soldier fly larvae that will be turned into sustainable feed ingredients for the pet food, aquaculture, and livestock sectors.

The plant is only the first step in Agroloop's strat-

egy to make insect feed ingredients available for Central and Eastern European (CEE) agribusiness. "The abundance of food processing by-products presents a unique opportunity for Agroloop's multi-plant rollout strategy in the CEE region. Leveraging our strategic partnership with the leading regional feed producer, UBM Group, we improve feed quality and sustainability by creating future-proof feed formulas. This enables Agroloop to focus on rapid expansion and solidifies our position as a key player in the region," said István Nagy, co-founder and CEO of Agroloop.

Andreas Baumann, Head of Market Segment Insect Technology at Bühler, added, "We are very proud to be part of this pioneering project for the CEE region and delighted to see that our solutions will contribute to more sustainable feed supply chains."

In the pursuit of sustainable and environmentally friendly practices, the CEE region is increasingly

turning to alternative sources for feed ingredients. By incorporating insects into the feed supply chain, the region can address environmental concerns, reduce dependence on imported protein sources, and contribute to a circular economy approach. In addition, innovative feed formulations containing insects can optimise animal health and growth, thus leading to more efficient livestock production systems.

Read more>>

Leeds University and Entocycle to evaluate use of non-permissive feedstocks in UK to raise BSF

The University of Leeds and Entocycle unveiled a new £430,000 research programme dedicated to developing the protocols and codes of practice to unlock the growth of the UK insect farming industry and its potential to decarbonise livestock production.

According to the statement, the UK insect farming industry is currently constrained by strict legislation on the use of insect protein in animal feed and a lack of protocols and standards for insect-rearing facilities. Furthermore, current UK and EU legislation prohibits the use of livestock manure and slurry as feedstock for insects, restricting its potential to reduce the growing problem of agricultural waste and the associated environmental pollution. Currently, the feedstocks allowed to breed and feed insects are primarily of vegetal origin. Examples include vegetables not meeting specific supermarket standards, byproducts from vegetable processing such as potato or carrot peelings, or spent grains from beer or spirits production. Animal products are not permitted, except dairy products and eggs.

The project, named InSAFE, is funded by Innovate UK and BBSRC as part of the Novel Low Emission Food Production Systems competition and will evaluate the use of non-permissive feedstocks, including pig slurry, chicken manure, and sewage sludge, to raise black soldier fly (BSF). Protocols, codes of practice, and Food Safety and Quality standards will also be developed for a range of production scales, from small lab-scale units to commercial farms.

A new, state-of-the-art insect-rearing demonstrator facility, developed and installed by the UK's leading insect technology company Entocycle, will house the research and is situated at the National Pig Centre on the University of Leeds' research farm in Yorkshire.

Read more>>

Trouw Nutrition to chair Animal Nutrition Workstream for dairy net zero

Trouw Nutrition and the Global Dairy Platform (GDP) agreed to collaborate on a global pre-competitive Animal Nutrition Workstream to help support and guide research on innovative solutions to decarbonise the dairy sector. Developed as part of the Pathways to Dairy Net Zero (P2DNZ) initiative, the task force will provide leadership in the dairy nutrition space, focusing on opportunities to minimise the environmental impact of dairy production through innovative forage, feed, and feeding developments and technologies. To launch this partnership, GDP and Trouw Nutrition will host two P2DNZ webinars on January 17.

The GDP is a dairy value chain organisation whose members collaborate pre-competitively to address issues important to the industry. GDP developed the P2DNZ initiative, a growing global movement dedicated to reducing dairy's greenhouse gas emissions over the next 30 years by accelerating action against climate change throughout the dairy sector. Over 200 organisations, representing nearly 40% of global milk production, have already signed on.

JJ Degan, Ruminant Manager of Global Strategic Marketing at Trouw Nutrition, said: "At Trouw Nutrition, we are committed to investing in improving the future of dairy farming. We believe that the P2DNZ's collaborative and pre-competitive approach will enable us to collectively identify game-changing opportunities that will help us move the needle on the urgent task of reducing the dairy sector's climate impact while also increasing the supply and access to nutritious dairy foods for a growing global population."

The dairy sector supports one billion people's livelihoods while also providing nutritious dairy products to billions across the globe. It will play a critical role in helping to achieve Nutreco's purpose of Feeding the Future: ensuring the 10 billion people on the planet in 2050 have enough high-quality nutrients to thrive. But at the same time, dairy is a significant contributor to greenhouse gas emissions, representing 2.5% of global emissions, so lowering its impact is an urgent priority.

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Northern Europe's largest insect farm opens in Denmark

Enorm Biofactory inaugurated the largest insect farm in Northern Europe in Hvirring, Denmark. Enorm aims to produce 100 tonnes of larvae per day on its new farm.

On the new 22,000-square-meter farm, black soldier fly larvae (BSFL) will be bred and processed into insect protein and insect oil. Much of the technology installed at Enorm Biofactory was supplied by Better Insect Solutions, a subsidiary of the Big Dutchman Group that specialises in complete solutions for insect farming. Better Insect Solutions provided the climate systems for the breeding and growing sections, air cleaning and heat recovery equipment, the liquid feeding system, and the crates for the larvae. Overall, around EUR 70 million was invested in the project.

"Enorm Biofactory is a milestone for insect farming in Europe, and we are delighted that our equipment has made such an important contribution to the success of this lighthouse project," said Dr. Frank Hiller, CEO of Big Dutchman. "We value this cooperation very highly because the larvae of the black soldier fly have enormous potential. We believe that this alternative protein source can permanently replace a large part of the soy that is currently being imported to Europe." Accordingly, Big Dutchman has bundled the group's insect farming know-how into the subsidiary Better Insect Solutions, which was founded in 2020.

Enorm Biofactory breeds black soldier flies that mate and lay eggs, from which the larvae hatch.

The larvae's main food source is residue from the regional food industry. After around 12 days, they are processed into insect oil and insect meal, products that have already shown promising results in connection with the management and health of pigs and poultry. The goal to produce 100 metric tonnes of larvae per day.

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Evonik develops microbial consortium to reduce antibiotics

Evonik's Biotech Hub is partnering with the Technical University of Munich (TUM) and RWTH Aachen to develop a novel bacterial consortium to strengthen the immune system of chickens and prevent colonization by pathogens of their intestinal tract. The aim is to enhance health and help reduce the use of antibiotics. Evonik is both a partner in the three-year joint Chicken Synthetic Microbiota (ChiSYN) project and the project coordinator. The total project volume is over €2 million and is funded by the project partners on a pro-rata basis and by the Federal Ministry of Food and Agriculture (BMEL).

"For our health, we need healthy food, and for that, we need healthy animals," says Christoph Kobler, who heads the Biotech Hub. "Our innovative microbial consortium contributes to both animal health and sustainable human nutrition."

The aim of the project partners is to develop a prototype feed additive that makes sure that "beneficial microorganisms" colonise the gut of chicks. To achieve this, bacteria that strengthen the immune system and make colonisation by pathogens more difficult are selected from a broad population of chickens. The project partners then combine these microorganisms to create a novel consortium.

"In the development of this bacterial consortium, we benefit from our experience of gut simulation and the successful development of probiotics for livestock farming," says Stefan Pelzer, who heads the In Silico &

Target Systems research unit at the Biotech Hub. Pelzer and his team have been working with the dynamic chicken gut simulation model "DAISy" since 2018. They use the findings to develop new gut health products and disruptive, high-precision nutritional concepts that take account of gut bacteria for the first time.

In this project, Evonik's experience in industrial biotechnology is perfectly complemented by the skillsets of its strategic partners at the universities in Aachen and Munich.

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Benson Hill introduces five 2024 soybean varieties

Benson Hill, Inc., self-described as an ag tech company unlocking the natural genetic diversity of plants, announced that recent advances in its soybean breeding programme will drive the doubling of its seed portfolio by 2025. The latest field evaluations on Benson Hill's third generation of Ultra High Protein Low Oligosaccharides, non-GMO soybean varieties, showed protein gains of 2% over the previous generation and achieved a yield gap of only 3 to 5 bushels per acre, compared with commodity GMO soybeans.

"We've successfully demonstrated that CropOS®, our AI-based prediction and data insights platform, can drive our predictive breeding efforts and give us a step-change forward on multiple traits like protein and yield," said Jason Bull, Chief Technology Officer of Benson Hill. "We are now seeing massive gains in the field that minimise the tradeoff between yield and protein, surpassing expectations from when we began building on the high-protein soybean genetics we acquired in 2019."

"What this means for the industry is that we're accelerating our speed to market with de-risked, outcome-based products in record time," Bull added. "We expect to expand our portfolio of seed innovations again in 2025 to offer two dozen varieties that encompass protein, lower-indigestible sugars, and quality oil."

Benson Hill Chief Executive Officer Deanie Elsner also announced today at FARMCON 2024 an expansion of its commercially available soybean portfolio for 2024, adding five value-added varieties to its lineup. Benson Hill previously offered about a dozen soybean seed varieties that deliver ultra-high protein, high-oleic and low-linoleic oils, and low-oligosaccharide quality traits.

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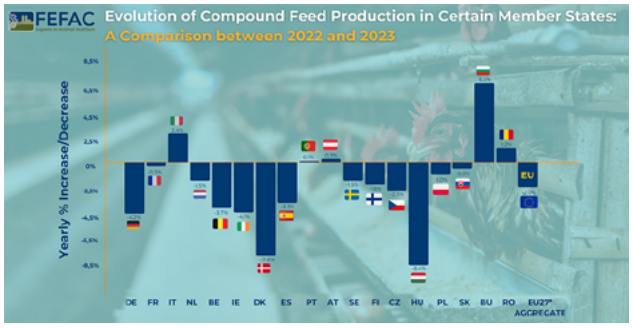
FEFAC: Outlook for compound feed demand in 2024 remains uncertain

European Compound Feed Manufacturers' Federation (FEFAC) explained its EU compound feed production estimates for 2023 and market outlook for 2024. EU compound feed production (EU27) for farmed animals in 2023 is estimated at 144.3 million metric tonnes, reflecting a 2% decrease compared to 2022, according to data forecasts provided by FEFAC members. The EU feed market in 2023 reflects continued political and market crisis management pressures and a growing demand for providing sustainable feed solutions to address market dynamics and regulatory considerations. These trends are a response to the adverse impacts of climate change and animal diseases on the supply of raw materials, such as



droughts and floods, and on animal production capacity, including Avian Influenza (AI) and African Swine Fever (ASF). Additionally, national policies ranging from greenhouse gas reduction goals to nitrate emission regulations have contributed to these shifts.

Moreover, shifts in production methods, as well as reduced or shifting demand due to changing consumer preferences (the impact of food price inflation), are affecting compound feed production differentially across Member States. While countries such as Germany, Ireland, Denmark, and Hungary have witnessed approximately a 5% decline in feed production, other countries like Austria, Bulgaria, Italy, and Romania have experienced a modest increase. The remaining Member States have either marginally decreased their feed production or maintained it at a level similar to the previous year.

Regarding the outlook for compound feed demand in 2024, the scenario remains uncertain. Key factors, such as the impact of animal diseases, economic uncertainty, persisting high food price inflation, ongoing weather irregularities, and the increased imports of poultry meat products from Ukraine, are affecting local production. The influence of "green and animal welfare" policies is expected to adversely impact the market outlook for livestock and feed production, although costs for key feed materials, mainly feed cereals, have fallen back to levels before the Russian invasion of Ukraine.

Read more>>

Novus shares innovation supporting poultry industry at IPPE

The Novus experts will present four abstracts as part of the International Poultry Scientific Forum (IPSF), which is held in conjunction with IPPE. The poster and oral presentations take place January 29-30, 2024, at the Georgia World Congress Center.

"IPSF is the premiere event to learn the latest research on environmental management, nutrition, physiology, pathology, and disease," says Gonzalo Prat, Novus senior director and managing director for the Americas. "We are honoured to participate in the forum to share how intelligent nutrition is supporting bird health and producer goals."

Dr. Zavarize said the abstracts from Novus showcase the importance of highly bioavailable trace minerals in poultry production.

"The poultry industry recognises that trace minerals support health and performance, but not all minerals are the same," she says. "Research like this showcases the difference a mineral source can make, both on its own and in combination with other products."

Read more>>

Novus shares hatchability insights at IPPE's TECHTalks

Hatchability has become a top concern for the broiler breeder industry in the United States. Investigating the cause and how producers can support fertility and hatch are the focus of a presentation by Novus during the TECHTalks at IPPE.

"In recent years, the U.S. has seen some of the worst hatchability numbers since the late 1980s. The U.S. Department of Agriculture in October 2023 reported average hatchability at just 80.4%," says Hugo Romero, Ph.D., Novus global poultry technology executive manager, who will present the talk. "During this presentation I'll examine the potential causes for this phenomenon and how adjustments to the ration can help combat it."

Dr. Romero's presentation for the TECHTalks will be from 11:30-11:50 a.m. EST on Tuesday, January 30 in Hall A at Booth A244.

Hugo Romero

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ANTIBIOTIC-FREE PRODUCTION & IMMUNITY DEVELOPMENT

- Use of advanced technologies and feed additives in connecting gut microbiome maturation to broiler performance

  Vivek Kuttappan, Cargill

- Metabolites and gut maturation in newly weaned piglets

  Yvonne van der Horst, Selko Global **&**
  Tetske Hulshof, Trouw Nutrition

- Boosting calf immunity through MCFA in mother's diet

  Frederik Gadeyne, Agrimprove

- Intestinal health and pathogen risk-reduction benefits antimicrobial management

  Célia G da Silva & Dr. Luiz Souza, ADM

- WOAH calls for antimicrobials not to be used as growth promoters

- Antimicrobial resistance in shrimp farms

  Abisha Juliet Mary S J, TNJFU

USE OF ADVANCED TECHNOLOGIES AND FEED ADDITIVES IN CONNECTING GUT MICROBIOME MATURATION TO BROILER PERFORMANCE

Vivek Kuttappan, DVM/PhD
Poultry Technology Lead – Postbiotics
Cargill

"The postbiotics could promote butyric acid producing bacteria directly or through cross-feeding mechanisms, while the essential oil compounds could control harmful bacterial, resulting in higher growth of butyric acid producing bacteria. Overall, the synergistic action of postbiotics and essential oil compounds could accelerate the development of a balanced and resilient mature microbiota in birds leading to improved performance."

Poultry production is forecasted to lead the global meat production by 59% in the next decade to meet consumer needs and ensure global food security (OECD/FAO, 2022). The challenge will be to meet this target in a sustainable way, making the most of limited feed resources and without being overly reliant on antibiotic or chemical compounds. As feed represents the largest cost input in poultry production, optimizing nutrient utilization and digestive efficiency are critical success factors. With 10^9 to 10^{11} bacteria/gram of intestinal digesta, the gut microbiome is a complex system with potential impact on gut health and production performance in broilers. Due to that complexity, understanding the changes in the gut microbiome and how we can influence it to adapt to challenges could be overwhelming at times. The use of advanced technologies and interventions, providing practical insights into the gut microbiome analysis of broilers to help improve animal health, performance, and preharvest food safety, can be advantageous in addressing sustainable broiler production.

THE CONCEPT OF GUT MICROBIOME MATURATION

Considering the complexity of the gut microbiome and the associated variations, it is important to establish the key attributes of a healthy gut microbiome. Extensive analysis of gut microbiome in broilers from field trials, as well as control research trials, were conducted using a non-invasive advanced microarray tool coupled with artificial intelligence – Galleon™ Microbiome Intelligence – to identify biomarkers for performance, preharvest food safety, harmful bacteria, etc. Results revealed that the broiler gut microbiome undergoes a maturation process from a simple to a more diverse microbial population (Figure 1). During the first week of age, the poultry gut microbiome primarily contains lactate producing bacteria (*Lactobacillaceae, Streptococcaceae etc.*). The short chain fatty acid (SCFA) producing bacteria (*Lachnospiraceae, Ruminococcaceae etc.*) uses lactate as a substrate, and thus there is a cross-feeding mechanism between the groups. As a result, the SCFA-producing bacteria increases in abundance later and produces SCFA such as butyric

Figure 1. *Healthy gut microbiome maturation profile in broilers*

acid. Butyric acid has been reported to have several benefits by improving the gut integrity, barrier function, and reducing inflammation. Overall, the maturation of the gut microbiome results in a more resilient microbiota which can withstand challenges and support the birds in better digestion as well as utilization of nutrients.

In fact, birds are most vulnerable to challenges during the initial stages of this maturation process. Interestingly, a comparison of high versus low performing flocks (~300g difference in body weight) showed that high performing birds had a more mature microbiome at an earlier age. Moreover, this could have helped the high performing birds to be more resilient to various environmental challenges, and divert more nutrients towards production performance. Low performing flocks were characterized by a lower abundance of lactate-producing bacteria during the first 14 days of production, resulting in lower numbers of short chain fatty acid (SCFA) producing bacteria at 35 days of age. The low producing birds showed higher abundance of several opportunistic harmful bacteria (*Proteobacteria* such as *E. coli*, Salmonella *etc.*), resulting in increased bacteria and food safety risk. Based on these findings, dietary interventions can be designed and implemented with changes in raw materials, nutrient levels, and using specific feed additives to promote a more favorable microbiome maturation, while keeping harmful bacteria under control.

INFLUENCING GUT MICROBIOME MATURATION USING FEED ADDITIVES

a. Postbiotics

Learnings from these field trials, with respect to maturation of the gut microbiome, were used to evaluate the microbiome modulation benefit of a postbiotic-based feed additive. Postbiotics are defined by the International Scientific Association for Probiotics and Prebiotics (ISAPP) as preparation of inanimate microorganisms and/or their components that confer a health benefit on the host. A metanalysis of nine trials was conducted comparing birds with and without dietary inclusion of postbiotics, focusing on the changes in microbiome using microarray assay and artificial intelligence biomarker identification. The artificial intelligence model generated from the analysis revealed that nine out of ten biomarkers at 14d of age from the birds were linked to lactate producing bacteria. Interestingly, the dietary inclusion of postbiotics resulted in significantly higher abundance of lactate producers at 14d, which promoted the growth of *Lachnospiraceae* (short chain fatty acid producers), indicative of an early maturation of gut microbiome compared to the respective no-additive control.

b. Syngery between postbotics and essential oil compounds

In addition to that, a unique combination of postbiotics with a proprietary blend of essential oil compounds was evaluated for gut microbiome mod-

ulatory and performance benefits in broilers. Four independent trials were conducted comparing broiler birds fed on a basal diet with birds fed the blend of postbiotic and essential oil blend on top of the basal diet. The results from the four studies showed that birds fed with the new solution containing postbiotics and essential oils showed significantly higher body weight and feed conversion ratio compared to control birds. Moreover, there was a significantly higher abundance of butyrate producing bacteria, and reduction of opportunistic harmful bacteria such as *Clostridium perfringens* at 21 and 35d. In fact, the postbiotics could promote butyric acid producing bacteria directly or through cross-feeding mechanisms, while the essential oil compounds could control harmful bacterial, resulting in higher growth of butyric acid producing bacteria. Overall, the synergistic action of postbiotics and essential oil compounds could accelerate the development of a balanced and resilient mature microbiota in birds leading to improved performance.

CONCLUSION

The use of advanced tools and technology is imperative to understand the changing in patterns of the complex poultry gut microbiome. Connecting these gut microbiome changes with animal health, performance, and preharvest food safety can help to implement appropriate interventions strategies with changes in raw materials, nutrients levels, inclusion of additives, etc., in the diet to attain the specific production targets in a more sustainable way.

About Vivek Kuttappan

Vivek Kuttappan, Ph.D., is a Poultry Technology Lead at Cargill, Inc. that supports the animal agriculture industry through unparalleled research capabilities, innovative feed and premix products and services, and digital modeling and formulation solutions. Throughout his career, Dr. Kuttappan has provided valuable contributions to the poultry industry in two specific areas:1) broiler meat quality, reducing poultry carcass quality defects such as myopathies, and 2) poultry gut health, improving gut health in broilers, thereby reducing economic losses to poultry producers. Dr. Kuttappan holds a patent for a novel molecule to improve gut health in broilers and has participated in approximately 100 scientific publications, including 40 peer-reviewed journal articles cited by researchers worldwide. He has received several awards for his research, including the prestigious PSA Early Achievement Award for Industry. As a subject expert in solving poultry meat quality challenges, he has served as an invited speaker in the industry as well as in academia. Dr. Kuttappan continues to collaborate with academia to solve gut health threats in antibiotic-free production as a research partner in various projects investigating non-antibiotic feed additive strategies to mitigate health challenges and improve poultry production performance. He has been an active member of the Poultry Science Association since 2009 and currently serves as the Chair of the PSA Committee on Industry Relations to propose how the Poultry Science Association can support, fund, or create projects, plans, and actions to fulfill potential needs and initiatives within the sector of industry relations. He is also an editorial board member and reviewer for several scientific journals. Dr. Kuttappan received his doctorate in poultry science from the Center of Excellence for Poultry Science, University of Arkansas, and a bachelor's degree and master's degree in veterinary science from Kerala Agricultural University, India.

