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Matrix

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Animal Feed Manufacturers Association

Quarterly magazine of the Animal Feed Manufacturers Association

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Within challenges lie opportunities

By Liesl Breytenbach, executive director, AFMA

Each new year inevitably brings renewed energy and a sharpened sense of purpose. I trust that our members and industry partners have had the chance to rest and reconnect over the festive season. As we enter 2026, the feed industry finds itself at a defining moment. The Animal Feed Manufacturers Association (AFMA) will approach this year with clarity, resolve, and a firm conviction: The feed sector is not only adapting to change – it is shaping the future of South Africa's agricultural and food value chain.

AFMA Matrix has long served as AFMA's voice: a bridge between science and industry, between policy decisions and practical implications. It is more than a publication – it is the sector's narrative backbone. During 2025, AFMA refined the editorial direction of *AFMA Matrix* to ensure that each edition delivers targeted, sector-specific analysis that reflects the realities, opportunities, and innovations across South Africa's feed-to-food system. Members can expect even stronger insights from experts across trade, regulation, production, and infrastructure.

Opportunity across the value chain

This first issue of 2026 reflects that renewed strategic intent to inform, connect, and inspire. It carries a central message for the feed and livestock industries: within challenges lie opportunities.

After several difficult years, the poultry sector is demonstrating early signs of recovery. Continued improvements in disease control of highly pathogenic avian influenza (HPAI), biosecurity systems, and trade protection, underpinned by policy alignment, will be essential as phase two of the *Poultry Masterplan* advances. For the feed sector, this recovery reinforces the critical importance of efficiency, cost management, and innovation as drivers of national food security and competitiveness.

Across the broader livestock value chain, cautious optimism is emerging. Softer feed prices, supported by higher soya bean production and stabilising market conditions, are creating space for improved performance, particularly in intensive production systems. Nonetheless, persistent challenges in disease management of foot-and-mouth disease (FMD) and African swine fever (ASF), infrastructure reliability, and constrained consumer spending will influence the pace of growth. These are precisely the areas where the feed sector's technical expertise from formulation to safety, quality assurance, and biosecurity continues to deliver tangible value.

Driving sustainable progress

As the industry evolves, attention must now shift decisively to the regulatory environment that governs agricultural inputs. The modernisation of the *Fertilizers, Farm Feeds, Agricultural Remedies and Stock Remedies Act, 1947 (Act 36 of 1947)* remains a priority area for collaboration between government and industry. The transition towards electronic submission systems, more effective oversight, and formal recognition of existing compliance initiatives across the feed and livestock sectors will collectively strengthen South Africa's food production system.

Logistics reform is equally pivotal. Rail and port performance continues to influence the reliability and affordability of feed ingredient supply. The revitalisation of Transnet and parallel logistics reforms will play a defining role in determining the sector's growth trajectory over the coming years.

Across all these themes, sustainability emerges as the unifying principle. Through engagement with the International Feed Industry Federation (IFIF) and Food and Agriculture Organization (FAO), AFMA has seen how global thinking has matured: Sustainability is no longer confined to environmental outcomes but extends to economic resilience, food safety, and social responsibility. For AFMA, sustainability is a practical, daily commitment ensuring that every tonne of feed produced contributes to a stronger, safer, and more efficient food system.

Leading with purpose

The articles in this issue underline a powerful reality, namely that the strength of the feed industry lies in its connectivity to primary producers, policy and regulation, trade and logistics systems, and global markets. It is an industry grounded in science, collaboration, and resilience, and one that continues to adapt to ensure South Africa's agricultural future is competitive and secure.

This year marks a new chapter for AFMA and the industry we serve. The challenges ahead require collaboration and innovation but they also offer a significant opportunity to reimagine the role of feed manufacturing in shaping a sustainable and inclusive food system for South Africa.

AFMA's vision for 2026 is to lead with purpose and to ensure our members are equipped with current information and the insights and confidence to act decisively. *AFMA Matrix* will continue to evolve as the industry's trusted knowledge platform, reflecting both the technical depth and the forward-looking ambition that define our community.

This year will undoubtedly bring challenges, but also unprecedented opportunity. Let's meet them with courage and collaboration, knowing that our collective efforts strengthen not only the feed industry, but the broader food system that nourishes the nation.

For enquires, send an email to Liesl Breytenbach at liesl@afma.co.za

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NEWS & VIEWS

Important AFMA events in 2026

Date	Event	Where it will be hosted	Contact
12-13 February	AFMA *Act 36* in-practice short course	Pretoria (fully booked)	admin@afma.co.za
26 March	AFMA *Act 36* registration workshop	Pretoria	intern@afma.co.za
23 April	AFMA technical writing skills workshop	Pretoria	events@afma.co.za
28 May	AFMA media and industry day	Pretoria	events@afma.co.za
5 August	AFMA golf day	Pretoria	events@afma.co.za
8 September	AFMA AGM	Sun City	admin@afma.co.za
8-10 September	AFMA Forum	Sun City	events@afma.co.za
1-2 October	AFMA *Act 36* in-practice short course	Pretoria	admin@afma.co.za

Orffa introduces new brand promise

Orffa, a global producer of specialty feed additives, announced its renewed purpose, vision and mission, distilled into a new brand promise: Orffa. The science in your feed.

The global feed industry is undergoing rapid transformation, with rising demand for transparent, evidence-based and reliable insights. Orffa's renewed direction responds to these needs by strengthening its scientific foundation and providing customers with clearer guidelines for formulation efficiency, performance predictability, and sustainability.

Over the past year, Orffa has taken steps to further embed scientific excellence into its operations, including advancing gut health analytics; initiating scientific collaboration on methane abatement; and completing external verification of life cycle assessment (LCA) data for its digestibility enhancer Excential Energy Plus by the Global Feed LCA Institute. *– Press release*

Astral Foods clucks up solid results

The integrated poultry producer Astral Foods' financial results for the year ending 30 September showed significant improvement on all fronts. Revenue increased by 10% to R22,6 billion (R20,5 billion in 2024); operating profit increased by 11% to over R1,2 billion (2024: R1,12 billion); and headline earnings per share increased by 14% to 2 193 cents.

Revenue for Astral's feed division increased by 9,8% to R10,8 billion (2024: R9,8 billion), as a result of higher sales volumes and increased feed prices, reflecting higher raw material costs.

Total feed sales increased by 7%, primarily driven by an 8,1% rise in internal poultry feed requirements (62 507 tonnes). External feed sales volumes grew by 5,6% (30,632 tonnes), supported mainly by higher demand from the poultry and pig sectors.

Following a strong production season and with promising conditions expected for the next, Gary Arnold, CEO of Astral Foods, said the outlook is encouraging for the company overall. "It is still early in the season, but the indicators so far point to another good year for grain and oilseed producers. This suggests that feed prices will remain favourable and support poultry production," he noted. *– Susan Marais, Plaas Media*

Innovative research on sustainable feed

Melokuhle Queeneth Magagula, an MSc graduate in Animal Science from the Faculty of Natural and Agricultural Sciences, has earned national and international acclaim for her innovative research on the development of sustainable poultry feed.

The study investigated the effects of dietary incorporation of *Vachellia erioloba* oyster mushroom spent substrate (OMSS) on growth performance, carcass traits, visceral organs, haemato-biochemistry and meat quality, including fatty acid composition in Boschveld chickens.

The results demonstrate that feeding *Vachellia erioloba* pods-derived OMSS at 2,5% inclusion level enhances the nutritional healthiness of meat, notably improving its fatty acid composition, without majorly affecting its physico-chemical quality as well as bird growth performance, carcass traits, and haemato-biochemistry.

This research adds valuable scientific knowledge to the field of sustainable animal nutrition while offering practical solutions for smallholder and rural poultry producers. By transforming an underutilised indigenous resource into a biotechnologically enhanced feed, Melokuhle's study promotes circular agriculture and environmental sustainability across Southern Africa. – *North-West University*

Turning organic waste and manure into feed

A research project within Resource Recovery at the University of Borås in Sweden explored how valuable substances can be extracted from organic waste and how this loop can be closed by producing animal feed.

In her doctoral project, Clarisse Uwineza demonstrated how food waste and animal manure can be converted into valuable volatile fatty acids. These acids can then be used as a substrate to cultivate protein-rich fungal biomass, which can, in turn, be used to produce animal feed.

By using a method known as anaerobic digestion where microorganisms break down waste in an oxygen-free environment, it is possible to extract these volatile fatty acids. These acids, along with nutrients such as nitrogen and minerals, can then be used to cultivate a specific fungus: *Aspergillus oryzae*. The fungus grows into a biomass rich in protein, minerals, and dietary fibre, and is also easily digestible for animals.

In addition to animal feed, the fungal biomass can also be used in the production of bio-based materials, such as biodegradable plastics or as an alternative to leather. The results show that emissions can be reduced, resources can be better utilised, and new opportunities can be created within the circular bioeconomy. – *Poultryworld.net*

Russia enters soya bean meal export market

A record soya bean harvest in 2025 paves the way for Russia's leading soya bean processor, Sodrugestvo, to kick off exports. Sodrugestvo has signed the first contract to export soya bean meal from the Kaliningrad region. Under this agreement, 25 000 tonnes of soya bean meal will be exported to Turkey in January 2026, Alexey Mramornov, Sodrugestvo commercial director, said.

According to Mramornov, at current soya bean prices on the Russian market, exports to several other countries abroad make clear economic sense. "By the end of the season, we see the potential to process up to 500 000 tonnes of Russian soya beans in Kaliningrad for shipments to non-CIS (outside of post-Soviet space) countries," Mramornov said. A possible weakening of the Russian rouble could further spur the export potential.

Given that soya beans are subject to a 20% export duty in Russia, it is likely that Russian companies will prioritise soya bean meal exports.

It is not clear whether Russian soya bean processors use a Russian government waiver issued in June 2025 that allows imports of genetically modified soya beans. This one-year decree, which took effect, makes imports of GMO soya beans into the country legal under a crucial condition: the resulting animal feed must be exported and is banned for domestic consumption. The import of GM soya beans for domestic use remains prohibited. – *All About Feed*

Use of methane-reducing product halted

The largest buyer of milk in Norway is temporarily stopping the use of Bovaer, a product that reduces cows' methane emissions. Norske Melkeråvare is doing this as a precaution after complaints from Denmark about the supplement. According to the company, however, there are no indications that the product from the Dutch-Swiss company dsm-firmenich is harmful.

Bovaer has been approved by the European food watchdog EFSA as an additive that reduces the amount of methane livestock emit by dozens of percent. Recently, reports appeared in Denmark from dairy farmers who said their cows had become ill after using the supplement. These cases allegedly involved fever, reduced fertility, and even death.

Norske Melkeråvare says it is working with farmers, advisors, feed companies, and regulators to investigate the possible causes of the Danish complaints. – *All About Feed*

French market grows amid disease challenges

France's animal feed sector continues its recovery, with production rising 0,9% in 2024/25 and further growth forecast for 2026. However, persistent livestock diseases and market uncertainties are threatening the industry's full potential.

France has had some large epidemics of avian influenza from 2022, leading to the culling of millions of ducks and chickens. As for cattle and sheep, the department of agricultural registered over 6 500 cases of bluetongue 3 since 1 June 2025. At the end of 2024, the first cases of the cattle disease EHD were discovered. In July 2025, lumpy skin disease also entered the country for the first time, with the number of cases rising to 101 at the middle of November.

So far, those developments haven't influenced the feed market significantly, although it limited the growth potential in some parts. – *All About Feed*

The AFMA board of directors: Back, from the left, are Ruan Stander of Meadow Feeds, Paul Saunders of Sovereign Foods, Brett Roosendaal of Epol, Dieter Fleischmann of AFGRI Animal Feeds, Francois du Toit of NOVA Feeds, Dr Francois Crots of Country Bird Holdings, and Martin Oosthuizen of De Heus. Front, from the left, are Michael Schmitz of Meadow Feeds, Anina Hunter of Epol and AFMA chairperson, Thinus van Lill of NOVA Feeds and AFMA vice-chairperson, and LiesI Breytenbach, AFMA executive director. Dr Josef van Wyngaard of Voermol (inset photograph) was not present when the picture was taken.

AFMA celebrates 80 years of excellence

By Izak Hofmeyr

The Animal Feeds Manufacturers Association (AFMA) marked its 80th anniversary during its annual general meeting (AGM) at Zimbali Lodge on the North Coast of KwaZulu-Natal. Celebrations began with an industry golf day, followed by a meet-and-greet cocktail. The formal AGM took place the next day and featured several speakers who shared insights on developments shaping the sector. The festivities concluded with a gala dinner and awards ceremony.

Founded in 1945 by a small group of feed manufacturers seeking to stabilise supply during wartime shortages, AFMA has since grown into South Africa's leading feed industry body. Over eight decades, the association has adapted to significant regulatory and market changes ranging from the introduction of the *Fertilizers, Farm Feeds, Agricultural Remedies and Stock Remedies Act, 1947 (Act 36 of 1947)*, to global market volatility and evolving feed-safety standards.

Challenges and opportunities

In his keynote address, Ian Bird, senior executive at Business Unity South Africa (BUSA), highlighted two critical logistical challenges facing the country. First, Transnet's rail and port services need to be strengthened and stabilised operationally, with private stakeholders supporting structural reforms under the Freight Logistics Roadmap. Second, he emphasised the importance of private-sector investment in rail and ports through the Department of Transport's Private Sector Participation Unit.

Despite these challenges, Bird's overall message was optimistic. He referred to progress in third-party applications to operate on the Transnet rail network. Although successful applicants still have considerable work ahead, the regulatory environment is now in place, putting the next steps firmly in their hands.

Dr Tracey Davids, who leads the commodity markets and foresight programme at BFAP, noted in her keynote address that the agricultural sector is currently navigating a volatile environment, with the broader macro-economy under pressure. "In a 'business as usual' scenario, we see limited growth for agriculture overall," she said. "However, some cyclical changes could be slightly more favourable for the livestock sector."

She noted that feed prices are expected to decline, which should improve profitability and create growth opportunities. However, she cautioned that major challenges remain, particularly relating to animal diseases, that must be addressed to unlock this growth.

"There are several core interventions that can significantly accelerate growth prospects. These interventions include

The AFMA Person of the Year, Wiana Louw, flanked by AFMA chairperson, Anina Hunter, and executive director, Liesl Breytenbach.

Elzané Liebenberg, 2025 AFMA Student of the Year, with Anina Hunter and Liesl Breytenbach.

improved logistics, strengthened animal health systems, and export-led growth through increased market access."

State of the soya bean industry

A panel discussion on the state of the South African soya bean industry highlighted the significant progress made across the value chain, including soya bean production growth and increased crush capacity. A few decades ago, national production stood at around 700 000 tonnes; today, production has grown to approximately 2,7 million tonnes. Crush capacity has expanded accordingly, enabling the animal feed industry to become fully self-sufficient in soya meal, eliminating the need for imports.

According to Peter Lovelace of CEOCO, one of the most notable achievements in recent years is that the quality of locally produced soya meal now matches, or even surpasses, that of imported product. The soya bean trajectory, he said, is a major success story for the entire value chain.

However, the industry also faces pressing challenges. Continued expansion of local production will be essential to meet domestic demand, yet rising volumes may push prices towards export parity. As production increases, ensuring seamless export capacity of either soya meal or whole beans via the country's transport networks will become increasingly critical.

Past leaders honoured

AFMA paid tribute to its past leaders, recognising former chairpersons Gerhard Scholtemeijer (1977-1983), Dr Erhard Briedenhann (2002-2005, 2007-2010), Dr Hinner Köster (2005-2007), Loutjie Dunn (2010-2018), Wouter de Wet (2018-2022), and current chairperson Anina Hunter. The organisation also acknowledged its former executive directors Hansie Bekker (1990-2006) and De Wet Boshoff (2006-2022), and its current executive director, Liesl Breytenbach.

Reflecting on his early tenure as chairperson, Scholtemeijer noted that although the organisation was significantly smaller at the time, it was always vibrant and resourceful. The industry's biggest challenge then was the shortage of protein sources for animal feed.

"Importing protein had always been a headache, especially due to quality issues," he recalled. "This is why we invested so much time and energy in promoting the local production of soya beans. History shows that those early efforts played a role in developing the thriving soya bean industry we have in the country today."

Dr Köster, who served on the AFMA board for more than 20 years and chaired it from 2005 to 2007, noted that many of the industry's current successes were built on foundations laid a decade or more ago. "Take the abolition of the Agricultural Control Boards in the late 1990s, which introduced a radically new approach to marketing, including futures trading. This opened the door for the industry to manage price risk."

He also pointed to the integration between feed manufacturers and especially the poultry industry during that period, which led smaller manufacturers to either specialise or exit the market.

Technological progress in feed mills accelerated dramatically during his tenure. "High-tech machinery and computerised feed formulation programmes had a significant impact on costs. Near-infrared

Past and present leaders are, from the left, Dr Erhard Briedenhann, Loutjie Dunn, Gerhard Scholtemeijer, Anina Hunter, Liesl Breytenbach, Dr Hinner Köster, and De Wet Boshoff.

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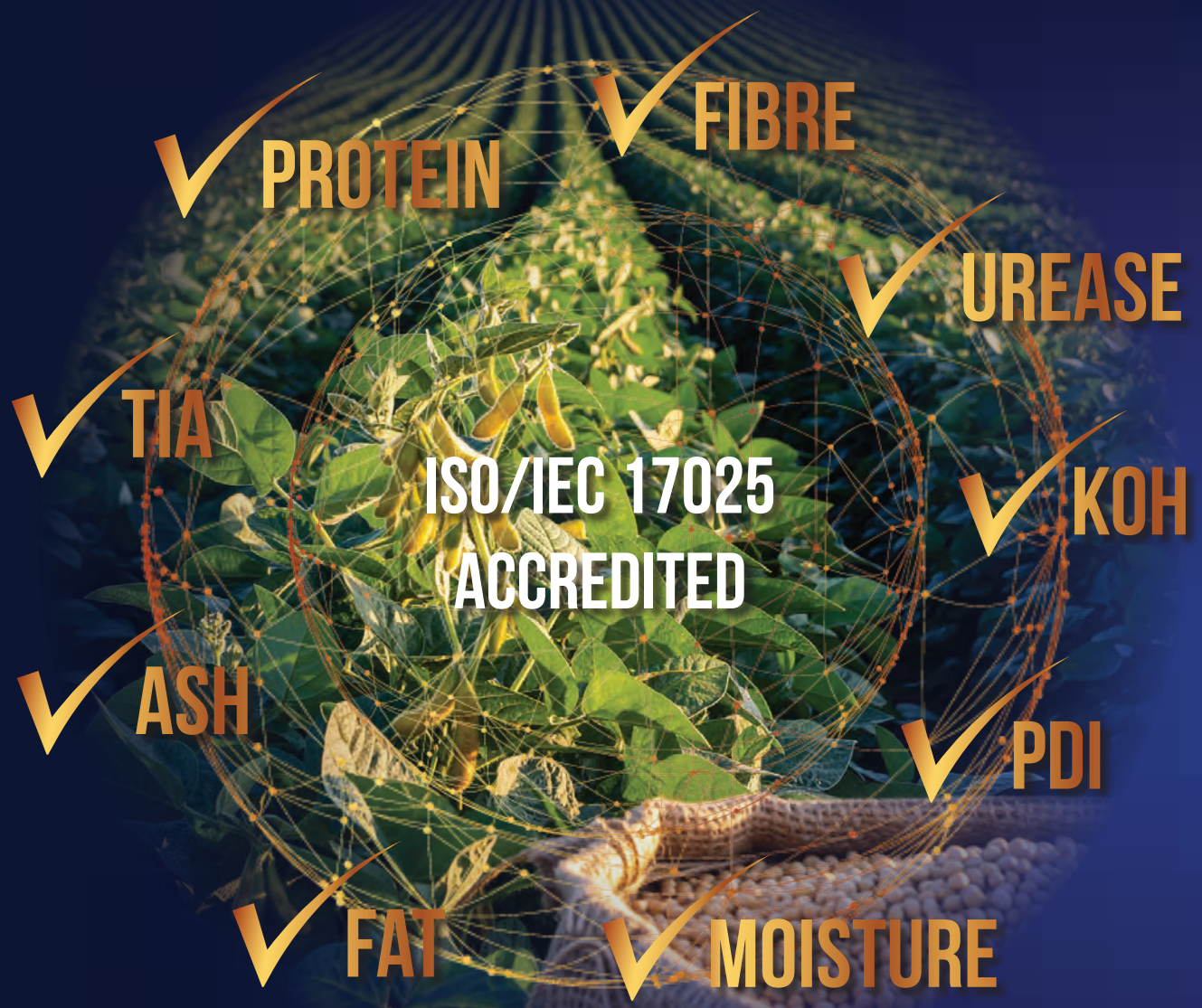

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Participants of the panel discussion on soya beans. From the left are Prof Ferdi Meyer of BFAP who moderated the discussion, Anina Hunter, Peter Lovelace of CEOCO, Dr Erhard Briedenhann of MIDS, and Kellie Becker of SOILL.

Ian Bird of Business Unity South Africa delivered the keynote address and focussed on logistical challenges facing the industry.

technology, which enabled rapid analysis of raw materials, became widely used and made fast, informed decision-making possible." He added that developments in micronutrient technologies, such as amino acids, enzymes, organic minerals and natural performance enhancers, had also profoundly improved animal production efficiency.

"I believe the development of a code of conduct for the industry is one of AFMA's most important achievements. We created standards for animal feeds and quality control that allowed us to become a self-regulating industry."

Looking ahead, he said that future challenges include further refinement of technology to maintain cost effectiveness, stringent management of mycotoxins, and strengthening quality control even further.

Loutjie Dunn, who chaired AFMA from 2010 to 2018, also highlighted the association's Code of Conduct as a major achievement during his tenure. He cited the development of the *Salmonella* and *Mycotoxin Protocols* as additional milestones. The *Mycotoxin Protocol*, in particular, aims to predict seasonal mycotoxin risk at the start of each season.

"An initiative I never thought I would see realised in my lifetime is the potential to register animal feed manufacturing facilities rather than specific products," he said. "Although this has not yet been achieved, it remains a high priority for AFMA. This speaks to one of the great strengths of an organisation such as AFMA, namely its continuity in pursuing long-term goals."

Newly re-elected chairperson Anina Hunter urged AFMA members to become more actively involved in the association by raising their most pressing challenges with the board and participating in efforts to address them. She noted that national transport infrastructure remains a universal concern among members. The positive message shared by Ian Bird of BUSA regarding progress in this area was therefore especially encouraging.

Awards honour excellence

The undisputed highlight of the gala event was the presentation of the AFMA Person of the Year and AFMA Student of the Year awards. The AFMA Person of the Year award is presented annually to recognise a South African individual who has made an outstanding and influential contribution to the animal feed or feed-related industry.

Wiana Louw, general manager of The Southern African Grain Laboratory (SAGL), was bestowed this honour. She was nominated by Dr Erhard Briedenhann, chairperson of SAGL. In his motivation, Dr Briedenhann highlighted Louw's transformative impact on the animal feed and grain sectors through her leadership at SAGL and her active involvement across multiple industry platforms.

She established and expanded the *National Mycotoxin Monitoring Programme*, providing essential data that informs regulatory standards and strengthens feed safety. Her pioneering work in analytical method development, laboratory accreditation, and the adoption of advanced technologies has elevated South Africa's ability to meet international compliance benchmarks. Read an article on Louw's achievements elsewhere in this issue.

AFMA Student of the Year

The AFMA Student of the Year Award, presented annually in honour of Dr Koos van der Merwe, whose work greatly advanced the development and scientific credibility of South Africa's animal feed industry, was awarded to Elzané Liebenberg, an MSc student in Animal Nutrition at the University of the Free State. She was nominated by Dr Ockert Einkamerer, senior lecturer in the same department.

Liebenberg's research focussed on the effects of genetically modified (GM) maize (*Zea mays* L.) grain on gut health and microbial diversity in finishing lambs. Her work contributes to the field of animal nutrition by improving understanding of nutrient utilisation, supporting the potential for more sustainable feeding strategies using GM maize, and exploring gut health factors that can optimise efficiency and overall livestock productivity.❖

For more information, visit *www.afma.co.za*

Trendsetter Wiana Louw on passion, pension and 'paprheology'

By Susan Marais, Plaas Media

Wiana Louw is a stalwart in the South African grain value chain. From seed to feed, it would be difficult to find any segment untouched by her influence.

Although she will retire as general manager of the Southern African Grain Laboratory (SAGL) at the end of September this year, Wiana has no intention of settling into a typical pensioner's life. In fact, simply writing these words feels as absurd to me as it will to anyone who knows her! Instead, she sees retirement as a launchpad for renewed innovation.

As we sit in her office, sipping coffee, this becomes unmistakably clear. Wiana still speaks about her work with the enthusiasm of an eager intern discovering a world of possibilities – yet she carries the wisdom that comes only from decades spent at the coalface.

Doing the best with the best

Over nearly 17 years at the SAGL, Wiana has witnessed remarkable developments and collaborated with exceptional people. "I have been very privileged to work with some of the best in the industry during the peak of their careers," she says, adding that the role is any scientist's dream because the SAGL is the link between academia and real-world application.

The laboratory's work has also provided researchers with ample opportunities to advance their own careers through meaningful, industry-benefitting research. One example is the PhD study by researcher Theresa de Beer, focussed on what has been dubbed 'paprheology'. If the term is new to you, don't worry – it was coined at the SAGL to describe this unique study.

"Rheology refers to the study of dough quality, and Theresa is investigating the quality of *pap*, or cooked maize meal. So, we combined the two and came up with 'paprheology'," Wiana explains. "The rest of the world doesn't cook and eat *pap* the way we do in Southern Africa, and people often underestimate how sophisticated our maize milling industry truly is. International visitors are always amazed when they encounter it."

Theresa's research focusses specifically on methods to measure the stickiness of *pap*. It is also one of the reasons why Wiana wants to remain involved. Her scientific curiosity is far from satisfied.

The vision continues

The SAGL was born from the laboratories of the former Wheat and Maize Boards. In those early years, the laboratories performed basic tasks such as crop surveys and small-scale research for millers. Times have changed, however, and if Wiana has her way, they will continue to evolve. Her dream is for the laboratory to transform into a one-stop hub where every part of the industry can find answers to most, if not all, of their crop survey, grain measurement, and grain-related scientific questions. After all, scaling up is key to any laboratory's long-term sustainability.

"Many labs in other sectors are somewhat removed from the industries they serve. Yet we are right in the middle of the action, and it is wonderful to be here. It is great to truly be part of the value chain," Wiana remarks. This proximity, she adds, gives the SAGL a unique advantage in understanding exactly what the industry aims to achieve.

One of the major issues Wiana hopes to focus on once she is 'retired' and has more time, is investing in people – both within the SAGL and across the broader industry. "People truly are your biggest asset, and it is critical for us to retain human capital as best as possible. To achieve this, we must ensure that our people feel safe and empowered."

To strengthen human-capital development even further, Wiana envisions helping to establish a training centre for grain monitoring and measurement scientists – a facility that could serve multiple industry bodies and companies beyond the SAGL. "There's a lot of training happening across the grain and oilseed value chain, and there might even be room for consolidation."

Risk monitoring

She also believes the SAGL may one day be well positioned to apply as an

Wiana Louw.

assignee of the Department of Agriculture. "If ever we are in such a position, I think it would be wise to start with a risk assessment of the industry and focus on the greatest risks first. You don't have to be perfect from the outset, but you do need to start somewhere."

A potential starting point for monitoring risk in South Africa's grain industry could be auditing the dry-matter content of bread. "Begin by reviewing companies' records, identify gaps, and use that as your foundation," she advises.

Among her many career highlights is the establishment of the Crop Protection Division, which brought that part of the grain and oilseed value chain closer to the mainstream.

Ultimately, there are countless research opportunities across the value chain that remain unexplored and Wiana believes the SAGL is ideally positioned to pursue them.

Rooted in research

Wiana is an educator at heart. She holds a Higher Education Diploma in Natural Sciences (now BSc Ed) from the University of the Free State, where she majored in botany, zoology, and chemistry. This academic foundation set the stage for her lifelong dedication to training, scientific rigour, and public health through food safety and regulatory compliance.

Her professional journey began at Roodeplaat Research Laboratories (1988 to 1993) where she coordinated the National Residue Monitoring Programme. Her work centred on detecting pesticide and veterinary drug residues in animal-derived products to ensure food safety and regulatory compliance. During this time, she played a key role in developing and validating analytical methods, as well as implementing quality management systems that led to achieving laboratory accreditation. She also demonstrated ethical leadership through her service on the institutional ethics committee.