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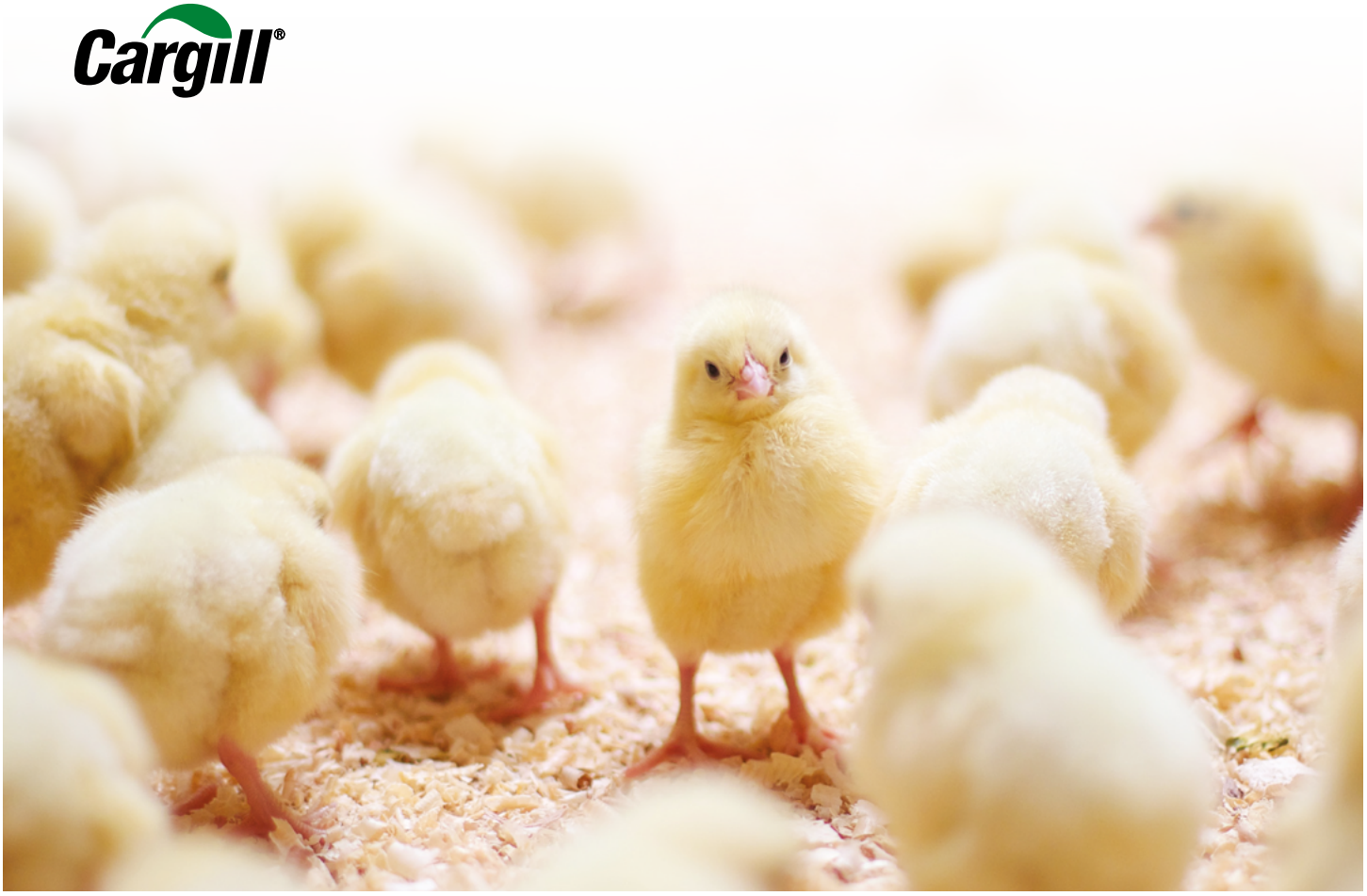

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Yvonne van der Horst
Product Manager Presan
Selko Global

Tetske Hulshof
Swine Researcher
Trouw Nutrition

METABOLITES AND GUT MATURATION IN NEWLY WEANED PIGLETS

More than 9,000 researchers, veterinarians, swine nutritionists, and pig farmers gathered digitally or in person at Wageningen University this year for the ArMoR (research projects on reducing antimicrobial use in livestock) Healthy Livestock research presentations. The robust attendance reflects the urgency of identifying effective strategies for supporting the enteric health of piglets. Below, we share a snapshot of a study researchers shared at the event that looks at the mode of action a blended feed additive relies on and the pathways it influences in the animal.

Newly weaned piglets face a range of stressors that can interrupt weight gain and development including declining feed intake and illnesses like diarrhea. Long-relied on interventions used to deal with these challenges – such as including antibiotic growth promotors in the diet or feeding high levels of some trace minerals – are facing restrictions, and being phased out in some production regions. The situation spotlights the urgency of identifying and validating new approaches to foster piglets' gut health.

Blended feed additives are among the alternatives being explored to steer and nurture the maturation of piglets' digestive tracts. Combining specially selected organic acids, medium-chain fatty acids, slow release C12, butyrates and phenolic compounds has been found to support gut health and animal development. Use of these types of ingredients also has been demonstrated to support overall performance and limit enteric upset. Additionally, these blends are known to support an altered microbiota helping to increase the presence of Firmicutes and specifically the *Lactobacilli* genus while reducing the presence of unwanted bacteria.

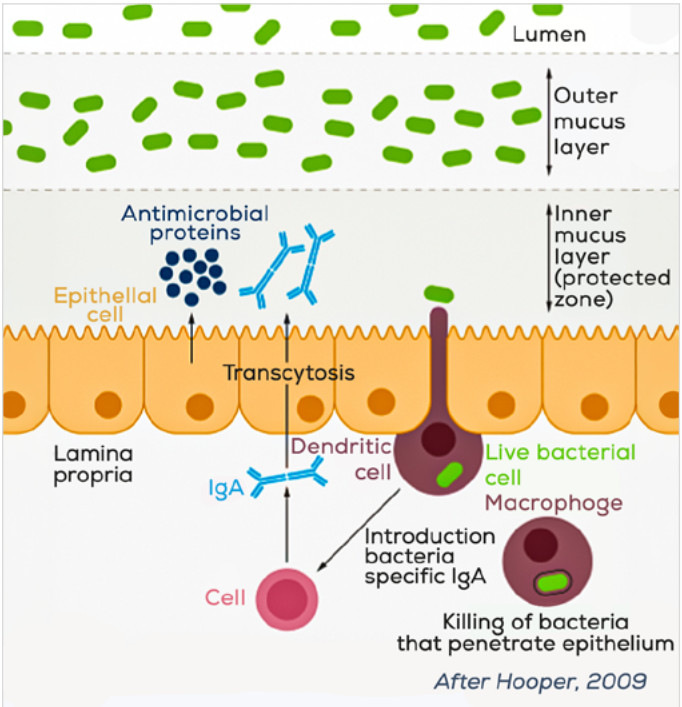

Figure 1. *Supporting gut health helps internal processes protect themselves from unwanted bacteria.*

In a study shared at the ArMoR event, researchers sought to learn more about what physiological changes might be occurring and which metabolic pathways might be involved in using blended feed additives to manage piglets' gut health. Tracking when and where feed additives prompt change within the animal supports future generational development and contributes to the efforts of producers using an antibiotic-free production system. Additionally, having a more complete picture of the mode of action can allow for improved precision of use.

STUDYING MODE OF ACTION

The study explored the mode of action for a blended feed ingredient comprised of organic acids, medium-chain fatty acids, slow release C12, butyrates and phenolic compounds (Presan®-FX). A total of 118 weaned piglets were given one of two diets for a period of 14 days. The diets included one with a blended feed additive and a control. Piglets were tracked for body weight gain and feed intake. Additionally, blood and intestinal samples were collected pre-weaning and throughout the trial. Samples were examined to determine microbiota present and metabolomics.

RESULTS AND PRODUCER IMPLICATIONS

Overall, piglets receiving the supplemented feed had a similar feed intake to piglets on the control diet. However, piglets receiving the feed additive had an improved average daily gain. The difference in weight gain is thought to stem from a change in fatty acid use and digestion meaning that piglets receiving the feed additive were better able to access the nutrition provided.

Internally, researchers observed a shift in response of a range of metabolites such as cholic acid, choline and taurine levels in the feed additive-supplemented feed piglets. Cholic acid levels increased in samples collected from both plasma and the small intestine during the trial. However, levels of both choline and taurine in plasma declined on days 7 and 14.

These changes indicated a shift in bile metabolism and potential increase in bile production and secretion, which supports the development of a microbiome that is more bile tolerant. Higher levels of cholic acid may improve nutrient digestion and support the growth of beneficial bacteria as it has an

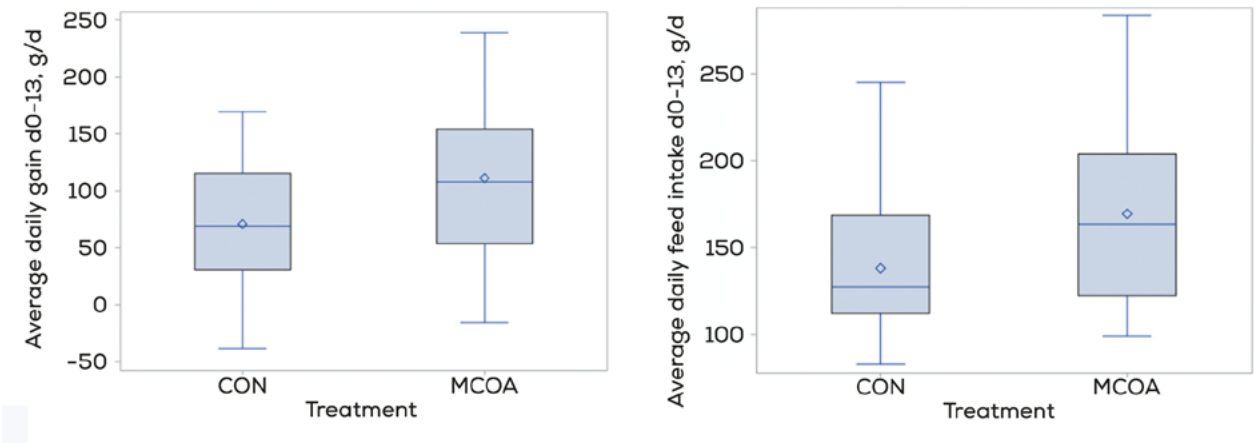

Figure 2. *Supporting gut health and development may have allowed piglets to get more nutrition from the same amount of feed as control group pigs.*

antimicrobial effect and may help protect gut function against the colonization of pathogenic bacteria.

Piglets on the supplemented diets also demonstrated an increased indole-3-propionic acid (IPA) level in plasma compared to control group pigs. The boost to IPA production helps support gut barrier function and indicates a more mature microbiota. IPA and other metabolites also help regulate gut barrier function.

At the intestinal level, piglets receiving the supplemented feeds showed a higher abundance of *Lactobacillus* in the small intestine. These bacteria help with the fermentation of tryptophan into IPA, again supporting gut barrier function. Along with the increased amount of *Lactobacillus* bacteria, there also was a decline in variation of opportunistic bacterial species not typically native to the gut, suggesting a more stable microbiota population had been established. This shift in bacterial population likely stemmed from a change in conditions that supported the growth of *Lactobacillus*, allowing it to outcompete other bacteria.

Multiple elements were tracked during the study not just cholic acid, choline, taurine and IPA levels.

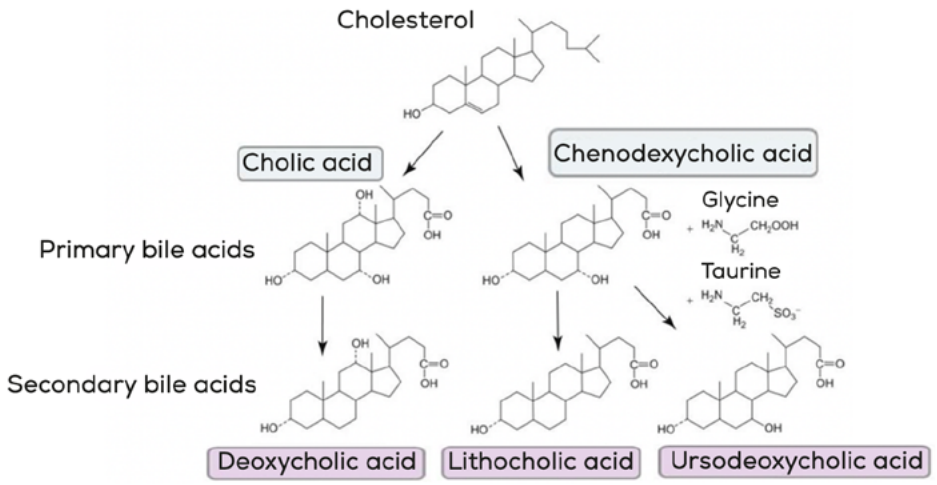

Figure 3. *Changes to the expression of certain metabolites inform the production of acid in the gut.*
Kriaa, A., V. Mariaule, A. Jablaoui, S. Rhimi, H. Mkaouar, J. Hernandez, B. Korkmaz, A. Lesner, E. Maguin, A. Aghdassi, M. Rhimi. 2022. Bile acids: key players in inflammatory bowel diseases? Cells 11(5), 901

However, changes in these areas were found during the data analysis. The alterations noted between the supplemented and control-group piglets were not surprising as the movement makes sense given past behavior of the feed additive used.

The mode of action findings indicate that the blended feed additive can support piglet gut health, development and maturation in antibiotic-free production systems.

CONCLUSION

Piglets continue to face multiple challenges and stressors around weaning, which can lead to reduced performance and negative side effects including diarrhea. Restrictions have continued to curb the types of ingredients, such as antibiotics and high levels of some minerals, that farmers can use to address these concerns and mitigate instances of diarrhea. However, feed additive blends can be an economically viable alternative as the combination of ingredients supports gut maturation helping maintain gut health and piglet growth and development. Understanding the pathways influenced by the ingredients helps verify usage-based results and informs precision of use.

About Yvonne van der Horst

Yvonne van der Horst holds a Master's degree in Animal Sciences from Wageningen University in The Netherlands. After working in a commercial position in the Animal behaviour sector, Yvonne acquired the position of technical manager Feed in the organic acids industry. In 2013 she moved to Selko Feed Additives in the position of technical manager Preservation and Health being responsible for technical support of the organic acid based portfolio. In 2016 she became responsible for the Presan portfolio as the Global product manager.

About Tetske Hulshof

Tetske Hulshof holds a Master's degree and a PhD in Animal Sciences from Wageningen University in the Netherlands. After finalizing her PhD, Hulshof started working as Swine Researcher in the R&D department of Trouw Nutrition in 2016. She has worked on several projects related to swine nutrition and health, thereby, supporting current and new commercial solutions. Tetske Hulshof has a strong scientific focus on gastrointestinal development of piglets starting from birth to the end of the nursery.

BOOSTING CALF IMMUNITY THROUGH MCFA IN MOTHER'S DIET

Frederik Gadeyne
Product Developer Cattle
Agrimprove

"Fast and healthy rearing of calves is an essential element for the farmer to obtain commercial success. This study demonstrated the potential of Aromabiotic® Cattle as part of the dry cow diet to improve colostrum quality."

Providing calves good quality colostrum is important to give them a head start in life. Since there is limited transfer of immunoglobulins (Ig) during gestation, the delivery of the most dominant form IgG through colostrum from the cow to the calf is essential in the first day of life. At Agrimprove, we believe that the dry period is key and offers an interesting window to boost calf immunity.

IMPROVING COLOSTRUM QUALITY

Generally, 50 g/L IgG is accepted as a threshold for good quality bovine colostrum (Quigley et al., 2013). These values are often not reached in practice, putting limits on the chances of successful calf rearing. Strategies to improve colostrum quality and increase IgG concentrations have been widely investigated. The dry period is of particularly interest to improve the quality of colostrum. This is the ideal moment to intervene via the diet of the calf's mother, for example by supplementing medium-chain fatty acids (MCFA). Besides the positive effects of MCFA on modulating rumen fermentation, impacting the immune system and ultimately improving milk quality during lactation, MCFA could as well improve colostrum quality. Indeed, an improved health status during the dry period could positively impact the quality of the cow's first milk. In swine, it was shown that the addition of MCFA in the maternal diet improved colostrum quality (Swanson, 2022). More recently, the positive effect of MCFA in C-vita on colostrum quality in swine colostrum was also observed (Crowder & Lannoo, 2023).

QUANTIFY THE MATERNAL EFFECT OF MEDIUM-CHAIN FATTY ACIDS

Experiments were designed to quantify the effect of Aromabiotic® Cattle (ABC), a mixture of MCFA, on colostrum IgG levels in dairy cattle under field circumstances. On two dairy farms in Belgium, cows were given a daily supplement of ABC during the dry period. On the first farm, starting at least 2 weeks before calving, an all-in-all-out approach was applied, allowing to compare a first set of control cows without ABC to a subsequent period with ABC during summer season. On the second farm, starting 3 weeks prior to calving, two of these alternating periods were applied, allowing to compare summer and winter season as well. Colostrum was collected from the first milking of 86 dairy cows on farm 1 and 87 cows on farm 2. IgG was analysed using radial immunodiffusion.

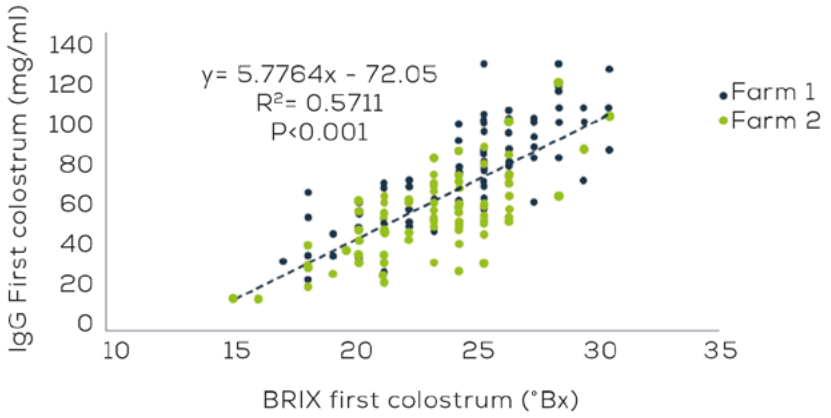

Figure 1. *BRIX acts as biomarker of immunoglobulin G content in bovine colostrum*

BIOMARKER OF COLOSTRUM QUALITY

In practice, the quality of colostrum is most often indirectly determined by measuring the BRIX value using a refractometer. Such device is typically used by winemakers to estimate the sugar content in grapes, must or wine, but can also be used to estimate colostrum quality. Through the refraction of light, a BRIX refractometer gives an indication of the dry matter content in colostrum, which is highly correlated with the IgG content of colostrum as well. The higher the level of dry matter, the higher the antibodies and the better colostrum quality. A clear correlation was observed between colostral IgG content and BRIX in our experiments (Figure 1). This confirms that BRIX could be used as a cheap and useful biomarker to identify the truly interesting immunoglobulins in colostrum.

BOOSTING IMMUNOGLOBULINS IN COLOSTRUM

Results for farm 1 are shown in Table 1. Significant differences were observed between the control and the treatment period for both BRIX values and IgG concentrations as measured in first colostrum. These differences cannot be explained by a dilution effect of colostrum, as colostrum volumes were not differing. Total amounts of IgG (colostrum volume x IgG concentration) show numerically higher values. Although colostrum volumes and total IgG amounts should be interpreted with caution because the exact time of colostrum collection can differ between cows, the substantial increase in IgG upon supplementing MCFA in the dry cow's diet was striking. Categorizing cows based on BRIX of first colostrum in low, medium, good, and high quality (Figure 2), further illustrated the positive effect of ABC on colostrum quality.

Similar results were observed on farm 2 (Table 2), confirming earlier observations. Again, significant differences were observed between the control and ABC for both BRIX values and IgG concentrations. This time, total amounts of IgG were higher as well.