From 1993 to 1998, at the South African Bureau of Standards (SABS), Wiana continued her work in residue analysis, supporting product registration and monitoring. She was instrumental in securing ISO/IEC 17025 accreditation and OECD Good Laboratory Practice (GLP) compliance while mentoring new analysts and strengthening internal quality systems.

Her tenure at the Council for Scientific and Industrial Research (CSIR) from 1998 to 2003 marked further expansion in pesticide and mycotoxin method development, and laboratory capacity building. She led cross-functional projects and contributed to pharmaceutical research involving indigenous plant materials, effectively bridging traditional knowledge with contemporary scientific approaches.

Wiana returned to the SABS from 2003 to 2009 to lead the Chromatographic Services Department. In this role, she oversaw pesticide and veterinary drug registration and residue monitoring activities, fortifying analytical capabilities and helping the agricultural sector meet both local and international standards.

Wiana served at the SAGL from 2009, where she did some of her most impactful work. She established the National Mycotoxin Monitoring Programme, generating essential data to inform regulatory updates and underpin feed safety. The Crop Protection Division provides GLP-compliant services for plant protection product registration. Her contributions have extended into academia through support for tertiary institutions, internships, and pathways for postgraduate research and development.

Recognition and engagement

Wiana's contributions have been recognised through several accolades, notably her selection as a finalist in the 2017 Standard Bank Top Woman Awards and her nomination for the 2025 National Science and Technology Forum Management Award.

Her influence spans a wide range of industry platforms. She serves on technical committees for agricultural trusts, the Animal Feed Manufacturers Association, Agbiz Grain, the National Chamber of Milling, and the South African Chamber of Baking. In these capacities, she has helped shape quality-control systems and supported regulatory authorities through public-private partnerships that generate and interpret technical data for policy development.

Wiana's legacy is characterised by her unwavering commitment to innovation, capacity building, and regulatory excellence. Her leadership has elevated South Africa's competitiveness in meeting international compliance standards, particularly in feed safety and analytical science. She has mentored numerous young scientists, championed skills development, and built strong collaborative bridges between academia and industry.

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SOUTH AFRICAN LIVESTOCK SECTOR:
Poised for growth if disease challenges can be overcome

By Dr Tracy Davids, director and manager: commodity markets and foresight, BFAP

South Africa's agricultural sector is set to rebound strongly following two consecutive years of decline in real agricultural gross domestic product (GDP). The projected growth reflects positive performance in a number of sectors, including strong fruit exports and a bumper summer crop harvest.

Despite considerable challenges associated with widespread foot-and-mouth disease (FMD), which has disrupted beef supply and constrained exports, intensive livestock sectors such as pork and poultry are recovering strongly on account of both price support and a significant reduction in feed costs. This turnaround follows a sustained period of elevated feed costs that brought significant pressure on margins, but the cycle is set to turn in favour of livestock production over the next few years.

Cost relief boosts stock gains

South Africa's agricultural markets are well integrated into global dynamics and the initial upswing in feed product prices from 2021 onwards was very much driven by global factors. These included supply chain disruptions post pandemic and Russia's invasion of Ukraine, which ignited sharp increases in energy and agricultural commodity prices.

When global prices started moderating, South Africa faced severe drought conditions in 2024, which prolonged the high price cycle domestically. Despite a challenging early season in 2025, conditions improved throughout the season and the latest estimates point to a maize crop exceeding 16,3 million tonnes and a soya bean crop in excess of 2,7 million tonnes. This is ample to rebuild stocks and leave a substantial exportable surplus. Consequently, feed-material prices have declined sharply, with yellow maize and soya bean prices in October trading 27 and 15% lower, respectively, relative to March 2025.

The intentions to plant for the 2025/26 season, released by the Crop Estimates Committee in October last year, point to further expansion in maize and soya bean area. It is still early in the season, but considering good soil moisture at the start of the season and projected La Niña conditions, which typically bring good rainfall in South Africa, the 2026 crop could exceed that of 2025 by some margin. This suggests that there is room for prices to decline further, possibly all the way to export parity levels.

The decline in feed product prices is good news to livestock producers, particularly those that use feed intensively in the production system. *Figure 1* shows that the chicken-to-maize price ratio, which depicts a basic indicator of profitability for poultry producers, is expected to improve significantly in 2025 and 2026. Producers will also benefit further from improved affordability of protein meal following expansion in soya bean production and processing facilities in recent years that will push South Africa to a surplus producer of protein meal.

The *2025 BFAP Baseline* indicated that this recovery in profitability is sufficient to induce production growth of 1,8% per annum over the coming decade, implying that most of the consumption growth expected in South Africa could be met by domestic poultry production. South Africa's chicken producers have successfully replaced a large share of previously imported products since the inception of the poultry industry masterplan, benefitting from changes in the tariff structure, intermittent HPAI outbreaks in several countries, and a weaker exchange rate, which raises the cost of imported products.

In 2018, South Africa imported more than 500 000 tonnes of chicken, of which 287 000 tonnes was bone-in portions that compete directly with the IQF portions that dominate South Africa's market. By 2024, total imports had declined to 330 000 tonnes, of which less than 40 000 tonnes was bone-in portions.

While a success, these changes indicate that the runway for further import replacement is getting short – almost 73% of the chicken South Africa imported in 2024

Figure 1: Chicken production, consumption, trade and profitability: 2014 to 2034. (Source: BFAP Baseline 2025)

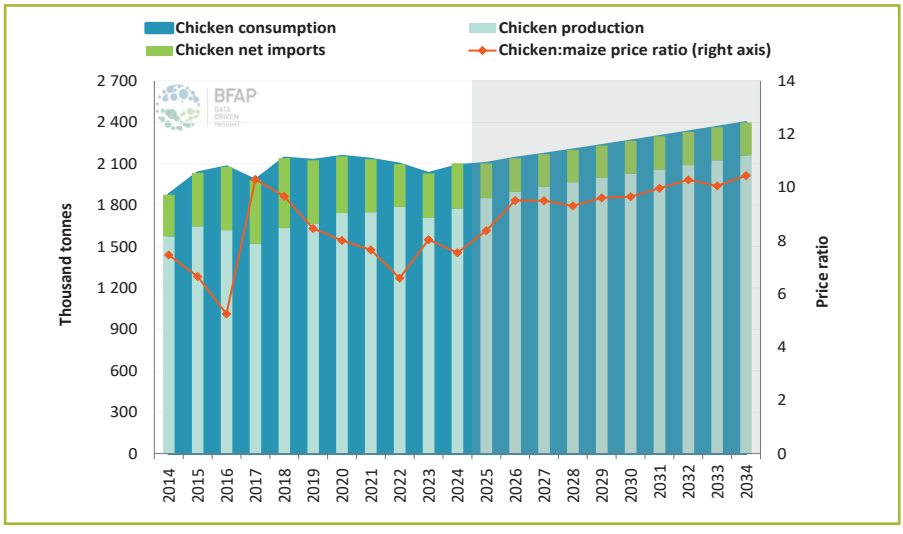
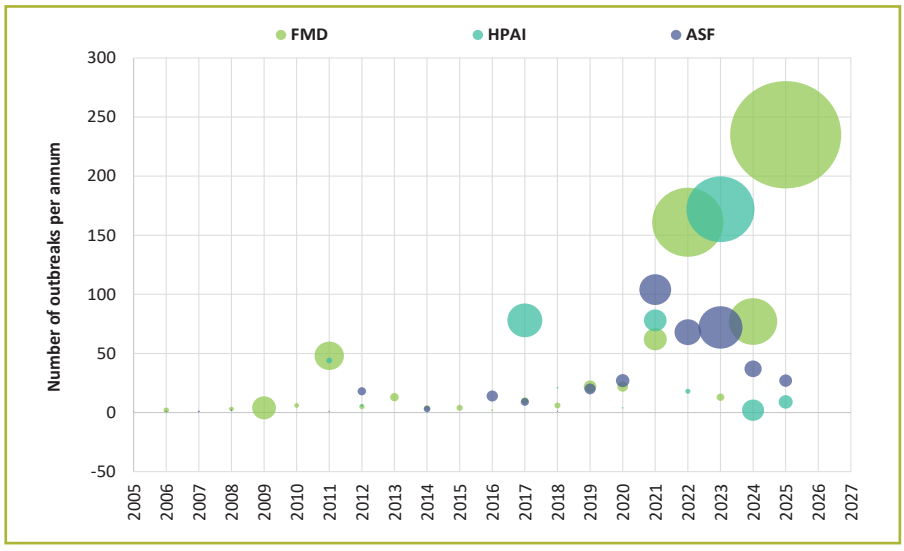


Figure 2: Number of animal disease outbreaks and cases over time – bubble size is indicative of the value of meat affected in 2024 constant terms.



was mechanically deboned meat, which is not produced at large scale in South Africa. Thus, future growth will need to be underpinned by a combination of additional domestic consumption and growth in exports.

Productivity and market access

While the outlook for livestock production is undoubtedly more positive than the results of the recent past, it is also not without challenges. Many beef producers continue to face significant challenges as a result of persistent FMD outbreaks, which have disrupted operations, constrained market access, and placed substantial financial strain on producers and the rest of the value chain.

South African consumer spending power has also been under pressure for some time and from 2014 to 2024, growth in household income per capita exceeded inflation by only 0,8% for the entire ten-year period. Meat products in particular are sensitive to spending power constraints and meat consumption in per capita terms have declined consistently from 2019.

Despite some green shoots in economic performance, spending power is likely to remain constrained in the short term. The latest forecast from the Bureau for Economic Research points to growth of 1,3% in real GDP in 2025 and a further 1,5% in 2026. This is better than the recent past, but still well below target. Combined with slower projected meat price gains in the outlook relative to the past, the recovery is sufficient to arrest the decline in per capita consumption going forward, but consumption gains are projected to be slow. This suggests that livestock sectors will increasingly need to look to exports to accelerate growth.

Animal disease issues

The beef sector in particular has successfully transitioned from a net importer to a net exporter, and has achieved success in optimising carcass value particularly through exports of high value cuts into premium markets. While other industries could also strive to replicate such strategies in future, the challenge of inadequate animal disease management remains a critical constraint.

Figure 2 highlights that the frequency and intensity of animal disease outbreaks have increased substantially in recent years. This constrains both productivity growth and export market access and progress is needed to accelerate inclusive growth and unlock the sector's full potential. The current spread of FMD is a clear example of how damaging such outbreaks can be – both economically for producers and through the value chain, and in terms of food security as prices continue to rise

The increases in beef prices resulting from supply disruptions have supported prices for other meat types, as consumers look to more affordable alternatives, and sectors with shorter production cycles such as pork and poultry can ramp up production to ensure meat supply, but these sectors are not immune to animal disease risks themselves, with ASF and HPAI a constant threat.

Recent disruptions in beef supply are temporary and when supply resumes, the current price benefits will subside. The ability to export will then become even more critical.

Disease constraints stall growth

Contrary to feed products, international beef prices have risen through most of 2025, reflecting the slower supply response relative to grains and oilseeds, with several leading suppliers globally having reduced herd numbers through the high feed price cycle. As herds are now being rebuilt, supply remains constrained, supporting higher prices.

The potential benefit of these prices to South African producers was clear in Quarter 1 of 2025, when beef exports were almost 20% higher than Q1 of 2024, but exports have since stalled amid the spread of FMD across major feedlots. Overcoming animal disease constraints to enable broader market access is therefore critical to enable local producers to benefit from the strong global cycle.

In conclusion

Recent dynamics in meat and animal feed markets suggest that the livestock subsector, which contributes almost half of agriculture's production value, has ample potential for growth. Despite positive profitability prospects, the 2025 *BFAP Baseline* noted that despite past progress, growth projections are balanced on a knife's edge. Immense potential for inclusive growth can be unlocked, but these are conditional on improvements in animal disease management, which has been sorely lacking.

Addressing weaknesses in animal health and strengthening overall biosecurity will unlock export market access and critical productivity gains. Consequently, it remains a distinct priority for industry stakeholders that are actively collaborating with government role-players to find needed solutions.

For more information,
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Feeding for prevention:
Building resilience through adequate nutrition

By Bonita Cilliers, technical and regulatory advisor, AFMA

Antimicrobial resistance (AMR) has become one of the defining global health and food security challenges of our era. Once hailed as the cornerstone of medical and veterinary progress, antimicrobials are losing their effectiveness as bacteria adapt and evolve faster than the development of new medicine.

The scale of the crisis is staggering. According to the World Health Organization or WHO (2023), bacterial AMR was the direct cause of 1,27 million deaths in 2019 and contributed to almost five million additional deaths worldwide that same year. The World Bank warns that by 2030 AMR could cost the global economy up to US$3,4 trillion annually in lost productivity.

Resistant pathogens move between people, animals, the environment and food, and demand a unified One Health response that connects human, animal, and environmental wellbeing. Under the leadership of the Quadripartite Alliance – comprising the Food and Agriculture Organization (FAO), World Organisation for Animal Health (WOAH), United Nations Environment Programme (UNEP), and WHO – the forthcoming Global Action Plan on AMR (2025-2035) calls for renewed global commitment to prevention, focussing on hospitals and the entire agri-food chain.

Within this framework, the feed and livestock sectors play a decisive role. Preventing disease before it occurs through sound husbandry, biosecurity, and scientifically balanced nutrition is no longer optional; it is essential for safeguarding animal productivity, public health, and the long-term effectiveness of antimicrobials.

From use to stewardship

For more than 70 years, antimicrobials have supported livestock production by improving health, growth, and feed efficiency. When used responsibly and under veterinary guidance, they remain an indispensable tool for animal welfare and food safety. However, the misuse and overuse of these medicines, particularly at non-therapeutic doses or without appropriate oversight, have contributed to the development and spread of AMR.

The United States Food and Drug Administration's Guidance for Industry no 72 (2023) and the WHO's Critically Important Antimicrobials for Human Medicine (2022) both reinforce a central principle – stewardship, not prohibition. Medically important antimicrobials must be used only when necessary, under professional supervision, and for clearly defined therapeutic or preventive purposes.

In animal nutrition, this stewardship mindset is rapidly gaining ground. The focus has shifted from dependency on antimicrobials towards holistic health, using high-quality feed, improved management, and nutritional innovation to reduce disease risk. The principle is clear: A healthy, well-fed animal is naturally more resilient and less reliant on antimicrobial intervention.

Global evidence

Research continues to map the uneven global burden of resistance. A study by Van Boeckel *et al*. (*Science*, 2019) identified AMR 'hotspots' across China, India, Pakistan, Brazil, Egypt, and Southern Africa – regions where livestock production is intensifying but feed quality and oversight remain inconsistent. Resistance to common antibiotics such as tetracyclines, sulphonamides, and penicillin already exceeds 40% in pigs and poultry in several of these regions.

The findings underscore a simple but powerful truth: prevention must come before treatment. Vaccination, veterinary oversight, hygiene, and biosecurity remain indispensable, but nutrition has now been recognised as an equally vital pillar of prevention. The FAO, EFSA-EMA (2017), and the Quadripartite Alliance all highlight that adequate animal nutrition improves gut health, immunity, and overall resilience, hence reducing the need for antimicrobials while maintaining productivity and welfare.

IFIF's global leadership

Representing over 80% of global compound feed production, the International Feed Industry Federation (IFIF) has become a leading advocate for integrating nutrition into the global AMR response. Its flagship programme, Nutritional Innovation to Promote Animal Health and Welfare, provides a scientific and regulatory framework demonstrating how balanced feeding supports animal resilience and antimicrobial stewardship, particularly in low- and middle-income countries.

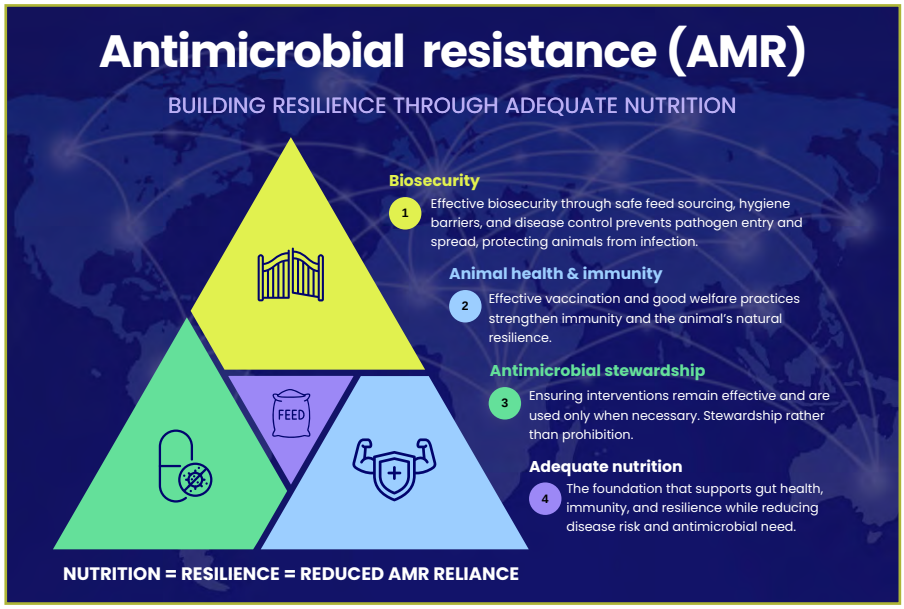
The IFIF framework is built on three interlinked pillars:

- **Scientific validation:** Demonstrating measurable benefits of quality feed on gut integrity, immunity, and resilience.
- **Regulatory clarity:** Using the *Delineation Approach* (2023) to distinguish nutritional solutions from veterinary drugs and prevent over-regulation.
- **Capacity building:** Empowering national feed associations to advocate for nutrition as a recognised prevention tool.

Through collaboration with the FAO, WOAH, and *Codex Alimentarius*, IFIF ensures that advances in feed science are reflected in One Health dialogues, which bridge science and policy to promote preventive, sustainable animal health systems.

Despite the growing evidence, regulatory recognition remains limited. The *IFIF Regulatory Report* (2020) notes that most national frameworks still treat feed mainly as a compositional or

Figure 1: The AMR prevention pyramid – a colour-coded triangle showing 'Adequate nutrition' bridging all tiers.



safety issue, while its health-supporting functions often fall between veterinary and feed legislation. To close this gap, IFIF and the FAO recommend establishing harmonised criteria for nutritional-health claims; recognising nutrition as an evidence-based resilience tool within AMR policy; and encouraging joint assessment mechanisms between feed and veterinary authorities.

Feeding for health

IFIF defines adequate nutrition as: "The oral intake by animals of adequate levels of nutrients, substances, microorganisms, and other feed constituents, considering their combination and presentation, necessary to fulfil functions related to their physiological states, including the expression of most normal behaviour, and their resilience capabilities to cope with stressors of various types encountered in appropriate husbandry conditions."

In practice, this means optimising feed composition, processing, and feed presentation; minimising exposure to feed-borne contaminants such as mycotoxins; meeting nutritional needs for maintenance, growth, reproduction, and immunity; and supporting digestion, metabolism, and behavioural wellbeing.

Adequate nutrition is therefore about feeding for health, not just growth, ensuring nutrient balance, gut integrity, and immune competence that create resilient animals less prone to disease and less dependent on antibiotics.

Nutrition as measurable prevention

Healthy, well-nourished animals are naturally more resilient to disease, respond better to vaccines, and recover from stress quicker. The *EFSA-EMA Joint Scientific Opinion* (2017) outlines a three-tiered prevention framework for reducing antimicrobial use in livestock, with nutrition as the foundation across all levels:

- **Primary prevention** stops pathogens from entering or spreading between farms through biosecurity, hygiene, and feed safety. Sound feed sourcing, mycotoxin control, and storage practices form the first line of defence.
- **Secondary prevention** reduces infection pressure via vaccination, housing design, and climate control, strengthened by balanced diet and probiotics that strengthen immunity.
- **Tertiary prevention** builds resilience and recovery through targeted nutritional support through functional feed additives such as enzymes, organic acids, pre- and probiotics, and trace minerals that improve gut health and immune function.

Across all tiers, nutrition is the unifying foundation for disease prevention, resilience, and reduced antimicrobial reliance. Evidence from IFIF recommendation papers (2019-2024) confirms that balanced nutrition measurably enhances gut integrity, immunity, and overall resilience.

Animal nutrition and AMR

The FAO (2024) brief *Animal Nutrition Strategies and Options to Reduce the Use of Antimicrobials in Animal Production* outlines key actions:

- **Eliminate or minimise the use** of antibiotic growth promoters, following *Codex* guidance.
- **Adopt** safe alternatives (enzymes, probiotics, prebiotics, organic acids, essential oils, and plant extracts).
- **Improve** husbandry and biosecurity, reducing stress, crowding and exposure.
- **Apply** good hygiene and feed safety practices across the value chain.
- **Enhance** welfare, water quality, and housing conditions.
- **Avoid** anti-nutritional factors (lectins, protease inhibitors) and optimise feed processing for digestibility.
- **Build** technical capacity through FAO/IFIF training and the *Manual of Good Practices for the Feed Industry*.

Together these steps shift production from antimicrobial dependence towards nutrition-driven resilience and productivity.

Global alignment

AMR remains one of the highest priorities on both the global and national agendas. Following the 2024 UN GAP-AMR declaration, South Africa reaffirmed its commitment to a One Health approach and the responsible use of antimicrobials across the food and animal production sectors.

At the international level, the Quadripartite Alliance is finalising the Global Action Plan on AMR (2025-2035). The plan promotes prevention, innovation, and capacity building as the foundation of global coordination, recognising animal nutrition as a key enabler of antimicrobial stewardship alongside vaccination, biosecurity, and responsible antimicrobial use.

Its four priority areas include **prevention** through improved hygiene, vaccination, biosecurity, and balanced nutrition; **innovation** in vaccines, diagnostics, and nutritional strategies that

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strengthen resilience; **capacity building** and stronger governance, particularly in low- and middle-income countries; and **surveillance and data integration** to guide evidence-based policymaking.

Aligned with these global objectives, the FAO Guidelines on Animal Feeding reaffirm that good nutrition and sound husbandry are central to AMR prevention. They call for stronger feed governance, more research on immunity-enhancing feed additives, and the inclusion of nutritional indicators in AMR monitoring systems.

As part of this global consultative process, AFMA participated as an observer in the GAP-AMR multi-stakeholder meetings in September 2025, ensuring that South Africa's feed sector remains aligned with emerging One Health priorities and future international policy directions.

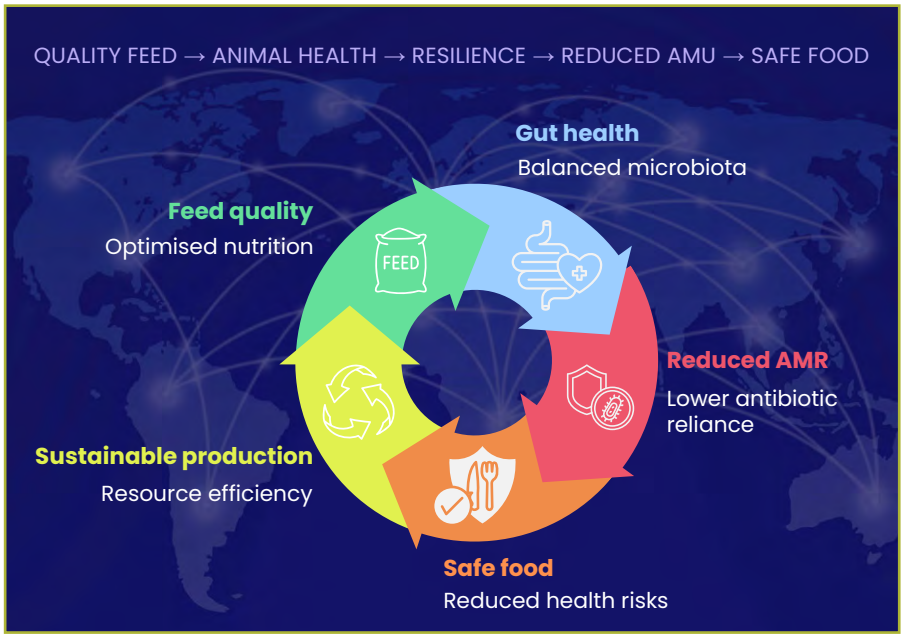
As an active member of IFIF and participant in its regulatory committee, AFMA represents South Africa in global feed-policy discussions, ensuring national alignment with FAO-*Codex* guidance and international best practice. AFMA also promotes the recognition of adequate nutrition as a tertiary prevention measure within South Africa's upcoming National AMR Action Plan, reinforcing the link between feed quality, animal health, and food safety.

National implementation

At a national level, South Africa is finalising its *National AMR Action Plan for Veterinary Medicines*, while the reconstitution of the ministerial advisory committee (MAC) on AMR is pending. Parallel regulatory reforms under the South African Health Products Regulatory Authority (SAHPRA) and the National Department of Agriculture (NDA) aim to enhance oversight, strengthen prudent-use practices, and antimicrobial stewardship across the value chain.

Within this evolving policy environment, AFMA plays a pivotal role in bridging science and practice. As a member of the AMR Industry Alliance, AFMA ensures that feed safety, quality, and nutrition remain recognised as central pillars of antimicrobial stewardship. Its approach combines science-based decision-making with practical implementation, recognising that safe, well-formulated feed supports animal health and productivity.

Figure 2: The feed-for-prevention loop.



Building on this foundation, AFMA is supporting **accurate antimicrobial-usage reporting** and contributing to evidence-based decision-making before new restrictions are introduced; updating its **position statement** on antimicrobials to align with IFIF's nutritional innovation framework, promoting 'adequate nutrition' as a science-based strategy to reduce antimicrobial reliance; and exploring the development of a **standard operating procedure (SOP)** on the prudent use of in-feed antimicrobials, guided by sector frameworks from poultry and swine.

Strengthening prevention

AFMA has elevated biosecurity as a cornerstone of disease prevention within the feed sector. Current initiatives include the distribution of the IFIF Biosecurity Guideline to members, development of a practical feedmill biosecurity audit checklist to support self-assessment and continuous improvement, and the publication of a SACNASP-accredited CPD quiz to encourage learning and professional recognition of biosecurity competency.

These initiatives – supported through the *AFMA Code of Conduct* and promoted across industry communication platforms – aim to strengthen on-farm and feed-mill controls, reduce disease risks, and enhance resilience at every level of production. By integrating biosecurity, feed safety, and nutrition as interconnected pillars, AFMA reinforces a comprehensive prevention model that supports animal health, food safety, and national food security.

Conclusion

Antimicrobial resistance is not a crisis of the future; it is a slow pandemic of today. Combating it requires prevention at the source - in feed, on farms, and across the food chain. Adequate nutrition, robust biosecurity, and responsible antimicrobial stewardship form the foundation of sustainable animal health.

Through its collaborations with IFIF, the AMR Industry Alliance, and the Quadripartite AMR Platform, AFMA advocates science-based, practical solutions that connect feed safety, biosecurity, and nutrition as the three pillars of prevention. By advancing evidence-driven policies, AFMA supports a national AMR response that safeguards public health while promoting animal welfare, sector sustainability, and national food security.

By feeding for prevention, we build resilient animals, safer food, and a sustainable future – one where antimicrobials remain effective when truly needed. ❖

Send an email to Bonita Cilliers at technical@afma.co.za for more information.

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Rules of origin for animal feed

By Dr Lucius Phaleng, trade advisor, AFMA

In today's interconnected global economy, moving animal feed ingredients across borders is more than a logistical task. For manufacturers and importers, it creates strategic opportunities to lower costs and boost competitiveness.

So-called rules of origin (RoO) lie at the core of these opportunities. These rules determine the national source of a product and affect tariff rates under free trade agreements (FTAs). For South Africa, understanding and correctly applying these rules is crucial. This knowledge is key to accessing preferential trade benefits, particularly under agreements such as the *Southern African Development Community-Europen Union (SADC-EU) Economic Partnership Agreement (EPA)*.

Understanding the role of RoO

Rules of origin define a product's country of manufacture, which is essential in international trade because tariff rates often depend on the exporting country. These rules also determine eligibility for reduced or zero import duties and whether a product is subject to anti-dumping or countervailing measures.

There are two main types of RoO:

- **Non-preferential rules**, which apply under the 'most-favoured nation' principles and determine general duty rates.
- **Preferential rules**, which apply under FTAs and other preferential duty schemes. In these cases, countries have agreed to eliminate or reduce duties on goods produced in each other's territories.