Table 1. *IgG and BRIX in first colostrum increased when supplementing Aromabiotic® Cattle in the maternal dry cow diet (farm 1)*

Parameter	Unit	Control	Aromabiotic Cattle	Standard error	P-value
BRIX	°Bx	21.4	24.1	0.81	0.014
IgG concentration	mg/ml	49.2	74.1	5.58	0.001
Colostrum	L	6.97	6.48	1.09	0.746
IgG amount	g	338	455	64.5	0.196

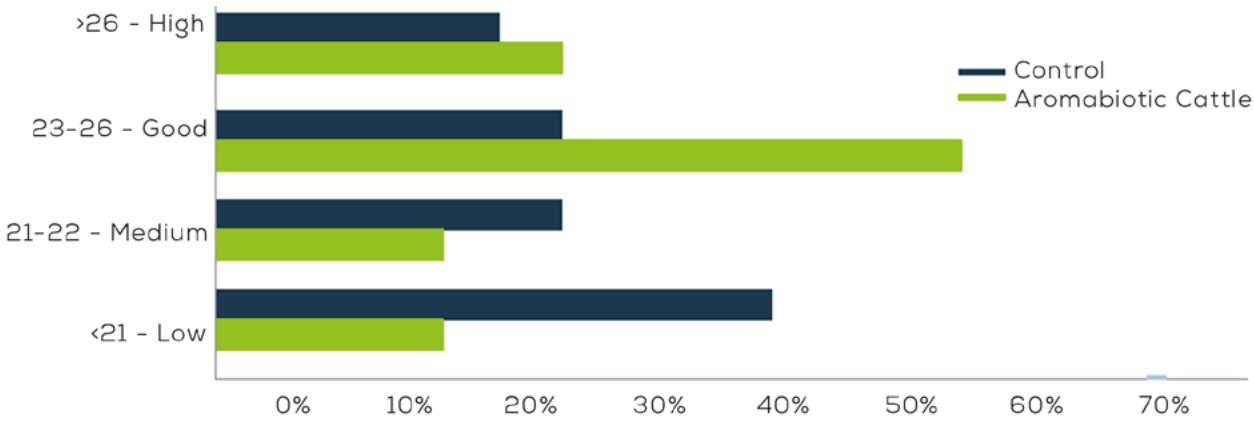

Figure 2. *Percentage of animals in the control and Aromabiotic® Cattle group per quality category of BRIX*

The effect of MCFA was most pronounced during summer season (Figure 3). IgG and BRIX were significantly higher during the more challenging summer period for the ABC treated cows compared to the control. Indeed, during summer time, colostrum fat and protein content tend to be lower when compared to other seasons. Differences between control and ABC were smaller in winter, but showed similar trends. Altogether, results indicated ABC had a positive effect on colostrum quality, especially when circumstances were more challenging.

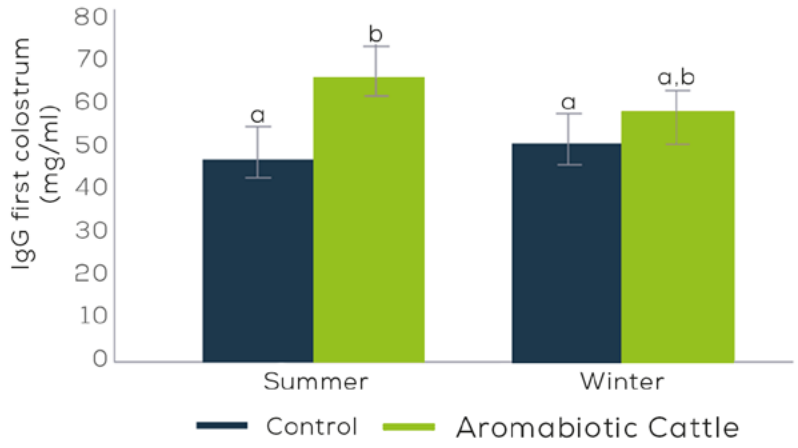

Figure 3*. Aromabiotic® Cattle in the maternal dry cow diet on farm 2 showed largest effects during the most challenging summer period*

Table 2. *IgG and BRIX in first colostrum increased when supplementing Aromabiotic® Cattle in the maternal dry cow diet (farm 2)*

Parameter	Unit	Control	Aromabiotic Cattle	Standard error	P-value
BRIX	°Bx	21.7	24.0	0.43	<0.001
IgG concentration	mg/ml	47.7	60.8	3.03	0.002
Colostrum	L	11.4	10.9	0.55	0.518
IgG amount	g	530	646	38.7	0.027

IMPACTING CALF IMMUNITY BY MCFA IN THE MOTHER'S DIET

At Agrimprove, we work every day to develop solutions helping farmers to improve the profitability of their farm. Fast and healthy rearing of calves is an essential element for the farmer to obtain commercial success. This study demonstrated the potential of Aromabiotic® Cattle as part of the dry cow diet to improve colostrum quality. Therefore, MCFA in mother's diet supports calf rearing success.

References are available upon request.

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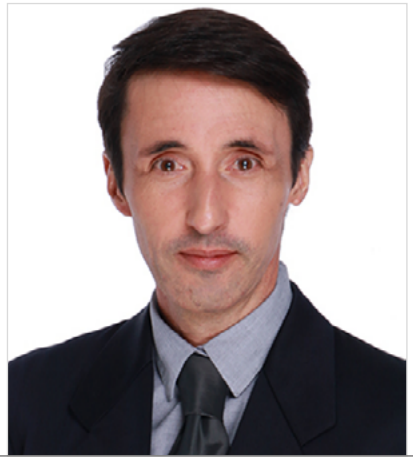

Célia G da Silva
Global Product Specialist Bioactives
ADM

Dr. Luiz Souza
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ADM

INTESTINAL HEALTH AND PATHOGEN RISK-REDUCTION BENEFITS ANTIMICROBIAL MANAGEMENT

"In the dynamic world of livestock production, the increase of antimicrobial resistance and consumer demand for high-quality food has raised the interest for sustainable and 'natural' alternatives to AGPs to meet growth performance and feed efficiency expectations. Phytogenic compounds are on the frontline for their demonstrated benefits in this field. Moreover, phytogenic compounds supplemented at low inclusion rates have shown to be beneficial not by inhibiting pathogens, but by supporting the animal's resilience to overcome them more effectively."

It has been almost 100 years since penicillin was discovered by Alexander Fleming. Since then, other antimicrobials and new applications other than medical treatment were developed. With that, also evolved the phenomenon antimicrobial resistance (AMR), in which bacteria experience structural or biochemical changes, becoming resistant to antimicrobials. The risk comes from the transmission of genes responsible for antimicrobial resistance from harmless bacteria to pathogen recipients.

Then mitigating AMR became a global priority, with the European Union leading the ban of antibiotics used as growth promoters in 2006. Since then, antimicrobials can only be distributed by veterinarians for therapeutic treatment.

Economical animal production will only be possible by adopting a holistic approach, enhancing intestinal resilience, supporting systemic immunity, and promoting proper biosecurity and management.

PAST AND CURRENT STATUS OF ANTIMICROBIALS IN ANIMAL PRODUCTION

According to the National Committee for Clinical Laboratory Standards of USA, in-feed antimicrobials have four applications to animal production:

(a) therapy, or the administration of an antimicrobial to a clinically diseased animal; **(b)** control, or the administration of an antibiotic to infected animals which exceed the baseline of morbidity and/or mortality; **(c)** prevention, or the administration of an antibiotic to healthy animals which are thought to be at risk; and **(d)** growth promotion, or the administration of an antimicrobial over a period of time enhancing the growth by improving physiological performance.

The current global annual consumption of antimicrobials per kilogram of animal product is estimated as 45 mg/kg for cattle, 148 mg/kg for poultry, and 172 mg/kg for swine. From this baseline, projections indicate that global antimicrobial consumption will increase by 67% between 2010 and 2030, from 63,151 ± 1,560 tons to 105,596 ± 3,605 tons (Ma et al., 2021). Pigs have the largest projected increase, contributing to 45% of the total increase between 2017 and 2030. Africa will have the highest expected increase by 2030 (37%). Asia is expected to increase its use of antimicrobials by 10.3% in the same period. Oceania (3.1%), North America (4.3%), and Europe (6.7%) are expected to have the smallest increase among the global regions (Tiseo et al., 2020).

IMPACT OF ANTIMICROBIALS ON ANIMALS AND HUMANS

Antibiotics are important for treatment of bacterial infections, pneumonia, urinary infections, arthritis, sepsis, and secondary infections. Their application is also valuable in protecting people more vulnerable to the harmful effects of infections: seniors over 75 years, neonates and babies with bacterial infections, patients with heart failure, diabetes, or a weakened immune system (NHS, 2023). Antibiotics are not only important for treating individuals, but also to avoid the spread of pathogens and diseases to the environment and the population.

Recent reports have revealed that the use of large amounts of antimicrobial medication could result in antibiotics residues in animal products. Although good quality milk, meat, and other related products are a prime need for supporting public health, the presence of antimicrobial residues above the maximum residue level (MRL) in food items and their subsequent consumption by consumers may cause health problems. The Food and Agriculture Organization (FAO) / World Health Organization (WHO) reported that antibiotic residues in foods of animal origin have increased beyond the permissible levels in developing countries.

SUPPORTING INTESTINAL HEALTH AND RESILIENCE OF FARM ANIMALS

The definition of "intestinal health" or "gut health" is not yet clear. It was initially proposed that gut health is the function of three major components: the diet, the mucosa, and the commensal microbiota. Later, researchers elaborated that it must include a diet that would provide sufficient nutrients, mucosa that maintains the gut integrity, and a microbial community that maintains a balanced, healthy environment (Jha et al., 2019).

Since we need to limit or remove antibiotics as growth promoters, and preventive medication or metaphylaxis, significant focus must be on precise nutrition and the concept of ideal protein, and other nutrients involved in the modulation of intestinal environment and epithelial integrity.

Excessive amounts of dietary protein reach the intestine, and the fermentation of it can produce various potentially toxic compounds (such as amines and ammonia), often associated with the growth of potential pathogenic bacteria (e.g., Clostridium perfringens) and the reduction of fecal counts of beneficial bifidobacteria (Yang et al., 2019). Similarly, formulation based on digestible rather than total amino acids reduce the non-digestible nitrogen reaching the intestine with an equivalent effect.

On the other hand, dietary amino acids requirements are defined based on growth or production performance, and those levels might not be the optimal for the vital roles they play on the small intestinal mucosa. Particularly, glutamate, glutamine, and aspartate are the major oxidative intestinal fuel. Utilization of glycine by the small intestinal mucosa to synthesize glutathione is a very important physiological pathway, and the role of glycine as a powerful cytoprotectant has also been recognized. The major end products of methionine and cysteine metabolism are glutathione, homocysteine and taurine, which play important roles in the intestinal immune and anti-oxidative responses. Threonine is highly utilized by the gut and is particularly important for mucin synthesis and maintenance of gut barrier integrity. Emerging evidence shows that arginine activates the mammalian target of rapamycin (mTOR) signaling pathway in the small intestine, integrating both intracellular and extracellular signals. It regulates gene transcription and protein synthesis, serving as a central regulator of cell metabolism, growth, proliferation and survival (LaPlante et al., 2009).

Other nutrients, like omega 3 and omega 6 poly-unsaturated fatty acids (PUFA), are essential for countless metabolic functions. Both fatty acids are needed for an adequate immune system; however, increasing the n3/n6 ratio reduces the production of the inflammatory mediators interleukin 1-β and prostaglandin E2, which is favorable to the integrity of tight junctions on the intestinal epithelium (Shin et al., 2017).

Dietary fiber (DF) stimulates the growth of beneficial intestinal bacteria, being fermented in the distal small intestine and large intestine with beneficial effects on the immune system. Microbial fermentation of DF results in the production of short-chain fatty acids (SCFA), branched-chain fatty acids (BCFA), lactate, amines, indoles, phenols, and gasses. In the absence of appropriate DF levels, proteolytic fermentation can take place in the colon, producing BCFA and potentially harmful metabolites like ammonia indoles, and phenols (Jha et al., 2019).

BIOSECURITY IN FEED AND FARM

Biosecurity practices in the feed to food chain are another fundamental tool to reduce AMR. Biosecurity helps to minimize the risk of entrance and transmission of microbial-associated pathogens, and therefore, reduces the need to use antimicrobials.

- **Feed Safety**

Heat treatment is a crucial processing step for feed hygiene management, preventing microorganisms from entering the feed to food chain. However, the efficacy of thermal treatment depends on the resistance of the contaminating agent and will not prevent further cross-contamination during

post-processing. Thus, corrective measures need to include different approaches: intensive feed quality monitoring to assess microbial risk situations, identification of critical control points and application of feed preservatives are important tools for microbial control, contributing to inhibit the growth of molds, and mycotoxins risk management.

• Farm environment and management

The adoption of proper farm biosecurity practices can considerably reduce the risk of infections and consequent use of antimicrobials. Important measures include defining zones of restricted access, limiting visitors, intensive cleaning and disinfecting between each production cycle, implementing a proper vector (wild birds, flies and rodents) control program, and coaching farm workers on the best biosecurity practices and risk awareness.

Monitoring the water quality and ensuring hygienic conditions throughout the water system will also help reduce microbiological load in the water and prevent biofilm formation in the water lines. All these steps are critical to prevent vertical and horizonal pathogen transmission.

• Vaccination

Vaccination programs play an important role in mitigating antimicrobials use, as they block the transmission of pathogens, including potentially drug-resistant forms. However, vaccination represents a particular stressor, inducing a reaction of the immune system with temporary inflammation. This represents a costly nutritional resource and it is important to limit over-activation after vaccination to avoid a drop in growth performance. Different studies have highlighted the interest of supplementing low inclusion rates of combined phytonutrients, such as curcuminoids (present in turmeric oleoresin) and capsaicinoids (present in red chili pepper oleoresin) in boosting the effects of vaccination while limiting its negative subclinical effects (Lee et al., 2011; Awaad et al., 2019; Upadhaya et al., 2020).

ENHANCING GROWTH AND FEED EFFICIENCY

In the dynamic world of livestock production, the increase of antimicrobial resistance and consumer demand for high-quality food has raised the interest for sustainable and 'natural' alternatives to AGPs to

meet growth performance and feed efficiency expectations. Phytogenic compounds are on the frontline for their demonstrated benefits in this field. Moreover, phytogenic compounds supplemented at low inclusion rates have shown to be beneficial not by inhibiting pathogens, but by supporting the animal's resilience to overcome them more effectively.

The proposed mode of action of phytogenic compounds is attributed to the mitigation of gut inflammatory response, the increase of the digestive secretions and nutrient absorption (and utilization) in the gastrointestinal tract, the improvement of animals' antioxidative status, reducing damage to intestinal cells and maintaining the integrity of the intestinal mucosal layer (Awaad et al., 2014; Bravo et al., 2014; Karadas et al., 2014; Pirgozliev et al., 2019).

An extensive number of studies in broilers demonstrated that the combination of carvacrol (present in oregano), cinnamaldehyde (present in cinnamon) and capsicum oleoresin (present in red chili pepper) has the potential to achieve similar levels of growth performance as AGPs and showed positive results in broiler carcass and meat quality (Bravo et al., 2009; Heng et al. 2017). Additional studies also showed this combination improved the nutritional value of low-metabolizable energy (ME) diets when fed to broilers. This beneficial effect seems to be mediated by decreasing the energy required for the maintenance of gastrointestinal tract, diverting more energy towards growth rather than maintenance (Bravo et al., 2011).

In poultry production, phytogenic compounds became a natural strategic tool to completely or partially replace the application of AGPs and have proved their effectiveness without involving risks to animals, consumers or the environment (Gharib et al., 2014).

POTENTIAL BENEFITS OF ANTIMICROBIAL REDUCTION AND MANAGEMENT

According to a 2019 report, the United States Center for Disease Control and Prevention (CDC) estimated that the annual cost of AMR is USD55 billion in the US, USD20 billion for health care and USD35 billion for loss of productivity. In contrast, costs related to drug-resistant bacterial infections in Europe correspond to EUR 1.5 billion/year. At the international level, it's estimated that AMR will reduce the global gross domestic product by up to 4% and the global livestock production by up to 7.5% by 2050.

These numbers provide a very clear understanding of the benefits of minimizing the use of antimicrobials. A multi-prong approach is required for proper antibiotic management and global reduction of AMR.

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About Célia Gomes da Silva

Graduated in Animal Science with a MSc degree by the University of Trás-os-Montes e Alto Douro (Portugal) and with a double BSc degree in Animal Husbandry (The Netherlands), Célia Gomes da Silva conducted her academic research in projects related with the effect of polyphenols on in vitro rumen fermentation and mycotoxins occurrence in feed. In 2016, Célia started her path in the feed additives industry, working with a broad range of product categories applied to microbial control, feed to food safety, gut health and contributing to the development of new solutions. In 2020, she joined ADM for the position of Global Product Specialist, focusing on Phytogenic Bioactives, where she's been actively involved in applied research, technical support, trainings to technical and sales teams and product life cycle assessment.

About Dr. Luiz W. O. Souza

With mixed expertise in animal nutrition and health, Dr. Luiz Souza has built his 20-years career with extensive work within research centers, farms and feed mills. Graduated in Brasil, he obtained further research experience in the US, and later joined the additives industry in Asia, based in Singapore. His holistic experience with swine and poultry includes in-farm management, welfare and bioclimatology, biosecurity, additives application, nutrition and formulation, good manufacturing practices, and raw material and feed quality control. Recently, Dr. Luiz joined ADM Animal Nutrition in the Vietnam office, to lead the technical sales and services in Asia.

WOAH CALLS FOR ANTIMICROBIALS NOT TO BE USED AS GROWTH PROMOTERS

The World Organisation for Animal Health (WOAH) urges veterinary authorities and the animal industry to live up to their commitments regarding the use of antimicrobials as growth promoters.

Antimicrobial resistance is a growing concern. In recent years, the international community has made important commitments to address this global health threat. One of these is to phase out the use of antimicrobials to promote growth in healthy animals. It is time to move from commitment to action, according to the World Organisation for Animal Health (WOAH).

Antimicrobial resistance (AMR) threatens the health of humans, animals, plants, and our shared environment. Too often, antimicrobials are misused or overused across sectors, creating the conditions for this phenomenon to emerge. While the majority of WOAH Members have taken strong action in recent years to reduce their use in animals, further efforts are needed as these drugs are still being inappropriately used as growth promoters in some countries.

TAKING STOCK OF THE USE OF ANTIMICROBIALS FOR GROWTH PROMOTION

In 2016, all WOAH Members committed to definitively ban the use of the highest-priority antimicrobials for humans and to phase out the use of antimicrobials in animals for growth promotion purposes in the absence of a risk analysis. How has this commitment been put into practice so far?

• Almost 20% of members still report using antimicrobials for growth promotion. Of these, it is estimated that 76% have not carried out any preliminary risk analysis.

• More worryingly, no less than 11% of WOAH Members still use as growth promoters at least one of the highest priority critically important antimicrobials for human medicine, such as colistin.

• At least 50% of the members using antimicrobials as growth promoters have no regulatory framework in place.

• In some countries, the labelling of certain feed additives intended to increase productivity does not mention the presence of low doses of antimicrobials, which are then unknowingly administered to animals by veterinarians and farmers.

Such practices are not in compliance with WOAH international standards or the Global Action Plan on AMR. So, WOAH emphasised that competent authorities and the livestock industry must fulfil their responsibilities to phase out the use of antimicrobials for growth promotion in animals.

WOAH standards make a clear distinction between veterinary medical use of antimicrobials, which is limited to the treatment, control, and, where appropriate, prevention of infectious diseases, and non-veterinary medical use. The organisation stated that the administration of antimicrobials for growth promotion in animals is a non-veterinary medical use, and it must not be assimilated to disease prevention use, which requires animals to be at a proven risk of disease if the medicine is not administered.

WOAH calls on its members to restrict the use of antimicrobials solely to veterinary medical use and to actively engage in dialogue with the concerned parties to achieve a total ban on the use of antimicrobials as growth promoters, starting with those that are critically important for human health.

According to the WOAH, competent authorities must enact relevant legislation in this regard and are invited to explore and promote alternatives to improve animal productivity, as relevant. These can include, among others, animal health programmes that focus on disease prevention (e.g., deworming and vaccination), biosecurity, and good animal husbandry practices.

The misuse of antimicrobials in different sectors accelerates antimicrobial resistance. WOAH called for the animal health sector to play its part in curbing this global scourge that threatens animal, human, and plant health and adopting sustainable practices.

ANTIMICROBIAL RESISTANCE IN SHRIMP FARMS

A Tale of Molecular Battles and Environmental Contamination

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"Initially, antimicrobial resistance (AMR) stood as a remarkable manifestation of bacterial intelligence, adapting and thriving in the modern scientific landscape of humanity. Its presence, akin to the proliferation of plastics in today's oceans, didn't raise significant concerns initially. However, as the reservoir of resistant bacteria burgeoned, scientists began grappling with a pivotal question: Could AMR bacteria not only inhabit but potentially dominate our world, or even forge a new one?"

Bacteria can be perceived as superorganisms, seamlessly coexisting with us in a manner reminiscent of the diverse life forms on Earth. Inhabiting our gut, they mirror the intricate web of life that surrounds us, persisting even after our demise, nourished by the remnants of our existence. The fascinating intelligence exhibited by these microorganisms prompts contemplation about the hypothetical scenario of a microbial uprising, where these bacteria, residing within us, embark on a transformative battle to supplant our dominance. Envision the intriguing question: What ingenious weaponry might they employ to assert their newfound supremacy?