The South African Revenue Service (SARS) administers trade agreements by collecting customs duties, enforcing tariffs, and ensuring compliance with RoO.

Determining origin

Under trade protocols, raw materials and ingredients are considered to originate in a member state if they are shipped directly between members and meet specific conditions. These conditions typically require the product to be:

- Wholly produced within a member state.
- Sufficiently processed when obtained from non-originating materials.

For animal feed ingredients under *Harmonized System (HS) Chapter 23*, especially HS 2309 (preparations used in animal feeding), the *SADC-EU EPA* specifies in *Annex II* of *Protocol 1* that origin is conferred where the product is manufactured from materials classified under headings other than HS 2309 and where the use of certain non-originating cereals and residues, as well as the total value of non-originating materials, remains within the percentage thresholds set out in that annex.

In practice, this means that origin for HS 2309 relies on a change in tariff heading (CTH) combined with specific weight and value limits for certain inputs, rather than being a purely CTH-based rule with no limits.

Example scenario

An EU manufacturer produces a feed premix (HS 2309.90) in Austria for export to South Africa, using a mineral binder from China (HS 2530.90), EU-origin vitamins (HS 2936), and enzymes (HS 3507). Since all inputs are classified under different HS headings from the final product, the change of heading rule is met. As long as the premix meets the change-of-heading requirement and stays within the specific weight and value limits for non-originating materials set out in *Annex II*, it qualifies as EU-originating under the *SADC-EU EPA*.

Upon export, the EU producer issues a *EUR.1 Movement Certificate* or origin declaration confirming EU origin. SARS verifies the certificate on arrival in South Africa and grants duty-free entry under the EPA.

Use of imported premix

After import, South African feed manufacturers can use the EU-origin premix to produce compound animal feeds (HS 2309.10) for poultry, dairy, or livestock. These feeds are blended with local ingredients such as maize, soya bean meal, wheat bran, and oilcake for domestic and regional markets.

However, if manufacturers wish to export the finished feed back to the EU under the EPA, challenges arise. Since both the premix and finished feed are classified under HS 2309, simple mixing does not qualify as sufficient processing to confer South African origin. The final product may not qualify for preferential access unless further transformation, cumulation, or value-added thresholds are met.

Conclusion

Understanding and applying RoO is essential for animal feed businesses to benefit from trade agreements such as the *SADC-EU EPA*. These rules affect sourcing, production planning, and export opportunities. The EU feed premix example highlights both the advantages of duty-free access and the complexities of origin determination for re-exported feeds. Manufacturers who align their supply chains and production with RoO requirements can improve competitiveness, lower trade costs, and ensure compliance.

For more information, send an email to Dr Lucius Phaleng at trade@afma.co.za

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Understanding *HS Code Chapter 23*

By Dr Lucius Phaleng, trade advisor, AFMA

Accurate product classification is essential in international trade. The *Harmonized System* (*HS*) is the globally adopted nomenclature for classifying traded products. Within this framework, Chapter 23, titled "Residues and waste from the food industries; prepared animal fodder", specifically covers animal feed ingredients and raw materials.

For traders, importers, exporters, and regulatory authorities, understanding the nuances of *HS Code Chapter 23* is critical. This system assigns standardised numerical codes to specific goods for customs and tariff purposes.

This guide unpacks the details of Chapter 23, offering clarity on classification criteria and highlighting common materials covered. In South Africa, tariff administration falls under the South African Revenue Service (SARS) who is responsible for establishing, maintaining, and updating tariff schedules for imported animal feed ingredients and raw materials.

For AFMA members, a sound understanding of Chapter 23 supports correct tariff application, promotes transparent trade practices, and strengthens advocacy in tariff-related discussions.

Chapter contents

According to the SARS *Tariff Book*, Chapter 23 primarily encompasses by-products and waste materials from food processing operations, and products manufactured specifically for animal consumption. These items are often used as animal feed ingredients but are generally unsuitable for human consumption.

The chapter is structured into headings ranging from 01 to 09, including flour and meals of meat or fish (HS 23.01), milling residues from cereals (HS 23-02), by-products from starch, sugar, brewing, or distilling (HS 23-03), oilcake and solid residues from extracting soya bean, groundnuts (peanut), and other vegetable oils (HS 23-04, HS 23-05, and HS 23-06), wine lees and argol (HS 23-07), and various other vegetable materials for animal feeding (HS 23-08 and HS 23.09).

Prepared animal feeds

Heading 23.09 covers products intended for animal feeding that are not specified elsewhere. In this context, processing refers to altering vegetable or animal materials to the extent that they lose their essential characteristics (appearance, texture, or nutritional profile). This heading includes sweetened forage and prepared feedstuffs.

Complete feeds: These preparations contain energy-providing nutrients, including high-carbohydrate substances such as starch, sugar, cellulose, and fats. They also have protein-rich nutrients from sources such as legume seeds, brewing dregs, oilcake, and dairy by-products. Elements such as calcium, phosphorus, chlorine, sodium, potassium, iron, and iodine help build bones and, in poultry, make eggshells. Functional nutrients promote the assimilation of carbohydrates, proteins, and minerals.

Supplementary feed: Produced feed often lacks sufficient protein, vitamins, or minerals. Supplementary preparations are formulated to correct these deficiencies and ensure a well-balanced diet. They typically contain proteins, minerals, vitamins, and additional energy sources, which act as carriers for other nutrients. Examples include fish solubles in liquid or viscous solutions, in paste, or dried forms. These are produced by concentrating and stabilising residual water. They are derived from fishmeal or fish oil manufacturing. Other supplements include whole green leaf protein concentrates and green fraction leaf protein concentrates, both derived from lucerne juice through heat treatment.

Premixes: Premixes are compound formulations. They consist of multiple substances, often referred to as additives, whose nature and proportions vary depending on the type of animal production. They include substances that improve digestion and feed utilisation efficiency, safeguard animal health through vitamins, provitamins, amino acids, antibiotics, coccidiostats, trace elements, emulsifiers, flavourings, and appetite stimulants. Some preserve feed quality until consumption, such as stabilisers and antioxidants. Carriers may include organic nutritive substances such as manioc, soya flour or meal, middlings, yeast, and food industry by-products, or inorganic substances such as magnesite, chalk, kaolin, salt, or phosphates.

Chapter 23.09 does not include ingredients or raw materials suitable for both animal feed and human consumption. For example, pellets made from a single material or mixtures classified under a specific heading, even with up to 3% binder by weight, are excluded. Simple mixtures of cereal grains (Chapter 10), cereal flours or leguminous vegetable flours (Chapter 11), protein substances (Chapter 35), antimicrobial disinfectant preparations (heading 38.08), and other products in headings 38.24, 29.36, 30.03, 30.04, 19.01, and 21.06 are also excluded.

Conclusion

Understanding *HS Code Chapter 23* is more than a regulatory requirement – it is a strategic advantage for all animal feed industry stakeholders. Accurate classification of animal feed ingredients and raw materials ensures compliance with customs regulations, prevents costly delays, and facilitates transparent trade practices. For South African stakeholders, alignment with SARS tariff schedules provides a framework for correctly identifying and valuing imported or exported feed products. Also, mastering distinctions within Chapter 23 enables traders, importers, and manufacturers to make informed decisions about sourcing, formulation, and market access. ❖

For more information, send an email to Dr Lucius Phaleng at trade@afma.co.za

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2026 AFMA INTERVARSITY WRITER'S CUP COMPETITION

The AFMA Intervarsity Writer's Cup competition allows you to share your research in the *AFMA Matrix* magazine, a quarterly publication dedicated to the animal feed industry in South and Southern Africa, with articles based on scientific research and the latest industry news.

DEADLINES

ROUND 1..... Article submission date: **21 October 2025**
Publication date: **January 2026**

ROUND 2..... Article submission date: **23 January 2026**
Publication date: **April 2026**

ROUND 3..... Article submission date: **8 April 2026**
Publication date: **July 2026**

ROUND 1 (2027)..... Article Submission date: **12 October 2026**
Publication date: **January 2027**

Who may enter?

Final year Animal Science students or Postgraduate Nutrition Science students, studying at a South African university.

Article themes

- Feed industry: Legislative environment; Trade environment (economy/pricing/trade)
- Feed science: Additives
- Nutritional science: All species
- Feed processing: Milling/mixing/formulation/packaging

Competition categories

- Own research
- Literature review

PRIZES

AFMA INTERVARSITY WRITER'S CUP CHAMPION:

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- Round 1-3 winners receive **R2 000** each.
- The overall winning author and his/her promoter each receive **R7 000**.

LITERATURE REVIEW CATEGORY:

- Round 1-3 winners receive **R1 000** each.

PLEASE NOTE:
The highest-scoring articles in each category will be published in the AFMA Matrix.
Overall winners will be chosen from the articles published in the AFMA Matrix.
Published own research articles will be considered for the AFMA Intervarsity Writer's Cup.
Overall winners in both categories will be invited to present their articles at the annual AFMA Symposium.

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For more information contact the AFMA Office:
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The Strategic Agricultural Inputs Forum

By Liesl Breytenbach and Bonita Cilliers

The Strategic Agricultural Inputs Forum (SAIF) has entered a decisive new chapter defined by renewed leadership, strengthened collaboration, and a focussed drive to modernise and streamline South Africa's regulatory environment for agricultural inputs.

Over the past decade, rapid innovation, expanding product portfolios, and technological advances across the agricultural input sectors have significantly increased the regulatory workload of the National Department of Agriculture (NDA). Ensuring the continuous availability of safe and approved products has become increasingly challenging under an outdated legislative framework and capacity constraints within the Directorate of Agricultural Inputs Control (DAIC). These limitations have led to registration bottlenecks and uncertainty for manufacturers and producers alike.

Recognising the need for reform, a partnership between government and the agricultural input sector, represented by SAIF, was established in 2022. Together, DAIC and SAIF produced a comprehensive gap analysis report that identified key regulatory constraints and proposed practical interventions. Since then, the partnership has consolidated its structure, strengthened its working mechanisms, and begun implementing targeted actions.

A unified voice

SAIF serves as the collective voice of the agricultural input industry, comprising trade associations representing all major input sectors regulated under the *Fertilizers, Farm Feeds, Agricultural Remedies and Stock Remedies Act, 1947 (Act 36 of 1947)*. Founding members include the Animal Feed Manufacturers Association (AFMA), CropLife South Africa, the Fertilizer Association of Southern Africa, Pet Food Industry Association, RSA Renderers, South African Animal Health Association (SAAHA), and the South African Pest Control Association.

Together, these associations represent suppliers of essential inputs (animal feed, pet food, fertilisers, stock remedies, and agricultural remedies). Through this unified forum, SAIF advocates for a science-based, efficient, and sustainable regulatory framework that supports crop and animal production.

Leadership and strategic focus

At its October 2025 council meeting, SAIF elected a new management team and reaffirmed its strategic objectives. Alan Kloeck of SAAHA was appointed chairperson and Liesl Breytenbach of AFMA as vice-chairperson.

In September 2025, the SAIF executive met with the Registrar of *Act 36* to reaffirm joint priorities. The meeting was constructive and forward-looking, highlighting areas of improvement in coordination, regulatory backlogs, and inter-sectoral communication. The partners committed to enhancing liaison structures and strengthening the role of joint working groups to provide technical expertise and practical solutions within each regulatory workstream.

Gap analysis to implementation

The initial *Gap Analysis Report* (phase one) provided a shared diagnosis of the challenges within the current regulatory system and proposed preliminary bridging actions. This partnership was formalised by a letter of engagement signed by the director-general of agriculture on 20 September 2022, laying the groundwork for a detailed operational plan to implement the recommendations.

Phase two, now underway, focusses on operationalising these actions. SAIF members, in collaboration with DAIC officials, are conducting updated assessments within each workstream to identify and prioritise the most pressing gaps, including technical, administrative, and legislative challenges. The forthcoming operational plan will outline priority actions, assign responsibilities, allocate resources, and set measurable timelines for delivery. Upon completion, the plan will be submitted to the department's management for endorsement and implementation support.

SAIF and DAIC will jointly launch a gap analysis on inspection services, addressing cross-cutting challenges in compliance verification and enforcement. This initiative will explore collaboration between government inspection services and industry self-regulatory mechanisms to strengthen oversight, close enforcement gaps, and safeguard the local industry and public from non-compliant or illegal operations.

A shared path forward

SAIF's strategy for the years ahead is pragmatic and results oriented. Its operational plan will drive measurable improvements in efficiency, accountability, and cooperation between the agricultural input sector and the department.

Key priorities include consolidating and prioritising practical solutions to reduce registration backlogs; initiating an assessment of inspection services to strengthen national compliance oversight; supporting capacity-building programmes to enhance technical and regulatory competence; establishing standardised communication frameworks for transparent and predictable engagement; and contributing to ongoing policy discussions and reforms under *Act 36 of 1947*.

A predictable, transparent and efficient regulatory system is indispensable to maintaining the steady supply of quality agricultural inputs. With fertilisers, animal feed, agricultural remedies, and stock remedies forming the largest cost component in food production systems, a functional regulatory framework directly influences the availability, affordability, and safety of food.

Effective regulation also safeguards environmental integrity and protects the health and welfare of livestock, pets, and consumers. Through continued collaboration with DAIC, SAIF is committed to delivering measurable progress, including transforming dialogue into action, addressing regulatory backlogs, and contributing to a modernised framework that supports sustainable growth in South African agriculture.

Send an email to Liesl Breytenbach at liesl@afma.co.za for more information.

Reading between the clauses:
The hidden details of the SAGOS contract

By Peter Watt, P Watt Consulting

Do both contracting parties always fully understand the implications of SAGOS Contract 1, version 9*, when incorporating such into a contract, applicable to a transaction they are committing themselves to?*

Many agricultural commodity sale and purchase agreements in South Africa incorporate *South African Grain and Oilseeds or SAGOS Contract 1*, *version 9*. Sometimes it is used 'as is', with the parties inserting the specific commercial terms into the contract format. More commonly, the parties conclude their own written agreement and then incorporate *SAGOS Contract 1*, *version 9* as an overriding or governing contract, applicable wherever it does not conflict with their specifically negotiated terms.

Once parties agree to use *SAGOS Contract 1*, *version 9*, they are automatically committing themselves to every clause it contains, unless they specifically agree in writing at the outset to exclude certain provisions. Too often, users focus only on the 'headline items' such as price, quality and delivery, and overlook the so-called 'legal detail' where most of the risk lies.

Dispute resolution, time limits

Using or incorporating *SAGOS Contract 1*, *version 9* as an overriding or governing contract, the contracting parties are automatically agreeing to resolve any dispute between them, which they cannot amicably resolve themselves, by means of arbitration rather than court litigation.

The aforementioned two specific, and very important, clauses in the contract were purposely crafted to ensure a reasonably speedy, but not hasty, resolution to any dispute that might arise, without either of the disputing parties having to incur significant or unnecessary legal costs.

While the applicable arbitration process administered by the Arbitration Foundation of Southern Africa (AFSA) is efficient and endeavours to be speedily concluded – the award itself must be issued by the arbitrator(s) within maximum 30 days after finalisation of the actual proceedings – such a process, however, may not be perceived as actually being 'cheap' per se.

Questions every trader should ask

How many people prior to finalising a contract for the purchase/sale of an agricultural commodity take the necessary time and trouble to read and fully understand such a contract in its entirety, and the ramifications and consequences of being committed to such?

It is suggested that all too often the contracting parties themselves concentrate only on price, specifications, and actual delivery (the 'main items'), and consider all the remaining aspects as 'mere detail' and possibly 'not worth bothering about'.

It should be remembered that in any contract the devil is in the detail, and unless both contracting parties fully understand and are fully in agreement with **all** the details included in any proposed contract, it could later be to one or the other party's disadvantage, were a dispute to arise between them at some later stage.

How many people are aware that any claim shall be notified in writing to the other party within 28 consecutive days?

People must also take note of the fact that such must then be referred in writing to the AFSA secretariat within 21 consecutive days from the date of such a notification to the other party.

How many people are aware that if a dispute goes to arbitration, legal representation at the hearing itself is not permitted, unless both parties agree thereto? (At the inception/ design of the* SAGOS Contract*, this was specifically included in an effort to minimise costs and assist in a speedier dispute resolution process).

Such clause also protects the 'smaller party' to the contract, be it either the seller or buyer, from having to incur possibly very significant legal costs, proposed/ preferred by the larger party, which may have much greater financial resources.

How many people have taken the time and trouble to access and read the AFSA expedited rules?

Such rules automatically apply relating to any dispute governed by *SAGOS Contract 1*, *version 9*, if a dispute arises and goes to arbitration. If the parties have agreed to be bound by the contract, they are automatically bound by every clause included therein, unless specific exclusions have been agreed and recorded in writing at the time of the transaction.

Before signing or incorporating *SAGOS Contract 1*, *version 9*, both parties should ensure they understand exactly what they are committing themselves to – not only the commercial items such as price and delivery, but also the dispute-resolution process, time limits, arbitration rules, and restrictions on legal representation. Overlooking these 'hidden details' can have serious consequences if a dispute arises later.

Efficient contract management training and a sound understanding of the SAGOS framework can help mitigate such risks and ensure fair, transparent, and cost-effective trade practices.❖

For more information, contact the author at peterwatt100@gmail.com

Future proofing South Africa's logistics systems

By Ian Bird, senior executive for transport and logistics, Business Unity South Africa


Source: freepik.com

In early 2023, president Cyril Ramaphosa commenced with the formation of the National Logistics Crisis Committee (NLCC) following substantial research by Operation Vulindlela – a joint initiative between the presidency and National Treasury. The research sought to identify constraints on South Africa's economic growth and job creation.

The findings highlighted multiple challenges, chief among them energy and logistics with the latter evidenced by the severe decline in Transnet's rail and port performance. Rail freight volumes dropped sharply from 226 million tonnes per annum (Mtpa) in 2017/18 to 149Mtpa in 2022/23. Exacerbated by poor port and terminal inefficiencies, the estimated cost to the economy reached R1 billion per day.

NLCC and private sector framework

Government had a proven model on which to base the NLCC, namely the National Energy Crisis Committee. In May 2023, the president formally announced the NLCC, launching a strategic partnership between government and the private sector. Operation Vulindlela's research was consolidated into the Freight Logistics Roadmap (FLR), which was subsequently adopted by cabinet in December 2023 alongside the Private Sector Participation Framework.

The framework details the formation of a Private Sector Participation (PSP) Unit; the unit will develop structures that will enable private stakeholders to invest in and operate strategic rail and port terminal infrastructure.

Recovery plans and early progress

Businesses were invited to engage in the NLCC through a series of workstreams. These were designed to stabilise and improve rail and port performance, ensure an efficient road transport system, and drive structural reforms in the rail and port sectors. The reforms aim to foster meaningful competition through private sector involvement, modernising the freight logistics industry, boosting export growth, and reducing transport costs.

In collaboration with the NLCC, Transnet launched its recovery plan in September 2023, targeting improved availability and reliability of rolling stock, clearing the maintenance backlog across the rail network, strengthening customer partnerships, and reducing security incidents.

Over the past two and a half years, the partnership has delivered meaningful progress, with rail volumes increasing to an estimated 171Mtpa in 2025/26 (representing a 15% increase from 2022/23). While port handling volumes have remained relatively stable, investment in new equipment has improved terminal performance: vessel anchorage times have fallen by 75%, throughput has increased, and container handling times have shortened. Collectively, these improvements have led to faster delivery of offloaded containers to customers' premises.

Reforms and private participation

Significant progress has been made in structural reform. The minister of transport, having assumed line responsibility for the Freight Logistics Roadmap from Operation Vulindlela, has remained focussed on driving impactful change. Current reforms to enable private sector participation in the logistics system include open access to the freight rail network, concessions, joint ventures, and other partnership arrangements for strategic rail corridors and port terminals.

In December 2024, the *Network Statement* governing how private rail operators gain access to the rail network was published. Transnet's Rail Infrastructure Manager (TRIM) made slots available across the freight rail network to private train operating companies (TOCs). Of the 98 applications received, 11 new TOCs were allocated slots on 41 routes spanning six strategic corridors.

The Interim Rail Economic Regulator has finalised and submitted recommendations for the 2025/26 *Network Statement* and Rail Access Tariff to the Minister of Transport. This will pave the way for a revised *Network Statement* and access agreement to be published in early 2026. A board has also been appointed for the Transport Economic Regulator, enabling its establishment in the 2026/27 financial year. The first privately operated trains are expected by mid-2026, adding more than 20Mtpa of capacity to the rail system.

Most critically, the PSP Unit has completed and published its review of responses to the request for information (RFI) issued in March 2025. This review informs the development of private sector participation projects in strategic rail and port corridors. The unit is now preparing the first requests for proposals, expected to be released by Transnet in early 2026. An RFI has also been issued for passenger rail projects.

Finally, following the dismissal of a legal challenge, private sector investment will now be introduced into South Africa's largest container terminal, namely Durban's Pier 2 Container Terminal, unlocking new capital and management expertise to improve operational performance.

Exiting opportunities ahead

South Africa has reversed the decline in rail volumes, but reaching the minister's target of moving over 250Mtpa of freight by 2030 will demand substantial reforms and public and private investment in infrastructure. According to the Bureau for Economic Research, these reforms could unlock up to R200 billion in logistics investment over the next five years.

The country's logistics system is being future-proofed, promising exciting opportunities for all stakeholders.❖

For enquiries, send an email to Ian Bird at ian.bird@capafricagroup.co.za

AFMA annual golf day tees off spectacular celebrations

By Izak Hofmeyr

The award for 'the longest day on the course' was won by team Fincham, represented by 4Mix International. Provimi SA sponsored the prizes, and Mannie Taljaard handed them over. Liesl Breytenbach was the master of ceremonies.

Ben Michielsens of Manuchar with his 'nearest to the pin' award.

Tee off, toast 80 years of excellence, and make memories to last a lifetime. This was the promise of the AFMA Annual Golf Day, set against the scenic fairways of Zimbali Country Club in Ballito on the KwaZulu-Natal North Coast. And it certainly delivered!

This year, the golf day converged with AFMA's annual general meeting (AGM) in celebration of the association's 80th milestone. The picturesque Zimbali golf course provided the perfect backdrop to kick off the celebrations that would later culminate in a dazzling gala event.

Friendly rivalry brought out the best of the day's competitive spirit, highlighted by the much-coveted AFMA Golf Day Sponsor Spirit Award Floating Trophy. This year's trophy was claimed by Chem Nutri Analytical. In the team competition, honours went to team Bester Feed & Grain, followed by team Free State Oil in second place and team Famsun Global in third.

Individual accolades added to the excitement, with Viljoen Jordaan of Free State Oil securing the longest drive title, while the nearest to the pin award was won by Ben Michielsens of Manuchar.

Viljoen Jordaan of team Free State Oil hit the longest drive.

Team Bester Feed & Grain was the overall winner of the golf day.

Second place went to team Free State Oil.

Waldo McDonald of Nutri Feeds won the lucky draw.

Team Famsun, represented by Meadow Feeds KwaZulu-Natal, took third place.

Chem Nutri Analytical won the team spirit award.


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At the front, from the left, are Xander Nieuwoudt of Kyron Agri, Muhammad Moosa, Yaameen Goolam and Elaine Kemp, members of the winning team, and Deidré Louw of Plaas Media. At the back, from the left, are Johan Mouton of Molatek, Dr Linde du Toit of the University of Pretoria, Stefan Corbett of Agrigistics, Erin Graham of Molatek, Hanno Janse van Rensburg, also of the winning team, and Dr Johan Cloete of Vet2Farm.

2025 UP Agric Feedlot Challenge: From farm to fork

By Deidré Louw, Plaas Media

Every year, the University of Pretoria (UP) hosts a feedlot challenge for its fourth-year Animal Science students. It is an engaging project supported by several private companies through hands-on training and technical advice. Plaas Media has been the project's long-time media partner, while Molatek, Kyron Agri, Vet2Farm, and Octavoscene provided additional support in 2025.

The 2025 UP Agric Feedlot Challenge commenced in July with lectures covering sheep feedlot management, guidelines, and rules. Amelia du Preez, technical advisor at Devenish, introduced students to what the feedlot challenge would entail. This was followed by a training session by Dr Johan Cloete of Vet2Farm on the principles of stress-free animal handling. Molatek's Johan Mouton and Erin Graham presented lectures on feed and feed formulation, and assisted students with feed mixing before lamb processing began.

Dr Jarred Morris of Octavoscene and Xander Niewoudt of Kyron Agri played key roles in the initial and second rounds of animal processing, while also providing ongoing technical support on animal health.

In addition to the practical aspects of animal care, such as health management, feeding regimes, and the measurements required to track feedlot performance, students were tasked with presenting their findings later in the year. Each team had to submit a comprehensive report addressing, among others, pen preparation, health management, processing, feed formulation and mixing, feed management, weighing, shearing, slaughter, and final results.

A highlight of the annual challenge is the cook-off, presented in collaboration with consumer and food science students on UP's main campus. This event showcases the full value chain – from farm to fork – as teams prepare flavourful dishes using their project's protein, supported by the consumer science students. A panel of judges evaluates the final creations.

Team findings and presentations

Each year's cook-off is followed by formal feedback presentations to lecturers and sponsors; the 2025 presentations were held in early November. The Baah-listics was the only group to record rumen acidosis in their sheep. Their presentation outlined reduced feed intake and growth due to acidosis, adjustments to their feed ration, and the subsequent improvement in overall growth.

The Flock Masters (Baaa-utiful Creations) reported minor health issues in their lambs. In addition to adjusting the feed, the team also introduced enrichment toys to the flock and found that the heaviest ewe, the second heaviest lamb overall, interacted with the toys the most.

The Lambinators found their ewes to be more economical than their rams, recording higher dressing percentages, greater saleable portions, and lower overall feed costs. They also concluded that molasses show potential as a partial substitute for maize in feed to reduce acidosis risk.

The Pewe Pewe team observed high feed intake and corresponding feed costs. After administering a booster to some lambs, those animals achieved a higher average daily gain.

As tradition dictates, the winners were announced at the fourth-year students' gala dinner. The Pewe Pewe team claimed the overall victory in 2025 with the best overall results and scores.

Send an email to Deidré Louw at deidre@plaasmedia.co.za for more information.

RPO meat achieves international recognition for quality

By Susan Marais, Plaas Media

Here's another reason to boast about your braai: the Red Meat Producers' Organisation (RPO) now meets international ISO 9001 standards and has registered its own RPO Quality Management System. This system will soon form part of a comprehensive, ISO-certified 'farm-to-fork' scheme.

At its recent congress, the national RPO officially announced the implementation of the new ISO 9001 and RPO Scheme Quality Management System, developed in partnership with Certification Partner Global (CPG).

According to Thea Laufs, director at CPG, this international standardisation indicates that the national RPO office operates at a globally recognised level in terms of administrative systems. In addition, it paves the way for a universal audit process for farms across South Africa, ensuring that uniform standards are met.

In practice

The ISO 9001 certification applies to the national RPO's overall systems and standards, whereas the RPO Scheme focusses on a specific, implementable, and verifiable standard. In essence, the scheme aims to demonstrate that producers are responsibly managing their animals, people, and the environment. Farms will therefore be audited on key aspects such as animal welfare and health, environmental management, labour practices, biosecurity, traceability, and legal compliance.

"Ultimately, I hope this process affords producers peace of mind, helping them realise that they have been farming the 'right' way for many years, while also encouraging them to pay closer attention to the finer details of their operations," says Laufs.

She further notes that the system could help producers expand their operations, as it promises to give them greater control. "The fact is, you can achieve more when you have better control over your processes. Every time a new system is implemented, it drives growth because more things are then done correctly."

Over the years, Laufs has observed that producers with such systems in place experience fewer concerns about product recalls. ISO 9001 is an international standard providing a framework for quality management, with an emphasis on customer satisfaction, continuous improvement, and risk management. Within this framework, issues such as biosecurity, animal welfare, and food safety are integral to the registered Quality Management Scheme being rolled out among producers.

"Of course, this is not a cure for challenges such as infectious animal diseases," Laufs acknowledges, "but it supports better management and risk control." She adds that the entire system is grounded in the well-known One Health principle – an approach that simply means what is good for your animals and your environment is also good for people.

Diseases can spread from animals to humans, and contaminated water or poor health management can make everyone ill. By keeping livestock healthy, maintaining clean soil and water, working with veterinarians and other health professionals, and caring for farm workers, producers ultimately safeguard their families and the future of their farms.