As the realm of medicine underwent a revolution, the trajectory of sophisticated living evolved in tandem. The breakthrough of the germ theory illuminated the presence of bacteria, setting the stage for a transformative understanding. The revelation of antibiotics emerged as a potent weapon in our arsenal against bacterial adversaries, reshaping the landscape of medical warfare. Evolving medical practices acted as a bulwark, curtailing the spread of diseases, transforming once-incurable ailments into recoverable conditions. Casualties dwindled with the advent of vaccines, reducing the toll of afflictions.

Today, treatments are conveniently accessible with just a tap, ushering in an era of unparalleled medical convenience. Yet, amidst these strides, a palpable absence lingers. Since the inception of modern medicine in the 20th century, marked by the discovery of penicillin, humanity held an optimistic view of antibiotics. Experts lauded the profound role these antimicrobial agents played in treating infectious diseases. However, as we entered the next century, optimism gave way to concern with the emergence of the antibiotic pipeline, signifying the ascent of resistant bacterial strains.

What sets antimicrobial resistance (AMR) apart, causing many eyebrows to raise, is its exceptional nature— a phenomenon challenging the efficacy of once-reliable antibiotics and posing a significant threat to our ability to combat infectious diseases effectively.

The word 'pandemic' resonates frequently in our present, raising the question: Could the next pandemic be the insidious rise of Antimicrobial Resistance (AMR)? This imperceptible force is burgeoning beyond conventional limits, prompting reflection on the dual nature of scientific progress. Does science, in its pursuit of knowledge and solutions, bring forth both blessings and challenges, leaving us to grapple with the nuanced consequences of our discoveries?"

NEED FOR AN HOUR

Initially, antimicrobial resistance (AMR) stood as a remarkable manifestation of bacterial intelligence, adapting and thriving in the modern scientific landscape of humanity. Its presence, akin to the proliferation of plastics in today's oceans, didn't raise significant concerns initially. However, as the reservoir of resistant bacteria burgeoned, scientists began grappling with a pivotal question: Could AMR bacteria not only inhabit but potentially dominate our world, or even forge a new one?

The gravity of the AMR crisis becomes evident in the intricate web connecting people, animals, and plants. It transcends beyond a mere healthcare issue, extending its ominous influence to threaten crops, farms, and ultimately, the food security of nations. This complex interdependence highlights the multifaceted nature of the AMR challenge. From the perspective of a fish pathologist, the urgency to underscore the significance of shrimp farms becomes imperative. Regrettably, these farms, serving as the primary and widely adopted practice, unwittingly become reservoirs for the global dissemination of this invisible adversary. The implications of AMR extend beyond the realm of health, infiltrating crucial sectors and demanding a holistic approach to safeguard our interconnected world.

RISKS AND CONSEQUENCES OF UNCONTROLLED ANTIBIOTIC USE IN SHRIMP FARMING

Shrimp farming in Asia heavily relies on antibiotics, with approximately 10% of shrimp feed containing antibiotics such as ciprofloxacin, chloramphenicol, erythromycin, co-trimoxazole, and tetracycline. The unregulated access to antibiotics in regions lacking proper oversight results in their indiscriminate use, contributing to antibiotic resistance in both pathogenic and non-pathogenic bacteria. The extensive use of antibiotics in intensive aquaculture has led to the emergence and spread of antibiotic resistance, a serious public health concern. Numerous studies have documented antibiotic resistance in bacteria from shrimp farming, and incomplete antibiotic utilization in veterinary and human consumption contributes to the release of antibiotics into the environment. This, in turn, leads to widespread multiple antibiotic resistance and reduced efficacy in treating diseases caused by resistant pathogens. The rise of antibiotic-resistant bacteria and genes poses a significant threat to public health, as human exposure to antimicrobial resistance can occur through the consumption of aquaculture products. Minimizing total antibiotic usage is crucial to alleviate the selection pressure for antimicrobial resistance.

The issue of antibiotic resistance in human medicine stems from inappropriate or excessive antibiotic use. However, in aquaculture, sub-therapeutic levels of antibiotics in the environment, especially in shrimp ponds, have been identified as the primary source of antibiotics. The long-term prevalence of antibiotic resistance genes (ARGs) in shrimp aquaculture, found in pond water, sediment, and shrimp intestinal tracts, creates conditions favorable for transferring these genes to indigenous or pathogenic

microorganisms. This transfer jeopardizes the efficacy of antibiotics used in treating bacterial infections and poses risks to both the aquaculture industry and human health. Research indicates a significant prevalence of antibiotic-resistant bacteria (ARB) and antibiotic-resistance genes (ARGs) in seafood, including marine fish, shrimp, and mussels.

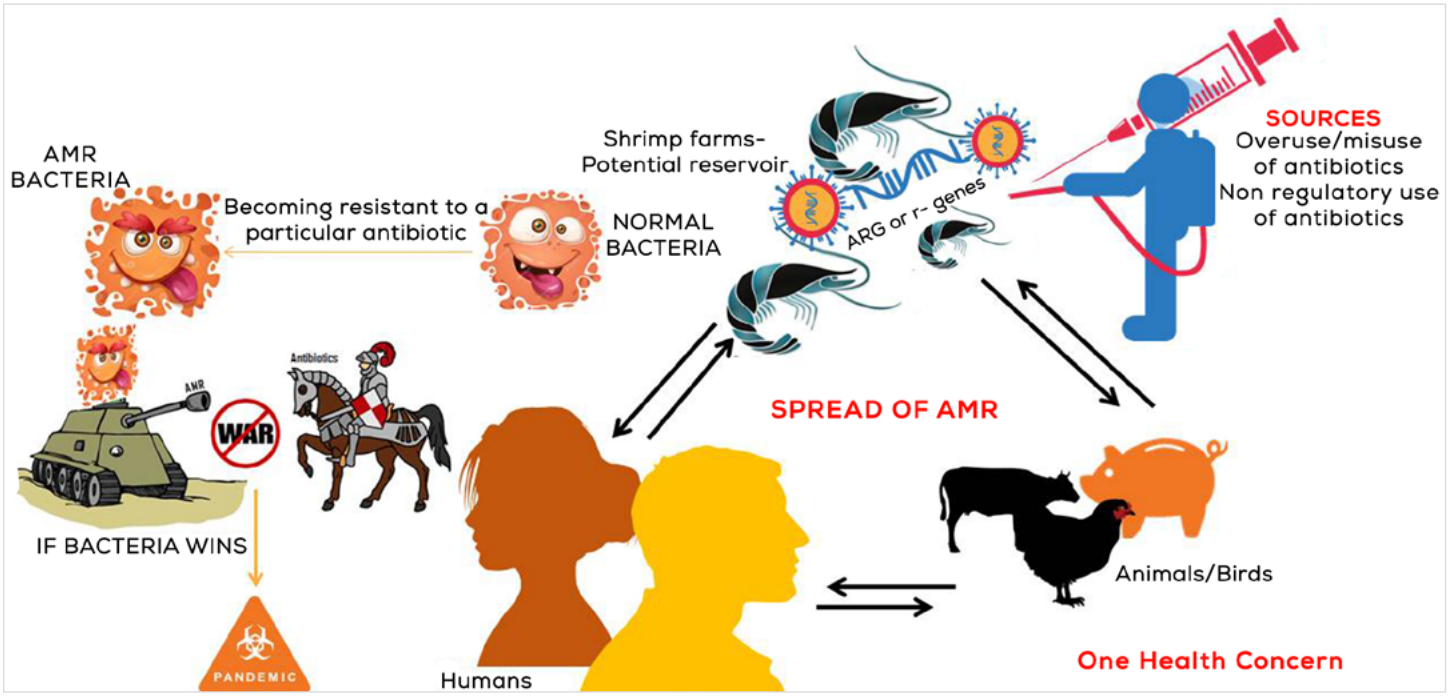
Investigations in mariculture farms revealed resistance in *Vibrio parahaemolyticus* isolates obtained from various seafood. The high resistance levels observed, particularly for methicillin and penicillin, reflect the global challenge of combating antimicrobial resistance in both clinical and environmental settings.

The release of antibiotics into the environment has adverse consequences for the ecological system and human health. Methicillin-resistant *Staphylococcus aureus* (MRSA) strains, resistant to methicillin and other β-lactam antibiotics, pose significant challenges in treating infections and have been reported worldwide.

SHORT INSIGHTS FROM MY RESEARCH

Here is my never-ending story of AMR. We always thought COVID was a threat but AMR is a close second one. This is about finding the one in the shrimp farms of Tamil Nadu. When I started to analyse the occurrence of this pattern, I got 85% positive samples which had shown resistance against commonly used antibiotics in aquaculture including ampicillin along with cephalothin, aztreonam and erythromycin. This means once the shrimp farmer applies the above-described antibiotics, neither the super organism will not get killed nor will the shrimps get better. To know them in a molecular level, I studied the genome of those resistant isolates.

There Antimicrobial Resistant Genes (ARG) or r-genes are the group of genes responsible for the AMR in the molecular level. Imagine the AMR bacteria as Avengers team. Suppose the Ironman is resistant to penicillin, and he has penicillin resistance genes (beta lactamase resistant genes) in his genome. He will also be very good at sharing his gene by making copies to Captain America and in such a way these two guys will share and spread their resistant genes to the whole group and the group members while fighting for the world will pour their genes in the environment and during this process of busy globetrotting, those genes will mutate randomly and increase their spectra of resistance. This process is simply called as 'Genetic Jugglery'. Beta lactamase gene (eg – blaTEM, blaSHV etc...) and macrolides (eg- erm C, erm B etc...) are 2 major genes that have shown this universal distribution with extended spectrum of resistance. This study shows positive for the blaTEM gene & ermB gene.



This resistance can be linked to the other antibiotics by overuse or improper use of antibiotics in shrimp farms. I studied the shrimp farms of Nagapattinam district. There is a canal running at the rear of these farms where the effluents from the farms are mixing up & people are catching fish from there for food. So, there is a certain possibility of the spread of this invisible AMR soul traveling beyond its limits to create their world. Carrying AMR bacteria in our gut could potentially lead to infection, which is difficult to treat. People may not display any symptoms when colonized, but they might suffer from infections in the future (or) pass on the resistant bacteria in their gut to other people who may become more vulnerable.

CONCLUSION

The escalating use and accessibility of antibiotics have highlighted a concerning trend: the pathogens targeted to prevent harm to humans and animals are developing resistance, diminishing the effectiveness of these crucial tools. Certainly, advanced technology and dedicated scientific research offer promising futuristic solutions to address environmental and health concerns. However, the substantial use of antibiotics can be curtailed by farmers to ensure food safety.

Recent headlines have highlighted the rejection of Indian shrimp exports by the European Union, attributing it to the use of prohibited antibiotics. In this context, upskilling becomes crucial, tapping into the potential of students and newcomers to raise awareness among farmers and readers. Additionally, establishing realistic goals for the proper and judicious use of antibiotics is imperative. Addressing antibiotic resistance requires a multifaceted approach, including responsible antibiotic use in both human and veterinary medicine, enhanced surveillance, development of new antibiotics, and public awareness. Collaboration on a global scale is essential to combat this growing threat and ensure that antibiotics remain effective in treating bacterial infections, safeguarding the well-being of both humans and animals.

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About Abisha Juliet Mary S J

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SUSTAINABLE ANIMAL HUSBANDRY

Is there a space for something more than the usual social, economic and environmental aspects?

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"A malicious saying describing something that cannot be reached any way: "you will see it when a pig will see the sky" is right on target here not only according to pig's vision. Is that it? Can nothing be done for pigs, cows, hens to ease their life behind bars? The research findings do prove otherwise as the mere reduction of stocking densities and using e.g. phytogenic additives in the feed lessens the need to treat the livestock with antibiotics and reduces the mortality, thus resulting in improved growth rates..."

Nowadays, sustainable development is a very popular subject. In agriculture, it means striking a right balance between what is economic, social, and environmental. More specifically, it is about a development which respects environment and where resources are managed thoughtfully, causing no harm to what future generations may inherit from us. In sustainable development at farm level, all three dimensions are being taken into account. In the 21st century, global sustainability is measured by the mutual coexistence of the biosphere and civilisation in an environmental homeostasis. All 17 Sustainable Development Goals are presented in detail at the United Nations' website (Figure 1), most of them directly or indirectly relating to agriculture, including livestock production. The impact of farming on greenhouse gas emissions can hardly be overlooked (Figure 2). Although much still remains to be done, the emissions of carbon dioxide, nitrous oxide methane, and their share in the various livestock production sectors are measurable and regularly reported upon.

EU maintains a fairly restrictive policy in this matter. However, the high demand for animal protein coupled with growing pressure on reducing emissions are likely to result in the risk of relocating production to such parts of the world where EU restrictions do not apply. This, unless appropriate mechanisms are put in place, might result in an exacerbated negative impact on the climate on Earth.

FOOD SECURITY IN THE 21ST CENTURY

"May you live in interesting times", goes a Chinese saying, or more likely a curse. Today, after over a year of Russia's continued invasion on Ukraine, one has to wonder how Ukraine has managed to provide its citizens with unfailing supplies of food. People in urban areas managed to survive thanks to their strong family ties, and traditional links with the countryside. Furthermore, the high fragmentation and diversification of agricultural production turned out a helpful factor, as food is easier to come by then. Thus, centralisation of livestock production and its intensification do have their limits and, in this case,

Figure 1. *Sustainable Development Goals*

they come under the heading of "food security". The case of Ukraine just brought its importance back as it stayed far away from EU boundaries and still there is a problem of hunger being unsolved. Every four seconds, one person, usually it is a child under the age of five dies of hunger. There is a variety of reasons for this, from the growth of the world population and thus the increased demand for food, to changes in consumption patterns, rising food prices, expanding water-scarce areas, climate change, loss of biodiversity, and losses in and various wastages of food supplies. Nevertheless, as per the United Nations data, 40% of the world's human population relies on agriculture for their livelihoods, with up to 80% of the global food demand being met by 500 million small, rain-water dependent farms. With this in mind, investing in small-scale farming seems key to strengthening food security for the poorest, as well as sup-

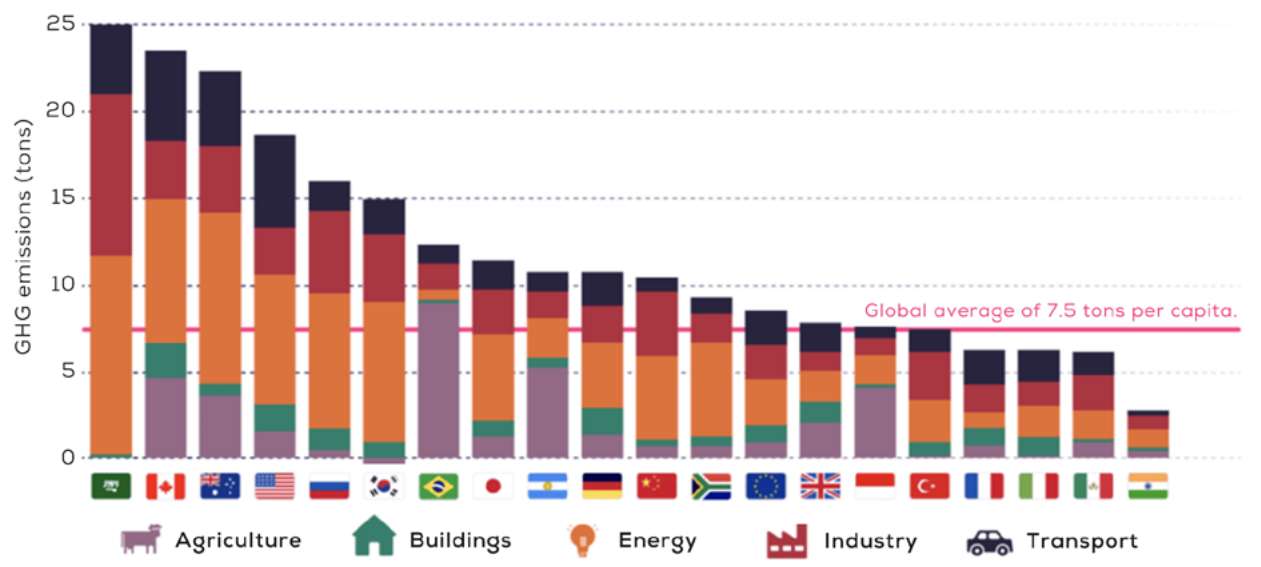

Figure 2. *From among the G20 economies, Saudi Arabia produces over six times more emissions per capita than India*

plying local markets with food. One thing is certain: access to biodiverse and more fragmented farming, especially if not too dependent on technology, works really well in situations of crisis. The above does not contradict existence of more intensified farming because, as with just everything, it is good to maintain a right balance.

WHAT MAKES THE BEST INVESTMENT?

There are many factors on which the profitability of livestock production depends on, with feed costs as a major contributor. Then there are costs of handling the animals, veterinary care bills, costs of media such as electricity and water, depreciation of buildings and equipment, etc. In the past, the issue of profitability was a taboo topic for many, especially in the pig production sector, where only a small minority was able to make long-term profits while the vast majority suffered losses. In such circumstances, surviving instead of investments is top priority. The question is, and it actually concerns the entire meat sector, what might become an added value of meat which would allow its producers to gain a competitive edge at the lowest possible cost. Meat leaders, especially producers of poultry, derive their competitive advantage from lower prices based on lower production costs. The poultry market, is way more flexible with its shorter production cycles and higher liquidity, while the red meat production is by far more fixed. Even the bird flu seemed to have treated poultry producers somewhat kinder compared with how e.g.. ASF affected meat producers. In such conditions, how can one build a competitive advantage against the inflow of cheaper non-EU meat?

LIVESTOCK OF YESTERDAY AND TODAY

Over the past few decades, breeding progress has significantly re-shaped the whole animal husbandry, and it even has affected the very appearance of the animals. Also, feed efficiency, growth rates, meat yields, rearing parameters and survival rates have improved significantly, and this applies to virtually all livestock species. The meat yield of fattening pigs, the fattening period of broiler chickens, or the milk yield of cows seem now pushed to their biological extremes. In fact, however, industrial animal husbandry does have certain consequences and constraints as feeding the masses inevitably comes at a price. In the past, animals used to live in the countryside but now they live in city like conditions, since what else can one call all these stacked piggeries, barns, and poultry sheds? Furthermore, they have no access to sunlight and no opportunity to take forage or herbs from the pasture swards or to walk on anything other than concrete floors or grates: such is the daily reality of farm animals. A malicious saying describing something that cannot be reached any way: "you will see it when a pig will see the sky" is right on target here not only according to pig's vision. Is that it? Can nothing be done for pigs, cows, hens to ease their life behind bars? The research findings do prove otherwise as the mere reduction of stocking densities and using e.g. phytogenic additives in the feed lessens the need to treat the livestock with antibiotics and reduces the mor-

tality, thus resulting in improved growth rates. This of course has got a huge positive impact on animal welfare and comfort. As proven by a study conducted in Switzerland, where pig farrowing crates were completely abolished by 2007, concerns about sows crushing their piglets proved unfounded. If given more space, sows respond with more litters, higher birth weights, and higher weaning weight of their piglets. The economic success (or otherwise) of such a venture will be most likely resolved by consumers and the purchasing power of their wallets, just as the case was with cage-free eggs.

THE PERCEPTION OF ANIMAL PRODUCTS

It takes an average shopper just over a second to select a product from what is displayed on a shelf. Is one second really enough to study the label? For digital natives, pictorial writing is nowadays a must. Packaging has become more important than the product itself. What's inside the packaging? Advertisements for foods compete intensely in portraying farming as an idyllic space for both humans and animals. All the milk, pork and eggs in supermarkets do not come, however, from the farms as they are pictured in popular TV series. On the other hand, one indeed can hardly pass through the centre of any large city without being confronted with billboards posted by various NGOs which present themselves as promoting animal rights. Such billboards present images which consumers find disturbing. Certainly, these images are loaded with emotions, but do they present facts, too? On the one hand, animal rights activists sometimes do use surreal arguments, but are they all in the wrong? Consumers are informed about sows encaged for a significant part of their lives, without even being able to turn their bodies around. Other stories refer to castrations, docking of piglets' and lambs' tails without anaesthesia, trimming of beaks, cannibalism among farm animals, stereotypies e.g. of sows because of lack of stimuli of animals more intelligent than dogs. Finally, there are the issues of transportation, loading and unloading of animals, lack of space, use of prods, and general mistreatment of animals by their handlers. If animal husbandry problems continue to be denied, is it going to help consumers understand them better? Actually, such a strategy stands no chance since more inquisitive souls will rather decide to reject an entire market segment than give producers a second chance. And, even though it may not be easy to engage is a debate with someone who proposes a ban on eating all meats, it may be worth just giving the concept a thought. At the Feedinfo Summit in Barcelona (September 2022), Tony Anderson, former marketing director of Easy Jet and an outsider to the farming industry, said that the airline industry and animal production had more in common than not, and that they faced similar challenges. What he meant were high expectations on the part of general public regarding environmental protection and the associated emissions restrictions being implemented at a sensitive time of the COVID-19 pandemic. Both sectors have a lot to change in terms of environmental impact. The air transport boasts about what has already been achieved and presents plans for the future. Is the meat sector working just as hard on how it is being perceived? Is it developing a strategy for the future or is it turning its eyes away from the problem?