ISO 9001 in the red meat industry

Over the past decade, the red meat industry has faced increasing international pressure to comply with more stringent food safety and quality standards. Through the implementation of ISO 9001 and the RPO Scheme, the RPO aims to ensure that South African red meat not only meets local requirements but also remains competitive in global export markets.

For producers, these standards provide clearer guidelines for farming and handling practices. Abattoirs and processing facilities, in turn, can streamline their operations to reduce waste and deliver quality products with greater consistency. Similar systems are already in place at many feedlots and abattoirs.

The introduction of the RPO Scheme strengthens the industry's ability to deliver a superior product, as every stage of the value chain adheres to defined standards. Red Meat Industry Services (RMIS) serves as the overarching platform that integrates these various systems. RMIS has also achieved ISO 9001 certification, along with certification for the RMIS Scheme, ensuring alignment across all certified role-players in the chain. This integrated approach is expected to foster greater consumer trust.

"The younger generation of consumers is well informed. They want assurance that the products they buy meet recognised standards," says Laufs. Regarding the potential for a premium, she adds: "Producers should not focus solely on achieving higher prices, but rather on the bigger picture. Implementing these systems helps improve profit margins and reduce risk by optimising production practices. The real question is: Can producers afford the risk of consumers turning away from red meat simply because there isn't enough information about the product?" ❖

Email Thea Laufs at Thea.Laufs@cpg.global for more information.

Factors contributing to GHG emissions on a dairy farm

By Dr Heinz Meissner, R&D programme manager, Milk SA

Dairy cattle provide a major benefit to the world by utilising feedstuffs that for humans are mostly inedible, to produce milk and associated dairy products. However, as beneficial as this process has become in modern dairies, it is not without potential negative effects.

Dairy cattle are a source of greenhouse gases (GHG) through enteric and waste fermentation, as well as nitrogen (N) emissions through their faeces and urine. These negative impacts vary widely due to the farming system employed and how and what dairy animals are fed – this provides directives for managerial interventions. This article provides an overview of the negatives of GHG emissions and possible mitigation strategies.

Urine, manure and other waste

Urine may lose more N per unit to the environment than faeces. In combination, dairy waste is a significant source of N and phosphorous (P) when applied in excess of crop or pasture requirements as they can cause contamination of surface water. Excess N and P in water causes a rapid bloom in the growth of algal populations that consume dissolved oxygen (O) in water, termed eutrophication, which reduces the available dissolved O required for growth of aquatic animal life.

Excess N can also contaminate groundwater through leaching. This poses a problem for human and animal health as consumed nitrate from drinking water is converted to nitrite in the digestive tract, which replaces O in haemoglobin and leads to O starvation.

Dairy waste can affect air quality. One such compound produced by dairy cattle that affects air quality is ammonia (NH_3). Ammonia is produced when N in urea from the animal's urine reacts with urease present in faeces. Ammonia production from dairy waste is dependent on a variety of factors including urea content in urine, pH, and temperature, as well as the enzymatic activity of urease. In addition to NH_3 losses from fresh waste, volatilisation can occur during waste application to soil as a fertiliser, as well as during the long-term storage of manure.

Nitrogen in waste can contribute to GHG production through the formation and volatilisation of nitrous oxide (N_2O). Nitrous oxide is created during an incomplete microbial denitrification process where nitrate is converted to N gas with the potential to create N_2O, an extremely volatile by-product. Dairy manure applied to cropland or pastures, as well as the long-term storage of manure in lagoons, can contribute to N_2O emissions. The N_2O emissions during storage depend on the N and carbon (C) content of the manure.

Nitrous oxide production and subsequent volatilisation is also dependent on environment and management. Higher temperatures and surface coverings contribute to increasing emissions, whereas anaerobic conditions, such as those found in lagoon systems,

have lower N_2O emissions. Long-term storage of manure also contributes to a larger proportion of N_2O emissions compared to land application with aerated, straw covered, digested, separated, and untreated manure, which contribute less N_2O emissions.

Methane (CH_4) is another substantial GHG produced by dairy cattle waste. The amount of CH_4 emitted by dairy waste depends on the amount of C, hydrogen (H), and O present in the waste, making manure storage, diet, and bedding major contributors to total CH_4 production. Manure CH_4 emissions are substantially higher from long-term storage, compared with field application. These emissions are highest from straw covered manure, and emissions decrease with untreated manure, followed by separation, aeration, and digested manure management methods.

Dairy waste can also produce volatile organic compounds (VOCs). These compounds are a class of chemicals that upon reacting with oxides of N and sunlight contribute to ozone formation. There are a substantial number of VOCs from slurry wastewater lagoons with the most common VOCs being methanol, acetone, propanal, and dimethyl sulphide. As with other waste emissions, VOCs from dairy waste increase with ambient air temperature, with the summer months having the highest rates of VOC emissions. Fermented feedstuffs (i.e., silage) contribute the most VOCs in dairy systems.

Role of nutrition

The most significant enteric (rumen) emission compound from dairy cattle is CH_4. Methane acts as a hydrogen sink in the rumen and is a product of CO_2 reduction by methanogenic bacteria. Methanogens play an important role in rumen health by removing this hydrogen that can be toxic to some bacterial communities and causes rumen acidosis.

CH_4 emissions

Dairy cattle diets have a significant impact on enteric CH_4. As there is large variability in the ingredient and chemical composition of diets fed, nutrition and feeding strategies have the greatest potential for reducing CH_4 emissions (potential reductions can range from 2,5 to 15%). The amount of CH_4 produced is dependent on many factors including intake and chemical composition of the carbohydrate, retention time of feed in the rumen, rate of fermentation of different feedstuffs, as well as the rate of CH_4 development.

Altering feed digestibility and chemical composition cause a shift in the proportions of volatile fatty acids (VFA), with the predominant VFAs being propionate, butyrate, and acetate. This shift in VFA proportion is important because propionate also acts as a hydrogen sink, so shifting from acetate and butyrate formation to propionate will consume reducing equivalents and help preserve the pH balance in the rumen.

An overall reduction in CH_4 emissions or a shift in VFAs can be accomplished by feeding more energy-dense or more digestible feedstuffs, resulting in less CH_4 from fermentation. An increase in the diet's starch proportion, such as through an increase in concentrate levels, also results in more rapid fermentation of these feedstuffs and therefore decreased CH_4 production.

Diet composition

However, feeding higher starch diets requires increased grain production, which can cause additional consumption of fossil fuel and fertilisers, resulting in an increase in N_2O and CO_2 although results show that this is usually offset by the substantial decrease in overall CH_4 emissions. Feeding of cereal forages can also favour propionate production and reduce CH_4 emissions due to the higher starch concentration.

Higher concentrations of legumes such as lucerne, when compared to grass forage-based diets, can lead to an overall decrease in CH_4 emissions. Furthermore, the age of forage at the time of harvest has a significant impact on emissions, with advancing maturity resulting in more lignified and less fermentable substrate, contributing to increasing emissions associated with higher ruminal acetate.

In addition to alterations in forage or concentrate composition and ratio, supplementation of lipids to dairy cattle diets can also mitigate enteric emissions. Replacing concentrates with lipids results in a decrease in fermentable substrate by the microbes in the rumen and can decrease total protozoa and methanogen populations. Inclusion of high-oil by-products, such as distillers' grains or oilseed meals, can result in decreased CH_4 emissions. With ensiled feeds, it is anticipated that maize silage will mitigate emissions due to its higher starch content; this has been confirmed by directly comparing grass to maize silage.

Manure emissions

Various dairy cattle feeding strategies have a significant impact on manure emissions. With higher concentrate diets, the fermentable substrate in the manure can increase. To alleviate this, feeding concentrate with higher lignified fibre has been shown to mitigate both enteric and manure-derived emissions.

Feeding low crude protein (CP) diets has the greatest impact on waste emissions, resulting in decreased excreted N and therefore NH_3 volatilisation. Comparing fresh grass with prepared hay at the same CP content, feeding hay causes a higher overall N and C/N ratio excreted; however, waste from grass-fed animals tends to volatilise more NH_3 emissions.

When comparing maize silage to grass silage, maize silage reduces urinary N excretion. When adding maize silage to lucerne silage-based diets, there is an improvement in N efficiency leading to a decrease in N losses in urine and subsequent decreases in available NH_3 and N_2O volatilisation. Similarly, higher sugar forages also reduce N excretions, which have the potential to limit the N available to be volatilised as gaseous emissions.

Feed additives

In addition to changes to the diet ingredient composition, diet additives may mitigate enteric emissions. The methanogenic inhibitor 3-nitrooxypropanol (3-NOP) and others such as nitrate, condensed tannins, and certain essential oils from plants, have showed some promising results. However, most results are still experimental and there is currently no final product tested for safety on the market or registered in particular countries. Thus, they were not discussed here.❖

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Comparative analysis of antibiotic-administered vs antibiotic-free farming in meat production: Implications for health, environment, and antibiotic resistance

By Asim Ur Rahman, Vincenzo Valentino, Giuseppina Sequino, Danilo Ercolini and Francesca de Filippis

Antimicrobial resistance (AMR) is currently one of the pressing global health challenges. It limits the effective treatment of infections and increases the risk of disease spread, severe illness, and death. AMR arises when microorganisms, such as bacteria, viruses, and fungi, develop the ability to resist antimicrobial agents, making standard treatments ineffective (Van Boeckel *et al.*, 2019; WHO, 2023). In 2019, bacterial AMR alone was responsible for an estimated 1,27 million deaths worldwide (Murray *et al.*, 2022; WHO, 2023), and projections suggest that, if left unaddressed, AMR could surpass cancer as a leading cause of mortality (O'Neill, 2016).

In animal farming, antimicrobials have long been used not only to treat infections but also as growth promoters, to increase productivity. These practices are particularly common in conventional (CONV) intensive farming systems. However, the overuse and misuse of antibiotics in livestock contribute significantly to the emergence and spread of antibiotic-resistant bacteria (ARB) (Manyi-Loh *et al.*, 2018; Szoke *et al.*, 2025). These bacteria, along with their ARGs, can be transmitted to humans through direct contact, environmental contamination, or consumption of animal products, thus posing a public health risk (Manyi-Loh *et al.*, 2018; Temple and Manteca, 2020).

To mitigate AMR risks in intense animal-based food production systems, alternative farming methods have been developed. The goal of alternative farming practices like organic (OR) and antibiotic-free (ABF) farming is to reduce the selective pressure that leads to resistance by using minimal or no antibiotics. However, current findings remain inconsistent.

Some studies report significant differences in resistance levels among farming practices (Guo *et al.*, 2018; Huizinga *et al.*, 22019; Vieira *et al.*, 2023; Buthasane *et al.*, 2023), while others find no significant difference (De Cesare *et al.*, 2022; Doster *et al.*, 2018; Gerzova *et al.*, 2015; Ishengoma *et al.*, 2024). However, a few even indicate higher levels of AMR in ABF farms (Vikram *et al.*, 2017; Li *et al.*, 2020, 2022; Schmidt *et al.*, 2021; Alvarado *et al.*, 2022). These discrepancies underscore the need for a comprehensive analysis to clarify the relationship between farming practices and AMR development in food-producing animals.

This study presents a combined systematic review and meta-analysis to evaluate the prevalence of AMR in CONV versus ABF farming systems. By integrating both quantitative and qualitative evidence, we aim to assess the impact of antibiotic use in animal agriculture on resistance spread. In addition, we explore broader environmental reservoirs, community-level interactions, and farm management factors to offer a more comprehensive overview of AMR persistence. This study uniquely combines meta-analysis and systematic review approaches to address key knowledge gaps, linking statistical findings with a broader AMR context under the One Health framework.

Results and discussion

This study analysed the impact of farming practices (CONV vs ABF) on the composition of microbial species and ARGs prevalence across 37 eligible studies. Among these, 15 studies focussed on poultry, nine on swine, and 13 on cattle. Regarding sample origins, 24 studies examined farm and environmental samples (including faeces, cecum, ileum, litter, feed, and water), five included both farm and retail products (such as colon contents, faeces, and carcasses, meat trimmings), and eight focussed on retail products alone (such as chicken breast, minced beef, or retail carcasses). The total number of samples investigated across all studies was 61 315 (minimum = 20, mean = 1 657, median = 128, maximum = 46 937).

Out of the 37 studies, only 3 (8%) reported differences in the prevalence of major microbial phyla, including Firmicutes, Proteobacteria, Actinobacteria, Bacteroidetes, Spirochaetes, and Tenericutes. Regarding microbial species abundance, 20 studies (54%) found no significant difference between CONV and ABF systems, 12 studies (32%) reported higher abundance in CONV, while five studies (13%) reported higher abundance in ABF. These findings suggest that farming practices may not strongly influence overall microbial diversity.

However, the abundance of specific microbial taxa could still vary depending on farming conditions. Similarly, different studies applied varied detection methods such as shotgun metagenomics, 16S rRNA amplicon sequencing, and qPCR, each measuring relative rather than absolute abundance. Thus, the patterns reported mainly reflect general trends rather than focussing on individual bacterial taxa among the studies.

Regarding ARG prevalence, the data were as follows: total ARGs detected = 2 273; ARGs detected in CONV = 993; ARGs detected in ABF = 764. On average, CONV farms reported 27 ARG detections per study, compared to 21 in ABF systems, although CONV farms showed a slightly higher number of ARG detections. Nevertheless, the statistical difference in

prevalence was not significant (p >0,05), either across host types (*Figure 1A*) or sample origins (*Figure 1B*). This suggests that both CONV and ABF practices do not appear to contribute differently to ARG dissemination in animal farming.

Despite reduced or eliminated antibiotic use in ABF systems, factors such as cross-contamination, farm management practices, and environmental reservoirs (such as water, air, and feed) likely maintain the spread of ARGs. This pattern may also reflect the spread use of similar antimicrobial treatments across conventional cattle, swine, and poultry operations. Indeed, all three often receive the same antibiotic classes (e.g., tetracyclines, β-lactams, macrolides).

Regarding the composition of ARG classes among the 37 studies included in our meta-analysis, ARGs conferring tetracycline resistance were detected in 96% of studies, followed by ARGs associated with multiple antibiotic classes in 80% of studies, aminoglycoside-resistance genes in 54%, beta-lactams in 50%, and macrolide-lincosamide-streptogramin (MLS) genes in 18% of studies, respectively. All species showed tetracycline resistance as dominant, followed by multiple ARGs.