ANTIBIOTIC-FREE AND GMO-FREE MEAT JUST AREN'T ENOUGH!

"Antibiotic-free meat" is a slogan which consumers recognise only too well. But what about animal welfare? Given that animal husbandry has become heavily industrialised, is it possible for one's pork chop to be ethically procured? Can we really think of some added value or is it just marketing? Steve Ells, founder of the Chipotle Mexican Grill chain, was one of the first to offer in his restaurants burritos made from antibiotic- and hormone-free, humanely-raised pork. Ells came up with the idea some 20 years ago and, despite a higher price (by about US $1), he managed to double the sales of his pork burritos. Of course, the statement on the label is important, but more important still is the certification. This is because meat producers, even those who farm grass-fed animals, too often take advantage of their consumers' lack of knowledge: cattle grazing on grass or being fed grass pellets in the last phase of their fattening is something quite the opposite. An NGO called Humane Farm Animal Care (HFAC) administers the “certified humane raised and handled” program label. Furthermore, there are many NGOs which educate consumers about animal welfare and help them choose products which guarantee so. BC SPCA, a Canadian organisation, provides on its website (https://spca.bc.ca/) a clear explanation of various markings. The added val-

Figure 3. *Examples of certificates present on the market*

ue in this case is the following: cage-free, restraint-free, farrowing restraint-free, an enriched environment, the possibility of expressing natural animal behaviour, and the transparency of the entire production process. The organisation presents several labels backed up by certificates and verified with independent audits (Figure 3).

The cooking website https://www.allrecipes.com offers beginner's guides to help consumers source meat from sustainable farms which ensure increased levels of animal welfare. Providing consumers with reliable information along with tracking the entire supply chain is part of the "farm-to-table" strategy, and it would be good to extend this to include animal welfare. The idea originated in the western economies and provides an alternative to the intensive farming model. Instead, farms operate according to the principles of regenerative agriculture as they draw on the idea of integrated, organic and precision farming. One of such farms is called "Lubuskie Angusowo" (located in northern Poland), whose owner aptly encapsulated the animal husbandry pattern as: "having a whole good life with just one bad moment". The “bad moment” is when the fattened animal is killed with a shot to its head, fired from a hunting pulpit, in a company of a few other individuals from the same herd. The reaction of the other animals from the group is a slight wiggle, after which the cattle are moved out of their quarters. Then a special vehicle arrives (a type of mobile slaughterhouse) where the animal is bled out, with the blood fully recovered. By law, after slaughtering, an animal must be sent for processing within two hours. Slaughtering in pasture is possible only after obtaining an appropriate certificate. All what is missing is a QR code for consumers to easily identify the purchased product.

DO I REALLY KNOW WHAT I EAT?

Nowadays, public opinion is increasingly guided by emotions rather than by objective facts. The market for added-value products, which would be different from conventional ones, is on the rise. Consumers are looking for food which is healthier and tastier, raised with no antibiotics, presenting good value for money and, increasingly, which meets high ethical standards. The market can either meet the demands by overcoming difficulties, or it can just ignore them as if saying: "it has always been this way". This, however, will no longer justify a lack of action, and certainly will not convince the public. As scientific research demonstrates, change is not only possible and beneficial to the environment, but it is also economically and socially viable for farmers. But what about consumers? Can one have between three and five meat-based meals a day and still claim that they take good care of their health? It may sound like a cliché but why not shift from quantity to quality? Once this is done, then it will be helpful to have properly labelled food (which already proves tastier and of better quality than industrially-produced one). Even though decisions on purchasing one's food are affected mainly by the affluence of one's wallet, the price of cheap meat should not be paid by the environment, and certainly not by the animals themselves.

An animal is not an item. For this reason, any pig, cow, sheep or chicken should always be considered more important than the chop which finally is produced from it.

The time has come for meat products aimed at welfare sensitive consumers!

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GROWING PROFITABLE HEIFERS: **A PRODUCTIVE LIFE STORY**

Dr. Gavin Staley
Technical Service Specialist
Diamond V/Cargill

"The productive lifespan of dairy cows is short compared to their natural life expectancy of twenty years. The average is very low in most developed dairy industries. This is becoming a global problem that we are seeing occur in many countries across the globe."

Around the globe, there is a growing need to extend the productive lifetime of dairy cows. Not only is it a necessity, but it can be economically and environmentally beneficial. Productive life can be defined as the time from first calving to culling, or when the cow is no longer sufficiently productive.

Unfortunately, the average lactation of most dairy herds is low (2.1-2.2), which means productive life is limited. Many cows still have a replacement or "mortgage" cost when they leave the herd, as their breakeven point is often the 2nd lactation. Healthy mature cows (Lact>2) are most profitable, but too often, heifer pressures and involuntary culls cut us short from reaching our full profit potential.

So, what needs to be done differently? Consider the following areas.

Heifers need to be bred at the right combination of age and body maturity so they can be close to mature size and weight at calving. An aggressive heifer management program will implement the right nutrition to keep heifers growing into productive adults.

It's easy to get impatient and want to breed heifers early to get them into the lactating herd and have them start paying off their debts as soon as possible. But if long term success is the goal, then making sure the heifers reach the milking string fully prepared to perform will help establish long-term success.

There is a name for these heifers that grow well and are prepared to freshen and thrive as cows—we call them platinum heifers. Set your herd goals to produce as many platinum heifers as possible. Start by setting your protocols to breed heifers by weight, not by age. The right weight is different for each herd and is based on your herd's average mature weight. To find this weight, weigh third and fourth lactation cows when they are between 80 and 120 days in milk.

With that goal weight in mind, you can develop a calf and heifer management program to achieve the proper growth rates to reach the optimal size in a reasonable amount of time. Since you are going off heifer size to make your breeding decision and not age, it's important to weigh heifers at regular in-

tervals—birth, weaning, pen moves, etc.—to make sure heifers are progressing toward the goal weight. You can choose to eyeball weights, but scales are much more accurate.

If heifers are bred at their ideal weight, then your heifer management program needs to continue their growth through to freshening. Ideally heifers will be at 95% of mature weight close to calving (DCC>260). Once they freshen (DIM<7) they should still be 85% of mature body weight. Determine the difference between goal and actual weights and adjust by either delaying breeding of virgin heifers or increasing average daily gain.

It certainly is possible for heifers to reach ideal size at an optimal age. It's also possible to keep first lactation cows growing and developing so they can turn first lactation success into second lactation success, and beyond. But reaching these milestones takes sound management and healthy animals. The right nutrition program from birth through calving and into lactation will help heifers reach growth milestones and fulfill their genetic potential.

In general, cows pay off their heifer rearing bill in their second lactation. Once that bill is paid, profitability goes up substantially.

The productive lifespan of dairy cows is short compared to their natural life expectancy of twenty years. The average is very low in most developed dairy industries. This is becoming a global problem that we are seeing occur in many countries across the globe.

The five key factors influencing herd parity demographic (the five drivers of the total cost of maintaining herd structure) are:

1. Calf value opportunity cost
2. Aged cow cost
3. Lack of maturity cost
4. Herd replacement cost
5. Genetic opportunity cost

Normally, the idea is that younger is always better. But there is a danger if these cows never pay off their "mortgage". Bear in mind, in the second lactation we finally break even. The breakeven point is the point at which a cow has created sufficient income from milk production to cover the costs of raising. So, the more mature animals, or what we call the "Golden Girls", are extremely important because they have paid their mortgage and are high producing. What are the requirements to achieve these "Golden Girls"? You want them healthy, fertile, high ECM (>6lbs fat & protein/day), and we need MORE of them.

Keeping healthy cows is vital as it's one of the main reasons these older girls get kicked out of the herd. Farms decide they have issues and then they leave. However, we need to consider working through the issues and strive to keep some of them regardless. It is important to remember, these mature animals, those in lactation group three, are producing a lot compared to their competition in lactation groups one and two.

Cows that live long, productive lives can be extremely profitable. It's important to maintain gut health and immunity.

While effective management plays a significant role, proper nutrition and nutritional interventions also play a vital part in paving the way towards a more productive life and generating more Golden Girls.

As a young ruminant, her nutritional requirements and nutritional health needs, are comparable to other young bovines, including beef calves, as they become full-fledged ruminants. It's important to keep in mind that post weaned calves are still developing their rumens and their diets need to account for this continued development. Supporting optimal health and performance is crucial.

One way to support her health and performance is to incorporate a postbiotic feed additive. A postbiotic has been proven to support balanced immunity, digestive health and development, and overall growth and performance. Be sure to engage your nutritionist and veterinarian for nutrition and management solutions to create a program that's ideal for your herd.

Extending the productive life of dairies may be a necessity under the current and predicted dairy environment. Achieving this goal requires a high level of management and focused intentionality. Creating the environment that creates and retains more profitable mature cows ("Golden Girls") along with producing the right number of quality mature heifers ("Platinum Heifers") is a large part of the Productive Life story.

About Dr. Gavin Staley

As a Technical Service Specialist for Diamond V, Dr. Gavin Staley provides technical and sales support to dairy producers, nutritionists, and feed manufacturers. He is based in Turlock, California.

Before joining Diamond V Dr. Staley spent five years on faculty at the University of Pretoria, South Africa, as a Senior Lecturer in Veterinary Reproduction. Following that he entered the private sector, joining the largest commercial dairy practice in South Africa. Later Dr. Staley and his family emigrated to the United States where he joined a dairy practice in Wisconsin. He later relocated with his family to California in 2003 when he joined Diamond V.

Dr. Staley received his veterinary qualification and earned a specialized degree in reproduction (MMedVet) from the University of Pretoria, South Africa. He also achieved Diplomate status in the America College of Theriogenologists (DiplAct).

ROLE OF NON-STARCH POLYSACCHARIDES (NSP) AND INDIGESTIBLE OLIGOSACCHARIDES IN FISH NUTRITION

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Plant-based ingredients are the most cost-efficient alternative feed for fish in the aquafeed industry. Non-starch polysaccharides (NSPs) reduce the digestibility and bioavailability of nutrients in fish. NSPs are indigestible carbohydrates that can promote microbial growth in the gut. These prebiotics have shown beneficial effect on fish growth and health. These changes in GIT altogether stimulate the immune system, thus, enhancing the host's protection against infections.

Feed costs account for over 50% of the variable costs in most aquaculture operations, therefore applying the best feeding strategy can have a significant impact on optimizing profit, which is the primary goal of commercial aquaculture. Fish meal due high protein content and favourable amino acid profile is an important protein source among commercial feeds and is preferred by fish culturists, however, due its restricted production (which increases its cost), the use of plant-based ingredients is increasing currently. Plant-based ingredients so far are the most cost-efficient alternative feed for fish in the aquafeed industry. This has increased the dietary content of indigestible carbohydrates such as **non-starch polysaccharides (NSP) or dietary fibers** which reduces the feed digestibility and bioavailability of nutrients.

Non-starch polysaccharides (NSPs) are a complex group, composed predominantly of linked monomers of hexoses and pentoses, e.g., galactose, glucose, arabinose, xylose and mannose that cannot be digested in fish and hence reduces the apparent digestibility of the diet and has negative impacts on growth. This is because the enzymes such as β-glucanases or β-xylanases that digest NSPs are scarce or absent in fish. Thus, the dietary NSPs remain indigestible and cannot be used as an energy source. NSP-containing diets in fish has slower rate of gastro-intestinal passage and also shown to reduce the availability of nutrients.

Through proper management of the NSPs in these plant materials, plant resources can very well be utilised as cheaper fish feed ingredients. The utilisation of exogenous enzymes (β-glucanases and β-xylanases) in feed processing decrease the negative effects of NSP and thus improve the nutritive value of feed. Moreover, NSPs such as β-glucans and mannose promote colonisation and microbial growth in the gut, thereby acting as immunostimulants.

The hydrolysed products of NSP, so called as **indigestible oligosaccharides (or prebiotics)** have shown beneficial effect on fish growth and health. **Indigestible oligosaccharides** are small fragments of carbohydrates (in between of simple sugars and

polysaccharides) or oligosaccharides of galactose, fructose or mannose that selectively stimulate the growth or activity of one or a limited number of bacterial species, already present in the gut and thus improve host health and act as "prebiotics" (promote the growth of beneficial microbes). A probiotic i.e., a live microbial feed supplement which beneficially affects the host animal by improving its intestinal balance can be directly given along with feed, however, the probiotics strains can remain dominant in the gastrointestinal tract only during the dietary treatment. Such an exogenous addition of a single probiotic will result in long-term colonisation of the gut, especially when the strains used do not belong to the normal dominant intestinal flora. In those cases, the stimulation of specific indigenous microflora by supplementing fish feed with indigestible carbohydrates that act as prebiotic is more fruitful.

Indigestible carbohydrates could either be given to fish indirectly as NSP supplemented with exogenous enzymes in the feeds or included in the feed as prebiotics.

NON-STARCH POLYSACCHARIDES (NSPs)

Non-starch polysaccharides are long polymeric carbohydrate chains containing up to several hundred thousand monomeric units, excluding α-glucans (starch). NSPs in aquaculture feeds are present as an integrated part of the cell wall (upto 90% NSPs) of plant ingredients and also in a purified soluble form, such as guar gum, to stabilise the pellet. The most abundant plant cell wall NSPs include cellulose, hemicellulose and pectins; while fructans (inulin), glucomannans and galactomannans are not so abundant as of those aforesaid and serves as the storage polysaccharides within the plants. Mucilages, alginates, exudate gums, β-glucans and various modified polysaccharides are other constituents of the NSPs.

The main difference between NSPs and starch is that, starch is composed entirely of glucose monomers, which are linked by α-glycosidic bonds while NSPs are composed of different kinds of monomers, which are linked predominantly by β-glycosidic bond. The difference in bonding structure has profound effects on digestibility, as different classes of enzymes are required for the hydrolysis of α- and β-glycosidic bond. The predominant starch digestive enzymes are α-amylase, α-glucosidase and oligo-1-6-glucosidase. In combination, these enzymes specifically hydrolyse the α-glycoside bonds of starch to yield glucose. On the other hand, the enzymes required to digest NSP, such as β-glucanase and β-xylanases, are very scarce or even absent among fish species. The physiological impact of individual NSPs is dependent on the sugar residues present and nature of the linkage present between these residues.

Classification of NSPs

NSPs are classified into three main groups:

- Cellulose,
- Non-cellulosic polymers and
- Pectic polysaccharides.

Non-cellulosic polymers include arabinoxylans, mixed-linked β-glucans, mannans, and xyloglucan while pectic polysaccharides include polygalacturonic acids substituted with arabinan, galactan and arabinogalactan (Table 1).

NSPs can be broadly classified into:

• Insoluble fibers include cellulose, hemicellulose and pentosans like xylans and arabinoxylans, and

• Soluble fibers include mixed linked b-glucans, galactomannan (guar-gum) and pectins.

Role of NSPs in fish nutrition

The adverse effect of NSP is associated mainly with solubility of NSPs which depends on their chemical nature and their association with the cell wall components and which in turn is responsible for their viscous nature (due to which they do not move easily). Soluble NSPs increases the viscosity, which increases intestinal transit time, delay gastric emptying and glucose absorption, increase pancreatic secretion, and slow absorption.

Insoluble fibers are the NSP constituents of the cell wall that shield the substances inside the cell from the effect of the digestive enzymes and thus reduce their digestibility. However, insoluble fibers decrease transit time, enhance water holding capacity of the digesta (chyme), and add to the bulk of faeces in non-ruminant animals.

1. Effect on transit time, feed intake, nutrient digestion and absorption

Soluble NSPs bind with the intestinal brush border and increase the thickness of the unstirred water layer adjacent to the mucosa. This increases the viscosity of intestinal content which decreases the intensity of intestinal contractions, which in turn slows down the transit time of the digesta or chyme through the small intestine. Slow passage of digesta through the digestive tract, delays the gastric emptying time which results in reduced feed intake.

Due to reduced intestinal peristalsis a certain part of water contained in the chyme forms a hydration sphere

Table 1. Classification of non-starch polysaccharides

Category	Monomeric residue	Linkage	Sources
Cellulose	Glucose	β-(1→ 4)	Most cereals and legumes
Non-cellulosic polymers			
Arabinoxylans	Arabinose and Xylose	β-(1→ 4)- linked xylose units	Wheat, rye, barley, oat, rice, sorghum
Mixed-linked β-glucans	Glucose	β-(1→ 3) and β-(1→ 4)	Oat and barley
Mannans	Mannose	β-(1→ 4)	Coffee seed
Galactomannans	Galactose and mannans	β-(1→ 4)-linking mannan chains with α-(1→ 6)-linked galactosyl side groups	Locust bean gum and guar gum
Glucomannans	Glucose and mannans	β-(1→ 4)-linked mannan chain with interspersed glucose residues in the main chain	Sugar-beet pulp
Non-cellulosic polymers			
Arabinans	Arabinose	α-(1→5)	Cereal co-products
Galactans	Galactose	β-(1→4)	Sugar bean meal, sugar-beet pulp
Arabinogalactans (Type I)	Arabinose and Galactose	β-(1→4) galactan backbone substituted with 5-linked and terminal arabinose residues	Grain legumes
Arabinogalactans (Type II)	Arabinose and Galactose	β-(1→3,6)-linked galactose polymers associated with 3- or 5-linked arabinose residue	Rapeseed cotyledon

around the intestinal content such that the digestive enzymes are not able to enter the intestinal lumen and also the mixing of enzymes with the intestinal content decreases. This decreases the efficiency of digestion.

As no digestive enzymes exist for the breakdown of cellulose and other NSPs, volatile fatty acids (VFA) like acetate, propionate and butyrate are produced in large amount in the gastrointestinal tract (GIT) by microbial fermentation of carbohydrates and endogenous substrates such as mucus. Such drastic change in gut ecosystem decreases nutrient digestion. Increased viscosity also causes shortening of intestinal villi and decreases their thickness which reduces the intestinal absorption surface area.

2. Effect on nutrient metabolism

NSP influence the metabolism and utilisation of dietary nutrients like glucose, lipid, amino acids and minerals. It also affected the distribution of digestive enzymes, gastric emptying rate, nutrients absorption and digestion.

• ***Effect on glucose***

Diet containing high amount of soluble fiber increases viscosity of intestine content. This lowers the activity of digestive enzymes (like intestinal maltase) on substrate (say, maltose), which in turn reduces the availability of glucose and thus delays the intestinal absorption of glucose.

• ***Effect on lipid and cholesterol level***

NSPs may bind or entrap bile salts (that cause emulsification of fats), thus reducing their efficiency of solubilizing fats. This disturbs micelle formation, thereby impairing lipid absorption in the GIT.

Increased viscosity in the intestine also increases bile acid excretion. As cholesterol is the precursor of bile acids so, it alters the hepatic cholesterol metabolism to provide cholesterol for enhanced bile acid synthesis and thus reduces the cholesterol content in the body (hypocholesterolaemia).

• ***Effect on protein and body growth***

High fiber content in the diet increases abrasion of the intestinal cells and also increase the secretion of mucin which is compensated by the increase in excretion of endogenous protein or endogenous nitrogen particularly, threonine, this also decreases the utilization of nitrogen. This limits the synthesis of body proteins and thus lowers the efficiency of body growth.

• ***Effect on minerals***

Components of polysaccharides that interact with minerals include the carboxyl group of uronic acid, carboxyl and hydroxyl groups of phenolic compounds and the surface hydroxyl of cellulose. Moreover, NSP-induced digesta viscosity has been shown to hinder mineral absorption mainly, sodium ions.

3. Effect on gelatinization

Fish in general have a limited capacity for carbohydrate utilisation and processing methods, such as gelatinisation, have been reported to improve the nutrient bioavailability to the fish. Gelatinization is a thermal modification process that modifies carbohydrate granules in such a way that their susceptibility to enzymatic action increases, making digestion more complete.

Wheat, being the major source of starch, also contains a low amount of NSPs. Arabinoxylan is the main NSP in wheat flour. NSPs due to its water-binding capacity (or hydration process) restricts water availability to the amorphous regions (wheat starch) and thus reduces the temperature within these regions and hinders gelatinization.

4. Purified non-starch polysaccharides as immunostimulants

Immunostimulants are chemical substances that activate the generalised immune response system of animals. NSP, such as β-1,3-glucans, acts as an immunostimulant. Supplementation of β-1,3 glucan in diets enhances non-specific cellular defence mechanisms by increasing the number of phagocytes and the bacterial killing activity of macrophages.

Mannose units that comprise glucomannans, belong to the category of compounds that adhere to receptors used by pathogenic microbes as the first

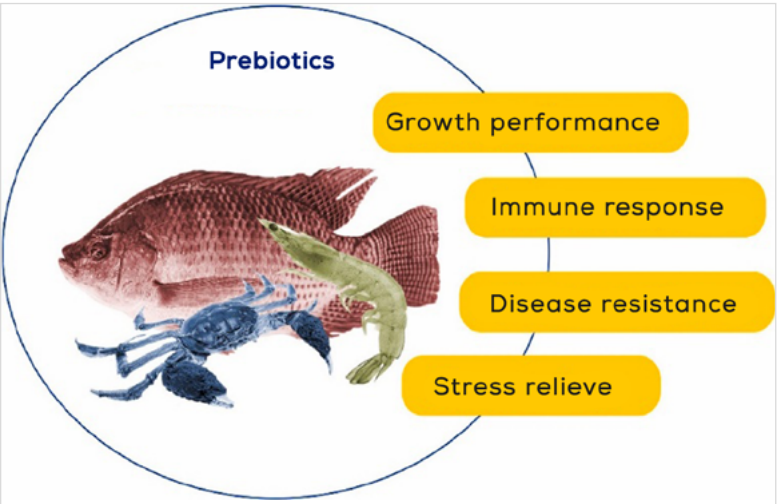

Figure 1. *Effects of mixed prebiotics in aquaculture species. Source: (Wee et al. 2022)*

step of colonisation of the gut. Therefore, supplementation of mannose in basal feed of animals may contribute to better health by interfering with colonisation and growth of pathogens in the gut.

INDIGESTIBLE OLIGOSACCHARIDES

Certain indigestible oligosaccharides are not digested in the upper part of the gastrointestinal tract, but are selectively fermented by bacteria like Bifidobacteria Lactobacilli and Bacteroides in the colon and promote the growth of these beneficial bacteria which in turn confer health benefit to host. Thus, these natural feed ingredients act as prebiotics. They include resistant inulin and oligofructose, transgalacto-oligosaccharides (TOS), mannan oligosaccharide (MOS) and lactulose.

Role of Indigestible oligosaccharides or prebiotics in fish nutrition

Prebiotic supplementation in fish feed may help in changing the community of bacteria in gastrointestinal tract, improving immune system and increasing growth rate.

1. Effects of prebiotics on immune system

Prebiotics can modify the GI tract microbial community to enhance non-specific immune responses. Indigestible oligosaccharides serve as substrate for the growth and proliferation of anaerobic bacteria, mainly the Bifidobacteria and are fermented by these bacteria in the caeco-colon region. During fermentation of prebiotics by beneficial bacteria (probiotics), short chain fatty acids (SCFA) are produced which cause acidification of the colonic content (or reduction of gut pH). Lower pH values inhibit the growth of certain pathogenic bacterial species while stimulating the growth of the Bifidobacteria and other lactic acid species.

Other changes include secretion of antimicrobial substances; blocking of adhesion sites; attenuation of virulence; blocking of toxin receptor sites; competition for nutrients, and suppression of toxin production. These changes in GIT altogether stimulate the immune system, thus, enhancing the host's protection against infections.

2. Prebiotic may have the role of supplying energy for the host

Prebiotics are selectively fermented by probiotic bacteria e.g. Bifidobacteria, Lactobacillus and Bacteroides to produce short chain fatty acids (acetate, butyrate, propionate) and lactate. Short chain fatty acids are absorbed through the intestinal epithelium and act as an energy source for the host, whereas lactate enters the liver and is used as precursor for gluconeogenesis.

3. Effect on mineral absorption

Minerals such as calcium, magnesium and iron are not absorbed in the small intestine and so reach the colon, where upon fermentation of prebiotics, they are released from the carbohydrate matrix and are absorbed.

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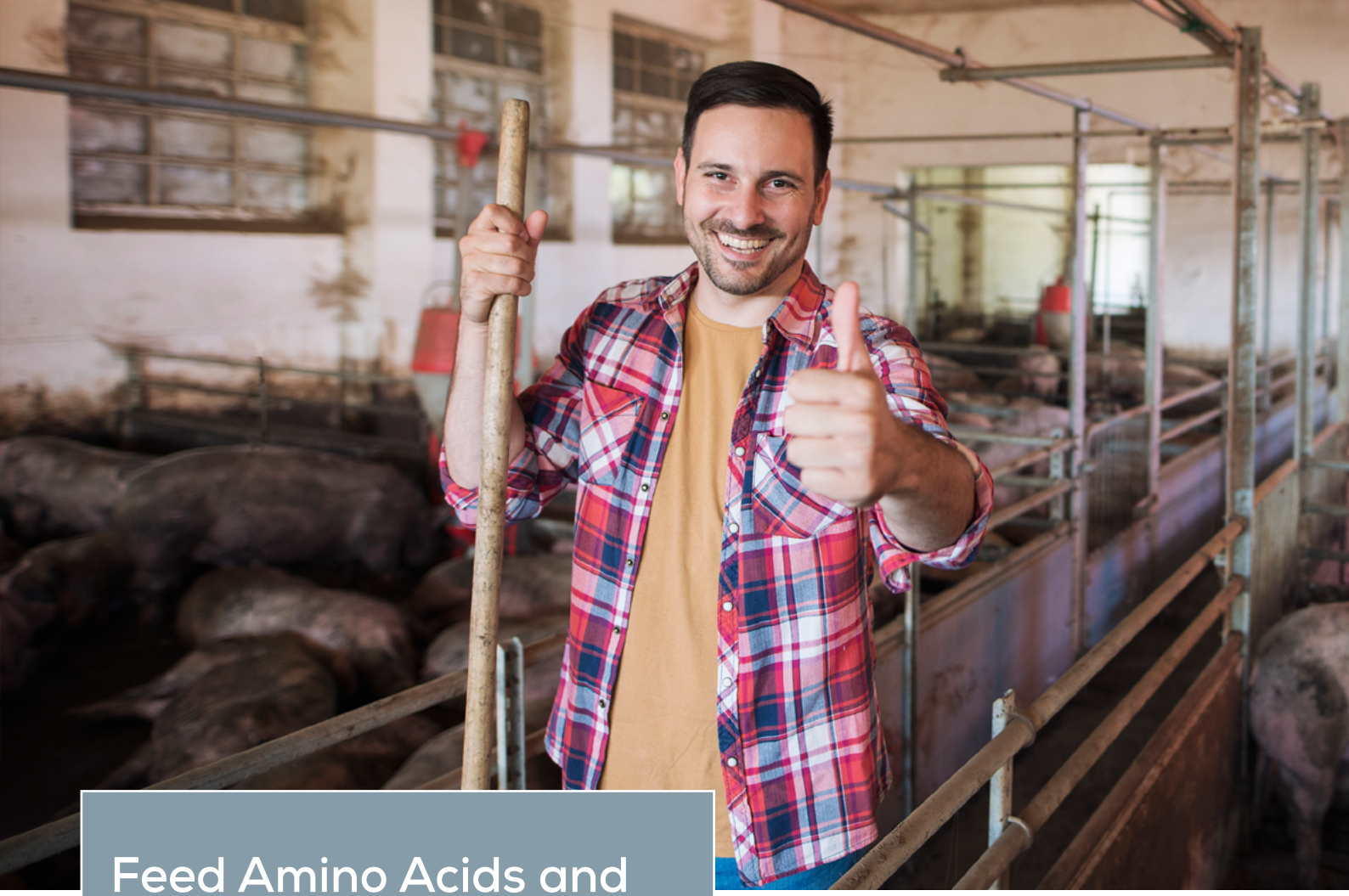

Feed Amino Acids and Global Market Status

Amino acids have many functions in animals such as maintaining health, improving immunity, improving metabolic functions, ensuring optimal growth and reducing nitrogen emission. Deficiency of certain amino acids in animal nutrition leads to decreased immune and metabolic responses. Therefore, some amino acid species are added to animal feeds in pure form or as part of a mixture to meet the specific nutritional needs of different animal species. The global market value of these amino acids used as feed additives is estimated to be USD 7.26 billion in 2023.

By Derya Yildiz

Amino acids, the basic building blocks that make up proteins, are defined in chemistry as organic compounds containing both an amino group (-NH3+) and a carboxylate group (-COO-). There are 20 different amino acids used to form a protein, and these can form one or more chains of amino acids known as polypeptides.

Amino acids have a critical role in both humans and animals. In humans, for example, they are characterised by a variety of functions ranging from the breakdown of food to the repair of body tissue, from the promotion of growth to the maintenance of pH balance. Scientific sources point out that 20 types of amino acids are needed for the proper functioning of the human body.

Similarly, in animals, amino acids have many functions such as maintaining health, improving immunity, improving metabolic

functions, ensuring optimal growth and reducing nitrogen emission. It has been reported that a deficiency of certain amino acids in animal diets can lead to reduced immune and metabolic responses, which can make animals more vulnerable to disease and in some severe cases can even result in death.

Furthermore, most of the structures (e.g. muscle) and metabolic reactions (e.g. enzymes, hormones) in animal tissue are catalysed by proteins. Therefore, protein synthesis is essential for the maintenance of the life process.

CLASSIFICATION OF AMINO ACIDS IN ANIMALS

There are more than 300 different types of amino acids known to exist in nature. About 20 of these are important components of proteins in animals and are associated with muscles, connective tissues, skin, feathers, hair, horns, blood, enzymes and hormones.

Amino acids essential for animals are generally classified into two main categories. The first of these is essential amino acids. Essential amino acids are a group of amino acids that the animal cannot synthesise on its own. In order for animals to fulfil their normal functions, these amino acids must be taken from outside through feeding. Essential amino acids include phenylalanine, histidine, isoleucine, leucine, lysine, methionine, threonine, tryptophan, arginine (included in the non-essential amino acid group in some sources) and valine. These amino acids are usually added to animal feed in pure form or as part of a mixture to meet the specific nutritional needs of different animal species.

The second category of amino acids is non-essential amino acids. Non-essential amino acids are amino acids that can be synthesised in the animal's body. This group includes alanine, aspartic acid, cysteine, cystine, glutamic acid, tyrosine, glycine, proline, hydroxyproline and serine.

FEED AMINO ACID MARKET AND FORECASTS

According to a report by Market Research Future, the feed amino acids market size will grow at a compound annual growth rate (CAGR) of 7.3% between 2022 and 2030, reaching USD 49.5 billion. However, this data does not coincide with the data of many other research companies. For example, according to Verified Market Research's (VMR) May 2023 report, the global feed amino acids market, which was USD 5.34 billion in 2021, will grow at a CAGR of 5.9% from 2023 to 2030, reaching USD 8.88 billion by 2030.

The report prepared by Future Market Insights (FMR) also provides forecasts closer to the VMR report. According to FMR's report on the feed amino acid market, the market size will be around USD 7.81 billion in 2023. The report forecasts that the market will grow at a CAGR of 5.5% and reach USD 13.34 billion by the end of 2033. FMR also estimates that the total market value of the global amino acid market will be USD 61.47 billion in 2026.

In terms of animal type, the aquaculture segment is projected to gain significant growth momentum in the feed amino acids market. This growth is attributed to the increasing demand for fish and other seafood, especially in the Asia-Pacific region. However, in aquaculture, one of the fastest growing sectors in the food industry, the utilisation of feed amino acids, including lysine, methionine and tryptophan, is essential for the growth and development of fish and other aquatic species.

Another research company that points to data more in line with VMR and FMR is Acumen Research and Consulting. According to Acumen's report, the global feed amino acids market size was realised at USD 7.1 billion in 2022. The company forecasts that the market will grow at a CAGR of 5.7% between 2023 and 2032 and reach a size of USD 12.4 billion in 2032.

The report prepared by Global Market Insights also reveals that the current size of the market is USD 7.4 billion in 2022. Forecasting that the market will grow at a CAGR of 5.5%, the company predicts that the average size will be USD 12.7 billion in 2032.

Except for the report prepared by Market Research Future, the market size estimates in the reports recently updated by the other 4 research companies seem to be quite consistent. An average calculation based on the estimated data in these four consistent reports shows that the global feed amino acids market will have a size of USD 7.26 billion in 2023, grow at a CAGR of 5.65% between 2023 and 2032 and reach a size of USD 11.89 billion in 2032.

FACTORS SUPPORTING MARKET DEVELOPMENT

With the exponential increase in human population and disposable income worldwide, increasing consumer demand for animal proteins, especially meat products, is one of the most important factors supporting the development of the market. This demand leads to an increase in livestock breeding activities and consequently feed demand. In addition, the importance of amino acids, especially essential amino acids that cannot be synthesised by animals, for animal health and performance supports their use in feed formulations and contributes to the growth of the market. Increasing awareness

of animal nutritionists and farmers, focusing more on productivity in order to meet the increasing demand for animal protein, the need to increase feed efficiency at lower costs, animal welfare concerns and the need to reduce the use of antibiotics are considered as other important supporting factors that will contribute to the growth of the market.

FACTORS RESTRICTING MARKET DEVELOPMENT

Due to the impact of animal husbandry on environmental sustainability, food safety and similar reasons, the number of regulatory legislations for animal producers is increasing day by day. In addition, developments in the alternative protein market are also accelerating due to the changing preferences of consumers. It is thought that the rapid development in the alternative protein market and strict regulatory legislations may pose a significant obstacle to the growth of the feed amino acids market.

In addition, the price factor is also seen to be important at this point. Due to the high price of amino acids, amino acid-based feeds are more expensive than conventional feeds. Although the higher price of amino acid-based feed can offer numerous benefits, including improved animal health and productivity, it is estimated that it can be a significant barrier for farmers and feed producers, especially in developing countries where cost sensitivity is more pronounced.

Raw material supply is also considered to be another restricting factor. According to reports, disruptions in the supply and price fluctuations of raw materials such as maize, soya, wheat and other grains required to produce amino acids can hamper the growth of the market by directly affecting producers.

MARKET DEVELOPMENT BY PRODUCT TYPE

The feed amino acids market is growing predominantly through the group of essential amino acids (threonine, tryptophan, methionine, lysine and others) that cannot be synthesised by animals. The threonine segment in this group is estimated to be the fastest growing segment among other amino acid types. Threonine is characterised as a preferred amino acid in animal feed formulations, especially in monogastric animal nutrition such as pigs and poultry, as it improves protein synthesis and weight gain and helps maintain immunity and intestinal integrity.

MARKET SITUATION IN TERMS OF ANIMAL SPECIES

In terms of animal type, the aquaculture segment is projected to gain significant growth momentum in the feed amino acids market. This growth is attributed to the increasing demand for fish and other seafood, especially in the Asia-Pacific region. However, in aquaculture, one of the fastest growing sectors in the food industry, the utilisation of feed amino acids, including lysine, methionine and tryptophan, is essential for the growth and development of fish and other aquatic species. The growth in the aquaculture segment is expected to continue in the coming years owing to various factors such as increasing demand for fish and other seafood, growing awareness about the importance of sustainable aquaculture practices, and advancements in aquaculture technology.

In terms of animal species, pigs are another prominent species in the amino acids market. The use of amino acids in swine feed is expected to continue to increase. According to reports, as the demand for high-protein pork continues to increase, there will be a greater need for fortified feeds to improve pig health. Moreover, the need for feed additives such as amino acids is also increasing due to the spread of infectious diseases among pigs and the emergence of new epidemics such as African swine fever (ASF).

MARKET DEVELOPMENT ON REGIONAL BASIS

North America, Europe, and Asia Pacific are the prominent regions in the global amino acid market. On a global scale, the Asia-Pacific region is expected to maintain its dominance in the market owing to high livestock production activities and contin-

SOME FEED AMINO ACID SUPPLIERS IN THE WORLD:

- Adisseo
- ADM
- Ajinomoto
- Alltech
- AminoSib JSC
- AMixCo Premix
- Anhui Huaheng Biotechnology
- Balchem
- Baoding Mantong Fine Chemistry
- BASF
- Bio-chem Technology Group
- Cargill
- Chattem Chemicals
- China BBCA Group
- Chongqing Unisplendour Chemical
- CJ Bio America
- CJ CheilJedang
- CJ do Brasil
- Daesang Corp.
- Donbiotech
- dsm-firmenich
- Evonik Industries
- Fufeng Group
- GEO Specialty Chemicals
- Hebei Donghua Chemical Group
- Hebei Huayang Group
- Heilongjiang Chengfu Food Group
- Henan HDF Chemical
- Henan Julong Biological Engineering
- IFF (Danisco Animal Nutrition)
- Kemin Industries
- Koudijs Mkorma
- Kyowa Hakko Bio
- Land O'Lakes
- Linghua Group
- Meihua Group
- MeiHua Holdings Group
- METabolic EXplorer
- Milk Specialties Global
- Mitsui & Co.
- Multi Vita
- Nagase & Co.
- NB Group
- Newtrend Group
- Ningxia Eppen Biotech
- Ningxia Unisplendour Tianhua Methionine
- Novus International
- Nutreco
- Nutriad
- Phibro Animal Health
- Prinova Group
- Prioskolye CJSC
- Saratov Biotechnologies
- Shaanxi Sciphar Hi-Tech Industry
- Shandong Shouguang Juneng Group
- Shantou Jiahe Biological Technology
- Shijiazhuang Donghua Jinlong Chemical
- Shijiazhuang Shixing Amino Acid
- Shijiazhuang Zexing Amino Acid
- Star Lake Bioscience
- Sumitomo Chemical
- Sunrise Nutrachem Group
- Taiwan Amino Acids
- Vedan International
- Volzhsky Orgsynthese
- Welding GmbH
- Zhaoqing Guangdong
- Zhejiang NHU
- Zhejiang Shenghua Biok Biology

uously evolving livestock production methods. Asia Pacific, home to some of the world's most populous countries such as China and India, is estimated to hold more than 38% of the global feed amino acids market in 2022. Farmers are becoming more conscious to achieve high productivity targets and significant growth in the aquaculture sector is fuelling the demand for feed amino acids in this region. In addition, rapid industrialisation and urbanisation have helped increase the per capita income level in the region, and the increase in the level of disposable income has increased the demand for protein-rich foods, which are cited as the most important reasons for the region's influence in the global market.

In the global amino acid market, it is estimated that North America will follow the Asia Pacific region, while Europe will continue to maintain its current strength in the market.

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By Derya Yildiz

Global Soybean Supply and Demand & 2024 Expectations

Production estimates for soybeans, one of the most important animal feed ingredients, are promising for the industry. According to IGC's report, in the 2023/24 season, chiefly linked to bigger crops in South America, global soyabean production is forecast to expand by 7%, to a record of 395 million tons.

Soybean, which has the highest protein value among oilseeds, is a versatile plant with its structure that does not contain cholesterol and saturated fats, and high-quality protein content. Soybean, which is used extensively in both animal and human nutrition, is generally extruded, separated into oil and pulp. Soybean meal is used extensively, especially in the production of poultry feed and cattle feed.

Soybean meal, which is used to balance the rations of farm animals and to complete the amino acid deficits, is a product with a high degree of digestion. As it is a major source of protein in the feed industry all over the world, it is a feed raw material strategically traded every day of the year.

LATEST EXPECTATIONS IN SOYBEAN PRODUCTION

In its latest report published in November 2023 by the International Grain Council (IGC), it is estimated that world soybean production, which was 357 million tons in the 2021/22 season, increased by 10 million tons in the 2022/23 season and stood at 367 million tons. The increase expectation for the 2023/24 season still continues. The latest forecast made by the IGC is that the production will be 395 million tons in the current season. This means a significant increase of 28 million tonnes.

Likewise, the latest report of the US Department of Agriculture (USDA) Foreign Agricultural Service dated December 2023 provides almost the same data as the IGC report and supports an increase expectation. According to the USDA report, world soybean production, which was 360 million tons in the 2021/22 season, was 374 million tons in the 2022/23 season. USDA's forecast for the 2023/24 season is 399 million tons, that is, an increase of 25 million tons.

SOYBEANS	2020/21	2021/22	2022/23 est.	2023/24 f'cast
Production	371	357	367	395
Trade	159	156	172	168
Consumption	370	366	359	386
Carryover stocks	55	46	54	62

Source: *IGC - million tons*

According to the reports, the increase in production is enough to meet the demand for soybeans. According to the IGC data, world soybean consumption, which was 366 million tons in the 2021/22 season, declined 359 million tons in the 2022/23 season. This means 8 million tons less consumption than the production amount in the same period. Likewise, forecasts for the 2023/24 season point out that the consumption will be 386 million tons, less than the production (by 9 million tons). The gap between production and consumption means that existing stocks are rising. According to IGC's report, the stocks, which reached 54 million tons in the 2022/23 season, will increase to 62 million tons in the 2023/24 season.

LEADING COUNTRIES IN SOYBEAN PRODUCTION

The American continent accounts for more than 93 percent of the world's soybean production. Brazil is the largest soybean producer in both the region and the world. According to the USDA data; Brazil produced 160 million tons of soybeans in the 2022/23 season. The country is expected to increase its production to 161 million tons with a minimal increase in the next season.

In global production, the USA follows Brazil with 116 million tons. Production in the USA is expected to decrease 112.4 million tons in the current season. Argentina, which experienced a significant decrease in soybean production in the 2022/23 season, is the third-largest soybean producer in the world with 48.8 million tons. Production in the country is expected to rise again and reach 48 million tons in the new season. Argentina is followed by China with 20 million tons, India with 12 million tons, Paraguay with 9 million tons, and Canada with 6,5 million tons.

HIGHLIGHTS IN WORLD SOYBEAN TRADE

According to the IGC report, the world soybean trade, which was 156 million tons in the 2021/22 season, reached 172 million tons in the 2022/23 season. The IGC estimates that the trade will remain around 168 million tons in the 2023/24 season.

The USDA's December 2023 report draws a similar picture and predicts that the trade, which was 171 million tons in the 2022/23 season, will be around 170 million tons in the 2023/24 season.

The ranking of the leading countries in the international soybean trade did not change much compared to previous years. The largest producers also stand out in exports. Brazil, the USA, Argentina, Paraguay, and Canada accounted for more than 95 percent of global soybean exports in the 2022/23 season. Brazil, which exported 95.5 million tons last season, is expected to increase its export amount to 99.5 million tons in the current season. In the same period, total exports of the USA are forecasted to decrease by 6.5 million tons to 47.7 million tons.

On the import side, China, the European Union, and Mexico stand out. Ranking first with 100.8 million tons in global soybean imports in the 2022/23 season, China is estimated to import 102 million tons in the 2023/24 season. While the imports by the European Union countries will remain around 13 million tons, Mexico will continue to import around 6 million tons.

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• *United States Department of Agriculture Foreign Agricultural Service (USDA), Oilseeds: World Markets and Trade Report, December 2023*

Willows Ingredients offers alternative feed ingredients to fish oil

Willows Ingredients signed a supply partnership agreement for Ireland and the United Kingdom with HuveNutra® for HuvePure® DHA, lipid biomass, a vegetarian source of DHA derived from microalgae that are a viable alternative to fish oil, feed material used in feed for pets, livestock species, and aquaculture.

It is increasingly challenging to source enough fish from oceans without unacceptable overfishing, according to David Scrivens, Managing Director of Irish family-owned raw ingredient distributor Willows Ingredients.

Omega-3 fatty acids deliver proven health benefits for companion animals, and dietary supplementation is recommended to ensure an animal's standard nutritional requirements are met, which is why it is in high demand by pet food manufacturers. HuvePure® DHA is lipid biomass in powder, a vegetarian source of DHA, an Omega-3 fatty acid derived through the fermentation process of the microalgae strain Schizochytrium sp.

"We are delighted to partner with HuveNutra® as an Ireland and UK distributor for HuvePure®. They have a state-of-the-art manufacturing facility based in Europe with a total fermentation capacity of over 10,000 m3, employing the most up-to-date manufacturing process. While being one of the largest fermentation facilities in the world, it still maintains a lower carbon footprint by utilising waste energy," said David Scrivens.

Tom Brudenell-Bruce, Managing Director, HuveNutra®, said, "HuveNutra®, together with our joint venture partner Huvepharma®, specialises in the manufacture, extraction, and processing of microalgae for nutraceutical ingredients such as omega-3 DHA lipids, proteins, EPS (exopolysaccharides), and ARA (arachidonic acid). Partnering with Willows Ingredients provides a great opportunity to expand HuveNutra's product distribution into new markets with Willow's dedicated and experienced pet food team, providing a reliable and sustainable plant-based source of omega-3 DHA that is GMO-free. We are excited about this new relationship."

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Pet food manufacturer Nugape obtains IFS Food certification

Nugape Pet Food obtained the prestigious IFS Food certification, which consolidates the manufacturer as one of the most important companies in Spain in its sector, guaranteeing that its quality and safety protocols are as demanding as those applied to products for human consumption.

From its factory in Vilanova de Arousa (northwest of Spain), Nugape exports its products to more than 40 countries. With more than 50 people on staff and a commitment to local, quality raw materials, its brands include Cebican, Sandegal, Danna, and Dousti, with a strong presence in Europe, the Middle East, Africa, and Asia.

Nugape already has some of the main safety certifications, such as the IFS Global Market, or continuous quality analysis technologies, such as the NIR, but the IFS Food represents a very relevant milestone in its history, placing it among the chosen global group of pet food producing companies that demonstrate safety, quality, and traceability protocols equivalent to those of human food.

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Mootral introduces new methane reduction technology, Enterix Advanced

Mootral, a British biotech company, announced that it completed the in vitro development and testing phase and is now commencing a range of in vivo trials of its Enterix Advanced technology, set to significantly boost the methane reduction efficacy of the original Enterix™ product while maintaining productivity benefits essential for wide-scale farmer adoption.

Enterix Advanced incorporates a patented technology that harnesses the power of iodoform, known for its methane-inhibiting properties, by synergizing it with specific active compounds from garlic. This approach builds on Mootral's original technology, which is already in use on UK commercial farms. The key lies in the strong synergy between these compounds, allowing for significant emission reductions without impacting dry matter intake or milk yield, a potential problem previously

associated with high doses of iodoform.

Mootral's new technology allows for the controlled release formulation necessary for bolus administration in grazing cattle, vastly increasing the potential for methane mitigation in animal agriculture globally.

"A known methane suppressant, iodoform, has the same mode of action as bromoform, the active ingredient in some species of seaweed proposed for methane reduction," said Thomas Hafner, Founder and CEO of Mootral.

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Eduardo Lopes Alberto joins Trouw Nutrition team as VP Innovation and Research

Nutreco announced that Eduardo Lopes Alberto has been appointed VP of Innovation and Research for Trouw Nutrition starting in January 2024.

Before joining Nutreco, Alberto spent seven years at dsm-firmenich as Vice President of North America and most recently as their Vice President of Global Innovation, Animal Nutrition, and Health, where he focused on driving strategic investments and successful launches of innovative technologies and services worldwide.

Before joining dsm, Eduardo Lopes Alberto spent 16 years at Elanco Animal Health, with diverse global roles in marketing, sales, and R&D and managing business operations in the USA, Asia, and Latin America. Alberto is a Doctor of Veterinary Medicine, holds an MBA from the University of São Paulo, Brazil, and is a specialised postgraduate in marketing from Escola Superior de Propaganda e Marketing (ESPM), Brazil. He also completed the General Management Programme at Harvard Business School.

In this role, Alberto will be responsible for Global Innovation at Trouw Nutrition, with primary responsibility for ensuring the development and delivery of the global innovation agenda and stewarding the innovation investment. Eduardo will report to David Blakemore, CEO of Trouw Nutrition.

Eduardo Lopes Alberto

"I'm delighted that Eduardo is joining the team and bringing his two-decades of commercial and industry experience and innovation leadership to Trouw Nutrition and Nutreco," said David Blakemore.

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Biomar, Edpacif, Earthworm Foundation, and Auchan collaborate on new sustainable shrimp product

Feed manufacturer BioMar, Ecuadorian shrimp farmer Edpacif, the French retailer Auchan, and the international NGO Earthworm Foundation joined forces to develop a new product line that sets a new standard for responsible shrimp.

"Our customers are asking for more responsible seafood. To ensure we can provide it, we need commitment from the entire value chain. This is the whole purpose of our collaboration with the Earthworm Foundation," said Olivier Vandebeulque, Auchan Seafood Manager.

Henrik Aarestrup, Vice President at BioMar, was the first to be contacted by Earthworm. "During the project, we utilised our sustainability impact assessment tool (BioSustain LCA) to minimise the carbon footprint of the shrimp feed through meticulous recipe optimisation. We replaced fish oil with microalgae and sourced 100% of the marine protein from high-quality trimmings," said Aarestrup. In a first for BioMar, the project also saw BioMar's team of sustainability consultants introduce recommendations to shrimp producer Edpacif on how to reduce the carbon footprint of the farming process.

"Equally important is the fact that none of the ingredients used in the shrimp feed come from deforested or even tropical areas," added Aarestrup. "Shrimp feeds can contain up to 50% soy, so responsible sourcing of this key ingredient is crucial to achieving good environmental outcomes."

Marcelo Velez, President of Edpacif S.A., said, "We are grateful to Auchan, Earthworm, and BioMar for the opportunity to work together on this important project, along with our partner Eurotrade Fish. The project allows us to strengthen our ESG commitments and improve our practices while delivering an ethical product of the highest quality."

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Registration opens for PISC 2024

The American Feed Industry Association (AFIA) opened registration for its 2024 Purchasing and Ingredient Suppliers Conference (PISC), happening on March 12-14 in San Antonio, Texas. This three-day, must-attend programme includes education and networking events for hundreds of feed ingredient buyers and sellers across the animal food manufacturing industry.

"We are thrilled to bring PISC to San Antonio this year and continue to be the place where business gets done," said Jessica Morse, AFIA's director of meetings and events. "PISC 2024 promises to offer even more networking opportunities and relationship building between suppliers and customers."

In addition to the networking events, conference attendees will hear presentations on myriad topics, including decoding the consumer's journey: meat purchasing in a changing landscape, transportation logistics, California's Proposition 12, navigating the people puzzle, and forecasting the grain and economic outlooks.

Early-bird registration is available now until Jan. 12 for $650 for AFIA members and $2,250 for non-members. Following that date, the fee will increase to $775 and $2,550, respectively.

Read more>>

Aviagen opens ninth US hatchery in Texas

Aligned with an ongoing commitment to food security in the US and worldwide, Aviagen® announced the inauguration of a state-of-the-art poultry hatchery in Longview, Texas, and has already seen a successful first Parent Stock shipment. This marks Aviagen's ninth hatchery in the United States and first in the state of Texas.

Representing a substantial investment, the new facility reflects a major commitment to food security and economic growth, as well as bird welfare and sustainability. It will make a positive impact on the poultry supply chain, with the capacity to set 1.1 million eggs per week, and will bring new employment opportunities to the area.

The location was chosen after careful consideration, taking into account its secure isolation from other bird populations, proximity to regional and international airports, and the availability of a high-quality workforce. The company explained that the facility is equipped with innovative features designed to ensure strict biosecurity measures and optimal bird welfare; furthermore, a significant investment has been made in cutting-edge equipment for hatchery automation. This level of automation

strengthens the hatchery's production efficiency, capacity, biosecurity, and chick quality; moreover, it provides a safe and ergonomic environment for employees, according to the company.

Dr. Marc de Beer, President of Aviagen North America, remarked, "We are proud to introduce our Longview hatchery, our response to the increasing demand for quality breeding stock that will serve as a sustainable food source. This facility is a testament to our commitment to 'Breeding Success Together' with local poultry producers, supporting their growth and success as they diligently feed communities in North America and worldwide."

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Future Green Solutions rebrands as Arvela

Future Green Solutions announced that it rebranded to Arvela. Since its inception in 2012, Arvela has been at the forefront of sustainable agri-business, supplying industry-leading black soldier fly eggs and converting organic waste into high-value products like antibacterial oils, animal protein substitutes, and biofertilizers. "This is a significant move that symbolises our ongoing commitment to sustainable development and marks a new chapter in our business journey," said Luke Wheat, Arvela founder.

According to the company's statement, the rebranding coincides with the addition of new leadership talent to the company's board and management team. These seasoned professionals bring a wealth of experience, invigorating Arvela's strategic vision and heralding an era of heightened innovation, operational excellence, and business growth.

Arvela, a creative reimagining of the word 'larvae', encapsulates the company's ethos of transforming waste into valuable, eco-friendly

products. From industry-leading black soldier fly eggs to a diverse range of agri-products, Arvela continues to redefine sustainable agricultural practices, contributing significantly to a circular economy – living its mission statement to 'give waste a purpose'.

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Billund to build first large-scale RAS nursery for Pacifico Aquaculture

The Mexican company Pacifico Aquaculture commissioned Billund Aquaculture to design and implement a Recirculation Aquaculture Systems (RAS) project for its first large-scale RAS nursery facility with a production capacity of 8 million fish per year in Baja California, Mexico. The new land-based hatchery and nursery will be the first in the world to produce striped bass (Morone saxatilis) at scale.

The facility will be built in the Ensenada Bay area of Baja California, Mexico, and produce 80 g of juveniles that will subsequently be transferred to the company's grow-out sites, located nearby, about 20km from the coast of the Pacific Ocean.

Although there have been several experiences worldwide of farming hybrid striped bass (Morone chrysops + M. saxatilis) in freshwater RAS, this will be a first for striped bass. Moreover, with operations in over 30 countries worldwide, this is Billund Aquaculture's first RAS design project in Mexico.

CEO of Pacifico Aquaculture, Per-Roar Gjerde, commented, "We are thrilled to have with us Billund as a main supplier to build the first Striped Bass RAS facility in the world. This is the before

and after for Pacifico Aquaculture in its growth as a company and in the start of creating a new industry in Baja California, Mexico. This project will allow us to build a state-of-the-art hatchery and nursery facility and unlock 20,000 metric tonnes of annual production capacity to meet the world's growing demand for healthy, nutritious seafood."

Speaking about the project, Marcelo Varela, CEO of Billund Aquaculture Chile, said, "This is a very important contract for Billund Aquaculture because it represents a major step towards diversifying the number of species farmed using RAS. Also, Mexico is a completely new market for us with huge potential, due to the diversity of new species that can be farmed and its proximity to such an important market as the United States."

Read more>>

AFIA appoints Taylor Lekin as marketing and program development coordinator

The American Feed Industry Association (AFIA) announced the addition of Taylor Lekin as its marketing and program development coordinator, effective December 11.

In this newly created position, Lekin will play a pivotal role in marketing AFIA's educational and networking events, as well as the overall value of AFIA membership. In addition, Lekin will work closely with the executive director of the Institute for Feed Education and Research (IFEEDER), AFIA's 501(c)(3) public charity, on an ambitious branding campaign to communicate the need for industry leaders and stakeholders to invest in the future of the animal food industry.

"Taylor exudes positive energy and a passion for helping the agriculture industry thrive, and I know she will bring creative new ideas to engage AFIA members at events

Taylor Lekin

and through our programs," said Victoria Broehm, AFIA's senior director of communications.

Read more>>

IFEEDER launches its new website

The Institute for Feed Education and Research (IFEEDER) announced the launch of its new website at ifeeder.org.

"Working with IFEEDER's Board of Trustees and Education and Engagement Committee, we built this website to be a resource for stakeholders up and down the animal food value chain who are interested in learning more about the animal food industry's ongoing sustainability efforts," said Lara Moody, IFEEDER's executive director. "We hope it will also provide potential collaborators and donors with deeper visibility into our education and research work so that they may opt to support our ongoing initiatives."

The new, easy-to-use website includes:

- background information on IFEEDER's mission and impact.
- information on ongoing research projects to close knowledge gaps in the animal food industry.
- educational and sustainability resources that provide a robust collection of materials.
- news and events that inform individuals on the latest developments within the Institute, including a newsletter that donors and members of the public may sign up for.

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AFIA applauds House introduction of Innovative FEED Act

The American Feed Industry Association (AFIA) announced that it appreciates representatives Greg Pence (R-Ind.-06), Jim Baird (R-Ind.-04), Kim Schrier (D-Wash.-08), and Angie Craig (D- Minn.-02) for leading the introduction of a key piece of legislation that will improve the regulatory environment for new animal feed ingredients. According to the association, the Innovative Feed Enhancement and Economic Development (Innovative FEED) Act will amend the Federal Food, Drug, and Cosmetic Act to establish a regulatory pathway for a new category of animal food substances that act solely within animals' gut microbiomes or in the feed they are digesting to provide a wide range of benefits, giving the Food and Drug Administration the power it needs to ensure regulations keep pace with scientific innovation in feed.

Upon the introduction of the bill, AFIA President and CEO Constance Cullman said: "The AFIA is excited that the Senate has already introduced the Innovative FEED Act, and now, with the House introduction, the bill has the bipartisan and bicameral support we hoped for. Now, we urge Congress to act quickly on the bill. The legislation will be the spark needed to drive nutritional innovation that improves animal health and production while addressing public health challenges. We need this modernised regulatory oversight instead of the current policy of overregulation. Any delay in enacting this legislation continues to put U.S. agriculture at a disadvantage compared to our global counterparts, whose regulatory systems have evolved with the times."

The AFIA has urged the FDA to modernise its outdated 1998 Policy and Procedures Manual Guide 1240.3605, which has hindered animal food manufacturers from clearly indicating non-nutritive benefits on labels without navigating the FDA's arduous drug approval process. Dozens of countries have already safely approved and started using these feed ingredients on farms, resulting in improved animal production and well-being, reduced pre-harvest food safety concerns, and a smaller environmental footprint.

Read more>>

AlgaEurope 2023 highlights future of algae industry

Jointly organized by EABA and DLG Benelux, AlgaEurope 2023, the annual conference highlighting breakthroughs and trends in the algae biomass sector, saw an extraordinary gathering of 407 delegates from 40 countries and 221 organizations. Hosted in Prague, Czech Republic, from December 12-15, the event unfolded over four days, featuring a curated programme delivered by 112 expert speakers. The content spanned scientific, technological, and business dimensions within the global algae biomass sector.

Exploring an array of subjects, AlgaEurope is one of the most comprehensive conferences in its field. More than 20 plenary sessions covered Physiology, Biorefinery, Food, Feed, Biostimulant, Bioremediation, and Biomaterial among others. The conference featured distinguished keynote speakers, including Sónia Ventura (Portugal), Susana Coelho (Germany), Angela Wulf (Sweden), and Robert Henrikson (USA), offering profound insights and expertise.

One of the highlights of the conference was the poster presentation area, which provided researchers with a platform to present their work. Some 136 scientific authors presented their work. The introduction of the Poster Presentation Award this year recognised outstanding contributions.

"Another year of great success with key topics that unravelled the promising future of the algae sector. The EABA community is growing very fast, and this is also reflected in the success of AlgaEurope. We have a unique conference, and it has become the reference event in the algae sector," said Carlos Unamunzaga, President of EABA.

The next AlgaEurope conference will be held in Athens on December 10-12, 2024.

Read more>>

IDEAL Animal Nutrition grows team with focus on research

IDEAL Animal Nutrition added Dr. Kelsey Hammers to its team and pointed out that helping pig farmers solve everyday challenges with practical, research-backed solutions is an important focus as it grows its team serving operations across the Midwest.

Dr. Hammers joins the company as swine nutritionist and research coordinator, adding nutrition expertise alongside Dr. Jeff Knott and Simon Kern while helping lead fast-expanding activity at the IDEAL Research Barn.

"We're excited to have Kelsey join our team," said Dr. Jeff Knott, swine nutritionist and founder/owner of IDEAL. "She brings fresh knowledge and experience that will benefit our customers and strengthen our research activities. Her work will support our main focus on delivering solutions at the slat level. It will also grow our supporting focus on generating research-backed data to guide decisions – helping our customers get better results and higher returns."

Hammers grew up on her family's mixed farm in Missouri (crops and cattle) and has gained a variety of agricultural experiences throughout her life. On the swine side, as a teenager, she participated in swine projects through the National FFA Organisation and was involved in the world of show pigs. As her university experience steered to a focus on swine, she also gained experience working with commercial hog facilities in production and sales roles as part of internships and summer jobs. She earned her Ph.D in Swine Nutrition at the University of Minnesota, building on a master's degree from Kansas State University and a bachelor's degree from the University of Missouri.

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Lallemand appoints Mathieu Castex as new president of animal nutrition business

Mathieu Castex, Ph.D., will succeed Yannig Le Treut, DVM, as President & General Manager of Lallemand Animal Nutrition on February 1, 2024. Dr. Castex comes to the position after serving as the company's Director of Research & Development since 2014.

According to Lallemand's statement, Dr. Le Treut has successfully led Lallemand Animal Nutrition since 2012. To ensure a seamless transition, he will take on the role of Senior Vice President & Special Advisor at the Lallemand Group level while supporting Lallemand Animal Nutrition's management team and leadership transition over the next several years.

"I am extremely pleased that, in Mathieu, we have a leader with a strong scientific background, aligned with the product offerings we have for our customers around the world. In addition, his product management and commercial experience make him an excellent choice to build on the success Yannig achieved over the past decade leading the Lallemand Animal Nutrition team," said Bill Nankervis, Executive VP and COO of the Lallemand Group. "I'm looking forward to continuing to work closely with Yannig in his new capacity."

Dr. Castex added, "I am delighted to be able to continue to channel my fervour for microbiology, animals, and animal breeding in the service of the animal nutrition business unit. I am honoured

Mathieu Castex

to be entrusted with succeeding Yannig in leading this remarkable team and business, which he played an integral role in establishing and strengthening. I am confident that our specialised teams —when coupled with science-based products, innovation, and our dedication to customer satisfaction— represent a winning formula for success for us, our partners, and our industry."

Read more>>

Biovet to participate in IPPE with its latest technologies and a scientific lecture

The international fair will take place between January 30 and February 1, 2024, at the Georgia World Congress Center, Atlanta, USA. In addition to participating with a stand, Dr. David Díez from Biovet S.A. will give a lecture in the scientific programme of the IPPE, the International Poultry Scientific Forum (IPSF).

The talk entitled "Effect of Liver Conditioner Pronutrients to Prevent and Ameliorate the Effects of Liver Stress in Layers" will be held on January 30 at 9:15 a.m., in room B313. According to the company, improving liver function is vital, especially in intensive systems where egg production is so high that the liver is under constant stress, making it more susceptible to the effects of toxins and infections.

During the event, Biovet's veterinary-technical team will also present other solutions for poultry producers and will answer technical queries from attendees worldwide.

Read more>>

K+S and Aquapurna build Europe's largest shrimp farm

K+S and Aquapurna announced that the largest and most modern indoor shrimp farm in Europe will soon be built at the Sigmundshall site near Hanover, Germany. This has been contractually agreed upon between K+S and the start-up Aquapurna. K+S is investing an amount in the low double-digit million-euro range in this sustainable project and is acting as a builder, landlord, and media supplier for the new farm. Aquapurna is receiving a further seven-figure investment from private investors.

"We are very pleased that with Aquapurna we will be establishing a sustainable business model in our Innopark on a large scale, which also meets the interests of the stakeholders in this region," says Carsten Möller, Head of the Sigmundshall site and the Innopark. "The project is a perfect strategic step for K+S for the subsequent use of the existing infrastructure at the former Sigmundshall potash site," adds Saban Bala, who is responsible for the further development of the Innopark at K+S.

"Together with the globally operating industrial company K+S, we are making a significant contribution to sustainable and autonomous food supply in Europe," emphasises David Gebhard, Managing Director of Aquapurna. Co-Managing Director Florian Gösling adds: "K+S shares our conviction of a better world through the sustainable use of green technologies."

The new shrimp farm is to be built in three phases. In its final state, the aim is for the complex to consist of two production halls with a floor area of approximately 18,000 square metres. This is equivalent to more than two soccer pitches. K+S has made a corresponding area available for this

purpose. In the first construction phase from 2024 to mid-2025, a production hall and a supply and infrastructure wing with a size of approx. 4,000 square metres will be built. The roofs of the production halls will later also be fitted with solar panels to generate environmentally friendly electricity. Modern recirculation technology will be installed for the grow-out process, with over 98% of the grow-out water being continuously reused and little wastewater being produced. A farm capacity of up to 800 tonnes of shrimp per year is planned. A total of around 50 jobs are expected to be created on-site.

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FAO: Record grain harvest expected for next year

The benchmark for world food commodity prices was broadly stable in November, with lower international cereal quotations offset by higher prices of vegetable oils, the Food and Agriculture Organisation of the United Nations (FAO) reported on December 8.

The FAO Food Price Index, which tracks monthly changes in the international prices of a set of globally traded food commodities, averaged 120.4 points in November, unchanged from its level in the previous month and 10.7 percent lower than in November 2022.

The FAO Cereal Price Index decreased by 3.0 percent from October. International prices of coarse grains dropped by 5.6 percent, led by a sharp fall in maize prices, while those of wheat declined by 2.4 percent in November. The FAO All Rice Price Index remained stable month-on-month amidst contrasting price movements across different origins and market segments.

The Vegetable Oil Price Index, meanwhile, increased by 3.4 percent from October. International palm oil prices rebounded by more than 6.0 percent in November, chiefly underpinned by more active purchases by leading importing countries and seasonally lower outputs in major producing countries. World sunflower oil prices rose moderately, while quotations for soy oil and rapeseed oils dropped

slightly in November.

The FAO Dairy Price Index rose 2.2 percent from October, led by high import demand for butter and skim milk powder from Northeast Asian buyers, along with increased internal demand ahead of the winter holidays in Western Europe.

The FAO Meat Price Index dipped 0.4 percent from October, reflecting minor drops in the world prices of poultry, pig, and bovine meats, driven mostly by ample exportable supplies.

FAO raised its forecast for this season's harvests in a new Cereal Supply and Demand Brief, also released on December 8. World cereal production in 2023 is now pegged at 2,823 million metric tonnes, up 0.9 percent from the previous year and 10.3 million metric tonnes above the previous record high

reached in 2021.

Looking ahead to the next season, planting of the 2024 winter wheat crop is ongoing in the northern hemisphere countries, and, reflecting lower crop prices, area growth could be limited.

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Global production of fishmeal and fish oil remains down

IFFO – The Marine Ingredients Organisation released its marine ingredient market trends report for December 2023. The organisation reported that as of December 21st, in Peru, around 66% of the second fishing season's quota had been landed in the north-centre of the country. The early start of the second fishing season in the North-Centre of Peru, which took place in October and is usually scheduled in November, explains larger catches of small pelagics than usual when we compare October 2023 with October 2022.

In the USA, the menhaden fishing season officially ended in November. The new fishing season will resume in May 2024.

Cumulative total fishmeal production during the first ten months of 2023 was down by approximately 22% compared to the cumulative production reported through October 2022. These figures are based on a list of countries considered in the IFFO reports. The predominant factor contributing to this decline must be attributed to the 60% year on year decrease in Peru, whose activities were heavily affected by the El Niño phenomenon, and the subsequent cancellation of the April-June first fishing season of the year.

As for fish oil, the total cumulative output in the first 10 months of 2023 was 20% down year over

year. The supply shortage in Peru (due to both fewer landings and lower oil yields) was again the main cause of such negative performance. Chile remained the only country that registered a positive change year on year, thanks to improved catches and higher-than-average oil yields in the south of the country.

China's domestic production of fishmeal and fish oil in quarter IV 2023 might exceed that reported in quarter IV 2022. Despite this, local fishmeal producers are encountering difficulties in selling their products due to poorer demand and the abundance of standard quality fishmeal. As a result, the inventory of domestic fishmeal appears higher than it was a year ago. Cumulative imports of fishmeal from January to November have declined by 9.4% year on year, in line with the weaker domestic demand from both aqua- and piglet feed producers and the reduced Peruvian supply.

Read more>>

Novus tackles maximizing production efficiency for dairy farmers

Feed is a major cost for dairy farmers. Ensuring that an expertly designed feeding strategy goes from the formulation phase to the bunk without being altered is paramount to a positive return on investment.

To help producers identify how to optimize resources while maximizing their production efficiency Novus will host a special pre-conference session on the topic at the Pacific Northwest Animal Nutrition Conference (PNWANC) on January 15, 2024, in Boise, Idaho.

"There are many ways that the effectiveness of a feed ration can be challenged," says Heather Tucker, Ph.D., global ruminant technology manager for Novus. "This event will show how to ensure satisfaction throughout the development and execution of a ration. From hedging feed products, reducing ration shrinkage, building a ration for feed efficiency, getting the most out of minerals, and ultimately ensuring the ration you make is the ration the cow eats, we hope to uncover what is limiting dairy farmers

from maximum success."

The event Conserving Resources While Maximizing Production Efficiency will be held before PNWANC at 1:00 p.m. (MST) on January 15, 2024, at The Grove Hotel in Boise, Idaho.

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Scientists make guide for assessing gene editing

Nofima scientists are conducting genomic research to understand which genes are involved in providing resistance against sea lice in the Pacific salmon species. This cooperation between scientists from a range of different disciplines and backgrounds is now providing lessons that will help improve the welfare, health, and sustainability of many other animals and plants.

"We are trying to understand the genetic mechanisms that affect how salmon become resistant to lice," says Nick Robinson.

He is Australian and a senior scientist at Nofima in Norway, and he has just settled down in a chair in an office in Scotland. Accompanying him is Diego Robledo. He comes from Spain, but he conducts research at the Roslin Institute at the University of Edinburgh. The project that Nick Robinson leads is international.

Sea lice live by eating skin and blood. Salmon become sick, and lice are a problem both for fish welfare and for the industry. But there are salmon that do well against salmon lice: "In wild coho salmon, this occurs naturally. The cells of the salmon surround the

lice and kill them," explains Diego Robledo.

Coho and pink are two salmon species native to the Pacific Ocean that combat sea lice naturally in a way that Atlantic salmon (the salmon we know from Norwegian rivers and fish farms) are unable to manage.

"Our genomic research is helping us to understand which genes are involved in providing resistance against sea lice in the Pacific salmon species, and the next step in our project is to test the function of these genes in Atlantic salmon using gene-editing. Early next year, we will be ready to introduce gene edited Atlantic salmon to sea lice in a closed biosecure facility," says Nick Robinson.

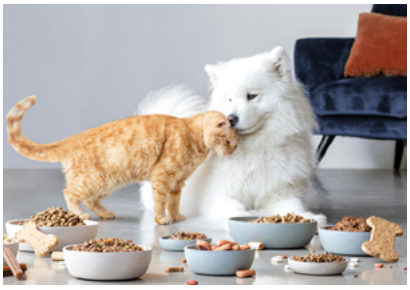
Read more>>

United Petfood acquires Dutch company De Haan Petfood

Dog and cat food manufacturer United Petfood announced a takeover of Dutch company De Haan Petfood. De Haan Petfood, located in Nieuwkoop, the Netherlands, specialises in the production of wet dog and cat food in the form of high-quality meat chunks in gravy. With over six decades of experience in the production of canned wet food for worldwide export, the company brings significant expertise to the United Petfood family.

"The takeover of De Haan Petfood opens up new avenues in terms of wet food and enables us to keep up with growing demand," United Petfood stated.

"We are pleased to be joining the UP family, and we are convinced this will allow us to consolidate our business success. On a commercial level, we can pool our resources while existing UP clients get access to an experienced manufacturer of canned



wet food. We will also be able to share our know-how and experience on an operational level," said the representatives of De Haan Petfood.

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Selective breeding increases omega-3 content of microalgae

Scientists shown that selective breeding can significantly increase the omega-3 content of microalgae. Marie Lillehammer is behind the research.

"We wanted to know whether breeding can contribute to faster growth and increased omega-3 content. The initial trials we carried out yielded very promising results," said Nofima Senior Scientist Lillehammer.

To grow, algae require light, temperature, and nutrients. However, growth is also affected by algae genes. Therefore, scientists tested whether it is possible to breed microalgae as one does with farmed fish: when crossing individuals or genera that produce high yields, the next generation produces higher yields than the previous one, and so on.

Many microalgae reproduce vegetatively. Therefore, the scientists chose the species Seminavis robusta, a well-studied alga that has sexual reproduction. Eight lines of the species were crossed with each other in one generation and tested in the breeding trial.

Although the species is not very relevant as a feed resource, the trial showed that 18% of omega-3 production in the algae is determined by the genes (heritability). Breeding gives an 8.8% increase in omega-3 in one generation.

Growth percentages were even higher. With a 50% heritability, the microalgae grow 25% faster per generation -in theory, a ninefold increase per year, given ten generations in one year.

"It may be that inbreeding and physiological limitations would halt growth over generations, or growth would have side effects. However, the trial shows that breeding should be explored further if microalgae is to become an important feed ingredient for European aquaculture," says Lillehammer.

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Pda: Companies with natural, non-antibiotic, non-drug products skip Canada

Dick & Associates (Pda), a Canada-based a full-service consulting firm for the human and animal health industries, emphasises the outdated regulatory system and points out that the regulatory approach of the Government of Canada needs to evolve so Canadian farmers can easily access natural, non-antibiotic, non-drug products that are safe and optimise the health and wellness of their animals.

According to the Pda, these products are often readily available to farmers in other countries that either have a reduced regulatory burden or a large enough market to justify a high regulatory burden. Farmers and consumers in these countries enjoy the benefits of innovative products that optimise the health of animals, allowing them to better resist disease. Importantly, these products will not contribute to antimicrobial resistance, which the World Health Organisation (WHO) says is the greatest threat to human and animal health.

"There are significant regulatory challenges for non-drug products in Canada," says Lauren Carde, vice president of operations and regulatory affairs for Pda. "If they don't meet all the requirements for a Veterinary Health Product or a Feed, they are pushed into the drug category, which is really problematic because these products are not drugs and the drug regulations don't make sense for non-drug products."

Pda launched a podcast to go deeper into the regulatory hurdles facing companies wishing to introduce important non-drug products to Canada. The first episode features an interview with Dr. Steven Theriault, the chief executive officer of Cytophage Technologies, a Canadian bacteriophage company that ultimately decided not to bring its innovative products to Canada because of the regulatory burden.

The podcast is called "Accelerating Success" and is available on all platforms, including YouTube.

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Novus supports European dairy customers with new appointment

Frederik (Freek) van Essen, DVM, joined Novus as regional sales manager of dairy for Europe. The company hired Dr. van Essen as part of its efforts to expand support for dairy customers in Europe.

"Dr. van Essen has a long history in the dairy business, even on the family side," said Dr. Uwe Ranft, vice president and managing director for Europe, the Middle East, and Africa, and strategic accounts. "He understands what's important to professional dairy farmers and brings a passion for animal health and welfare to this role that dairy customers will benefit from."

With over 15 years of experience, Dr. van Essen is accountable for implementing the sales strategy in the region as well as establishing lasting business relationships with key Novus customers by supporting the financial and environmental sustainability of their operations.

With expertise in feed additives, nutrition, and veterinary medicine, Dr. van Essen can provide dairy farmers, nutritionists, and feed mills with a variety of solutions to address challenges as well as options to help them meet production goals.

Frederik (Freek) van Essen

"The production demands that dairy cows in Europe are facing require feed solutions and management practices that optimise protein efficiency, reduce nitrogen emissions, and also maximise milk and component yields," said Dr. van Essen.

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Rumin8 CEO says methane-reducing solutions can transform cattle into climate champions

Utilising science-based solutions to reduce methane emissions from the global cattle herd can play an important role in reducing the impact of global warming on livestock and complement other solutions proposed in the United Nations' Food & Agriculture Organization's (FAO) global food systems roadmap released at the COP28 summit in Dubai.

Speaking after returning from COP28, Rumin8 CEO David Messina said companies like Rumin8 were seeking to meet FAO's goal of reducing methane emissions from livestock by reducing emissions at their source, the cow.

Rumin8 CEO David Messina said science-based solutions, such as methane-reducing feed additives, were succeeding in turning cattle into 'climate champions' while at the same time ensuring a sustainable future for the rural communities in developed and developing nations that rely on livestock for their livelihoods and existence. This was a key focus of the FAO roadmap.

"The cow is not the climate enemy; the methane they produce is," said Messina. "Promising solutions are being developed to reduce methane from livestock, which plays a critical role in the global food system in feeding both developed and developing countries. These solutions are really important to ensure that meat and milk can remain an important source of nutrition and economic support for people around the world, particularly in developing nations."

"Reducing consumption is one approach. Reducing climate intensity from beef and dairy production is another. Both seek the same result, but with different impacts on different sectors," said David Messina.

Read more>>

Chris Moses joins Royal Canin North America team

Royal Canin North America, a division of Mars, Incorporated, announced Chris Moses has been appointed Site Leader for the Royal Canin Pet Health Nutrition Center (PHNC) in Lewisburg, Ohio. Moses brings nearly 20 years of animal health experience into this crucial role, focused on expanding the company's research capabilities in the rapidly growing North American market.

Moses serendipitously discovered this role while contacted during an airport layover and, upon initial conversations with the business, called his move a "no-brainer." He shared, "I was immediately enamoured by what Royal Canin stands for – it truly is about the pets. Products are not designed to appease pet parents but to find the proper diet for each individual cat and dog."

In his role, Chris Moses is responsible for overseeing a team of 71 experts who assess the digestibility and palatability of Royal Canin diets. In addition, the PHNC focuses on specific areas and key priorities for the business, such as skin and coat health, mobility, immunity, and aging. This additional level of expertise helps enable increased nutritional precision and the development of products tailored to individual pet needs. The PHNC is one of two Royal Canin pet centres globally for the business and the only U.S.-based location.

Chris Moses

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Overfishing in Mediterranean and Black Sea fell to lowest level in a decade

While overfishing remains a concern, The State of Mediterranean and Black Sea Fisheries 2023 report (SoMFi 2023) records a drop of 15 percent in this figure over the last year, an improvement consistent with a continuous reduction in fishing pressure, which has fallen by 31 percent since 2012.

The report is the flagship publication of the General Fisheries Commission for the Mediterranean (GFCM) of the Food and Agriculture Organisation of the United Nations (FAO). For the first time, this year's report also includes data on the region's marine aquaculture sector.

Fisheries and aquaculture together produced nearly 2 million metric tonnes of seafood in 2021, figures in SoMFi 2023 show. Economically, the two played an equally important role, generating revenues of more than USD 20 billion and supporting 700,000 jobs along the value chain.

"This special edition of SoMFi paints a complete picture of this vital sector, reinforcing just how important it is for livelihoods, food security, and nutrition in our region," said GFCM Executive Secretary Miguel Bernal.

Although excessive exploitation of fish stocks has fallen significantly, fishing pressure in the Mediterranean and Black Seas is still at twice the level considered sustainable. However, the report also demonstrates that the GFCM's continued focus on expanding management plans and technical and spatial measures is having positive results for key commercial species. Stocks of European hake in the Mediterranean, turbot in the Black Sea, and common sole in the Adriatic Sea, all covered under dedicated management plans, showed a striking reduction in overfishing; some of them already revealed signs of biomass rebuilding.

SoMFi reports that, in contrast to capture fisheries, the region's marine aquaculture sector is growing significantly. Marine and brackish water aquaculture production has nearly doubled over the last decade, increasing by 91.3 percent, with revenues also up by 74.5 percent.

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Siemens, Nasekomo collaborate on digitalization of insect production

Nasekomo, a biotech scale-up, and Siemens Bulgaria, a part of the global digital leader Siemens AG, forged an agreement to collaborate on the digitalization of insect biotransformation—an emerging industry with significant potential for sustainable development.

The partnership between Siemens and Nasekomo, unveiled during the UN Climate Change Conference (COP 28), will serve as the foundation for establishing an intelligent insect industry 4.0. with built-in industrial cyber security to fulfil the growing demand for protein in both quality and quantity. The collaboration aims to expedite the expansion of the insect industry by leveraging digitalization to enhance capacity.

The official signing took place in the presence of the Bulgarian Minister of Innovation and Growth, Milena Stoicheva, and the Minister of Environment and Water in Bulgaria, Julian Popov. The strategic cooperation document was signed by Virak Chhuor, Vice President of Engineering and Production at Nasekomo, and Dr. Eng. Boryana Manolova, CEO of Siemens for Bulgaria, North Macedonia, and Ukraine.

The partnership will bolster Nasekomo's development concept, which envisions a data-driven

franchising business model. This involves initially creating a connected network of factories within European countries and eventually expanding globally. The initial phase of the collaboration will focus on establishing a state-of-the-art breeding centre to provide a sustainable supply of young insects for the network of bioconversion factories.

"We are at the beginning of the journey, but it is time to lay the groundwork for the execution of our expansion vision. The way to do it is the franchising model, based on data and digital systems to enable it," explained Virak Chhuor.

This concept not only envisions the automation of processes but also the digitalization of all biological and technological operations within the breeding centre, achieved through machine learning and the implementation of cutting-edge technologies like digital twins for production and live insect larvae. With Siemens' support, Nasekomo aims to integrate systems and data from up to 200 planned production sites worldwide in the future. This will ensure intelligently managed operations, reliable AI analytics, and sustainable management.

Read more>>

New FAO report maps pathways towards lower livestock emissions

FAO released its report titled "Pathways towards lower emissions – A global assessment of the greenhouse gas emissions and mitigation options from livestock agrifood systems" during the COP28 climate summit. The report raises the bar of opportunity for policymakers, industry participants, smallholders, and consumers.

"Beyond evaluating baseline emissions, this report offers estimations of future emissions under scenarios of increased production and outlines pathways to reduce emissions through the application of well-established best practices in animal management. It clearly demonstrates that ambitious and innovative programmes and wide-ranging interventions have the potential to bend the emissions curve while production grows," said FAO Deputy Director-General Maria Helena Semedo.

"Solutions such as improving animal health, breeding practices, reducing food loss and waste, and directly targeting GHG emissions have the potential to provide multiple benefits for people and the planet, but they require investments in the sector to narrow efficiency gaps while meeting an increased global demand for animal protein," she added, noting that interventions must be site-specific, facilitate farmers' access to finance and services to enable them to implement tailored interventions.

The report, subject to a double-blind peer review process involving world experts, outlines several pathways impacting both the supply and demand sides of the livestock sector, which, if adopted collectively, could address the environmental impacts and promote sustainability. While there is no universal solution and more work is needed to understand the barriers to implementing and upscaling these interventions, enhancing productivity and production efficiency across the entire value chain is the most promising way to mitigate and reduce livestock emissions.

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