Across host types, cattle and poultry showed high diversity in ARG classes as compared to swine, but with varied abundance. When stratified by sample origin, cattle showed high diversity as compared to poultry and swine in the farm and environmental samples. In farm samples and retail product samples, only multiple ARGs were detected; in contrast, poultry products from retail samples exhibited higher ARG diversity than beef products.

These results also indicate that while tetracycline resistance predominates all other classes across all farming systems, cattle farming may contribute more to ARG diversity compared to poultry and swine. However, in farm and retail product samples, poultry displayed a relatively balanced distribution between tetracycline, beta-lactams, and multiple ARGs.

Although fewer studies investigated ARGs in retail meat, available evidence suggests that farming practices may have limited influence on resistomes at the retail stage. For example, De Cesare *et al.* (2022) reported no significant difference in ARG abundance between retail products coming from different farming systems, underscoring the need for further research (De Cesare *et al.*, 2022). Furthermore, when examining ARG abundance, 15 studies reported higher ARG levels in CONV systems compared to five studies favouring ABF, while 17 studies found no significant differences.

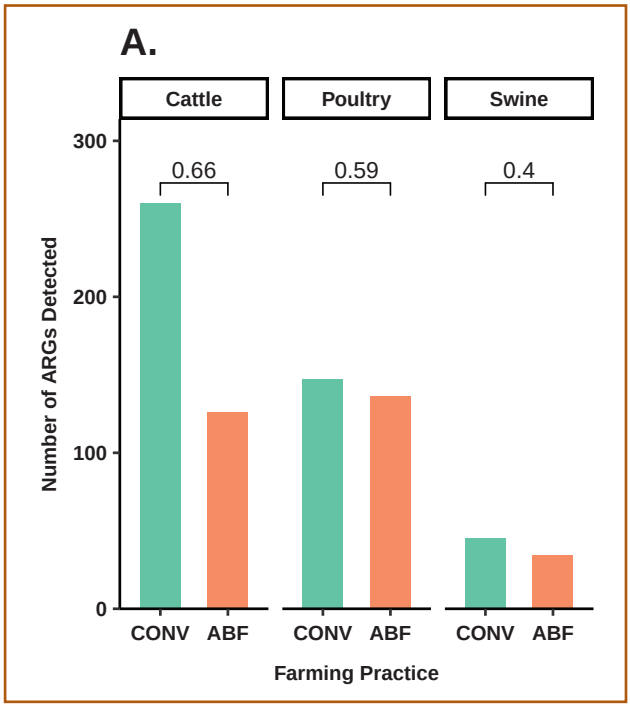
To further examine the number of ARGs detected across farming systems, we performed a meta-analysis using the meta package in R. In the initial descriptive analysis, 17 studies showed no significant difference in ARG prevalence between CONV and ABF systems. Therefore, to reduce the influence of these null effects and to better estimate the true impact of antibiotic use on ARG prevalence, we excluded these 17 studies from the primary meta-analysis. This step helped minimise bias and allowed a clearer comparison between CONV and ABF farming practices.

AMR in a One Health concept

AMR at farms

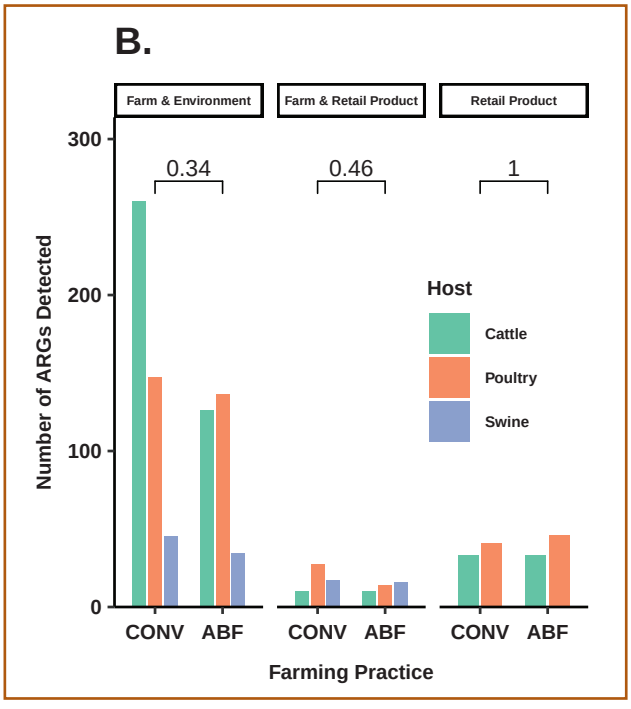
Beyond farming practices, environmental factors also play a critical role in shaping AMR patterns. For example, agricultural soil acts as a natural reservoir for a variety of microorganisms. Hence, the application of pesticides, herbicides, insecticides, and antimicrobials exerts selective pressure on microbes inhabiting feed crops and soil,

Figure 1A: Number of detected ARGs across different host types.



Cattle exhibited the highest number of ARG detections, followed by poultry and swine. However, Wilcoxon rank-sum tests showed no statistically significant differences between the groups. Values above the brackets are P-values from pairwise Wilcoxon rank-sum tests (all p >0,05).

Figure 1B: ARG counts further classified by both host type and sample origin.



In farm and environmental samples, cattle had the highest number of detected ARGs, followed by poultry. In contrast, poultry showed higher ARG detection in retail product samples compared to cattle.

promoting multidrug and cross-resistance traits (Qiu *et al*., 2022).

Additionally, the combination of antimicrobials with toxic metals such as copper further enhances this resistance (Jun *et al*., 2019). Moreover, the use of contaminated water and manure application in agriculture may further introduce ARGs in soil, water, and air. Indeed, manure-amended soils were found to have higher levels of ARGs than soils treated with chemical fertilisers (Tiedje *et al*., 2019; He *et al*., 2020).

Beyond soil, contaminated animal feed, resulting from poor storage hygiene or exposure to wildlife (e.g., rodents, birds), can further introduce and spread ARGs (Auffret *et al*., 2017). Similarly, drinking water, even from private wells, can also serve as a vector for ARB transmission (Hayward *et al*., 2020; Alawi *et al*., 2024). Additionally, farm dust (airborne particles), migrating birds, rodents, pets, and insects are other components that may contribute to the spread of ARGs between farms and the environment (Gwenzi *et al*., 2021; Bai *et al*., 2022; Guardia *et al*., 2024).

AMR in meat processing plants

Meat processing facilities serve as crucial hotspots for the emergence and dissemination of AMR. For instance, mixing animals from different farms during transportation and at lairage sites increases the risk of cross-contamination (Hazards *et al*., 2022). Additionally, procedures such as evisceration, defeathering, and dehiding elevate initial microbial loads, resulting in further ARB and ARG contamination. Indeed, ARG abundance in a new meat processing plant increased significantly over 1,5 years, due to the transfer of ARB from animal carcasses to surfaces, tools, and drains, highlighting their role as reservoirs of ARGs (Cobo-Díaz *et al*., 2021).

Despite sanitation measures, biofilms on processing surfaces may retain ARB, facilitating their spread throughout the entire food production chains, as demonstrated for several types of foods (De Filippis *et al*., 2021, 2024; Valentino *et al*., 2022, 2023; Sequino *et al*., 2024; Barcenilla *et al*., 2024). Moreover, cleaning agents used for disinfection in processing environments apply a selective pressure on foodborne bacteria, potentially resulting in adaptive changes in their genomes, transcriptomes, and proteomes, further enhancing their resistance to disinfectants and antibiotics (Marmion *et al*., 2022; Xiao *et al*., 2024). Therefore, the wastewater generated in food processing facilities has high levels of ARB and ARG, leading to the environmental contamination of other water bodies (Stošić *et al*., 2016).

> While minimising antibiotic use in animal farming has been a longstanding goal, the spread of AMR along the meat production chain involves many other drivers.

Beyond the food production sector, the spread of AMR in the environment is influenced by a multitude of factors, including clinical settings, domestic practices, climate change, and various ecological and human-related activities. Indeed, AMR spread is a One Health issue that summarises well that the health of humans, animals, and the environment is strictly interconnected and should be addressed with a more comprehensive approach, tackling all the aspects involved.

AMR at global level

In addition to the previously discussed factors, AMR is also influenced by a wide range of ecological and climate factors that extend beyond agricultural, hospital, and household contexts. For example, elevated temperatures, increased humidity, and higher pollution levels promote the proliferation of microbes and facilitate gene transfer. A 1°C rise in average ambient temperature is associated with a 1,14-fold and a 1,06-fold increase, respectively, in the population-level prevalence of carbapenem-resistant *Klebsiella pneumoniae* and *Pseudomonas aeruginosa* clinical isolates (Li *et al*., 2023). This elevated global temperature also mediates the release of ARB from the thawing permafrost.

A comprehensive review encompassing 574 studies revealed that 39% identified detrimental synergies between climate change and AMR, with 19% establishing a direct connection between climate change and the emergence of AMR, while 12% observed beneficial interactions between climate interventions and AMR control (Bavel *et al*., 2024). Human activities such as deforestation also increase the prevalence of ARGs in soils by exerting environmental selective pressures on unexposed soil microbial communities (Lemos *et al*., 2021). Similarly, the combination of these activities with microplastic and chemical pollution further accelerates the evolution of ARGs (Rzymski *et al*., 2024). For instance, a 1% rise in airborne particulate matter (PM2,5) is related to a 0,7% increase in AMR (Natali, 2025).

In addition to the environmental drivers, microbial evolution itself plays a key role in AMR persistence. Resistance can arise naturally through spontaneous mutations and spread through vertical and horizontal gene transfer, aided by mobile genetic elements like plasmids and transposons (Djordjevic *et al*., 2013). Moreover, co-selection mechanisms such as cross-resistance, co-resistance, and co-regulation allow bacteria to acquire multiple resistance traits even without direct antibiotic exposure (Murray *et al*., 2024). Together, these biological and environmental factors underscore the need for coordinated interventions, which are discussed in the following recommendations.

Future research recommendations

Surveillance and diagnostics

Comprehensive and real-time monitoring of AMR is crucial in various ecosystems to detect resistance trends in animals, humans, and the environment. Conventional monitoring is based on a restricted set of pathogens, often missing the emerging resistance threats. However, innovations in metagenomics, AI-enhanced predictive models, and machine learning can provide a proactive approach to detect emerging AMR hotspots prior to the onset of outbreaks (De la Lastra *et al*., 2024).

Furthermore, misdiagnosis within both human and veterinary medicine plays a substantial role in the rise of AMR (Chan *et al*., 2020). The development of affordable, user-friendly, rapid, and reliable diagnostic tests is essential for decreasing dependence on broad-spectrum antibiotics and encouraging targeted antimicrobial treatments.

Mitigation strategies

Prompt surveillance and instant isolation of infected animals can mitigate the AMR spread at the farm level. Additionally, decreasing stock density, increasing rearing space, and increasing farm biosecurity and herd management can further mitigate the spread of AMR (Dhaka *et al*., 2023). Post-slaughter washing of beef, pork, and lamb carcasses can effectively reduce contamination loads and improve meat hygiene at the initial stages of processing. Furthermore, the implementation of advanced on-site wastewater treatment, air filtration, and ventilation systems are essential to prevent the discharge of ARB and ARG into the environment.

Similarly, the final meat products frequently contain spoilage microorganisms, pathogens, ARGs, and even antibiotic residues; however, studies on their effects on the human oral and gut microbiome following ingestion remain limited and insufficiently investigated. Although comprehensive cooking diminishes bacterial populations, the fate of ARGs or antibiotic residues during digestion, as well as the possible transmission of ARGs to the gut microbiome are still unclear.

Alternatives and public awareness

Alternative treatments to traditional antibiotics, such as probiotics, prebiotics, bacteriophage therapy, and vaccinations, show promise in lowering infection rates and reducing antibiotic use. Furthermore, innovative conjugated antibiotic formulations may also enhance therapeutic efficacy against resistant microbes (Padilla and Nowick, 2025). Public involvement is also critical, yet it is frequently overlooked in AMR mitigation. Public education campaigns, using the most popular social media platforms should educate the public about how their everyday lifestyle choices influence the global AMR spread.

Conclusions

This study systematically reviewed and meta-analysed the presence of ARGs in CONV and ABF animal farming systems. ARGs were detected in both systems, with higher average counts in CONV farms. However, statistical differences in ARG prevalence across farming systems, host types, and sample origins were not significant. Subgroup analysis showed higher ARG presence in cattle and environmental samples, suggesting farm-level conditions may play a more critical role in ARG transmission than retail product exposure. However, this analysis is limited by the predominance of poultry studies, variability in study designs and ARG detection methods, and the lack of geographic meta data across the included research.

Notably, 97% of studies on ABF farms still reported the presence of ARGs, suggesting that reducing antibiotic use alone may not be sufficient to control AMR. Broader factors such as poor farm hygiene, environmental contamination, inadequate waste management, and microbial evolution likely contribute to its persistence.

While minimising antibiotic use in animal farming has been a longstanding goal, the spread of AMR along the meat production chain involves many other drivers. Therefore, it is important to recognise that AMR is not solely caused by the overuse or misuse of antimicrobials in animals. Rather, AMR is a global issue that demands shared responsibility across culture, healthcare, households, and environmental sectors, particularly in the context of climate change.

These findings support the One Health narrative, where effective AMR control requires coordinated action across sectors. Targeted interventions at the farm and processing level, combined with policies addressing environmental and societal drivers, are urgently needed to reduce the risk of ARG transmission and protect public health.

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for the full article or send an email to francesca.defilippis@unina.it

Evaluating fumonisin contamination in cattle feed: Impact on animal health, the agricultural industry, and regulatory considerations

By Ashli A Brown and Tim Herrman

Fumonisins (FUMs) are secondary metabolites produced by pathogenic moulds of the *Fusarium* spp. that infest maize globally (FDA, 2001a; Kamle *et al*., 2019). Of the several FUM analogues, fumonisin B_1 (FB_1) is the most prevalent, toxic, and extensively studied member (FDA, 2001a; Voss *et al*., 2007). Other forms, including fumonisin B_2 (FB_2) and fumonisin B_3 (FB_3), are also naturally occurring but generally less prevalent (FDA, 2001a; Voss *et al*., 2007). Toxicological evidence identifies FUMs as potent disrupters of sphingolipid homeostasis that have been associated with oesophageal cancer in humans, neural tube defects in neonates, and several systemic effects in animals (Kamle *et al*., 2019).

Consequently, the United States Food and Drug Administration (US FDA) issued a guidance document in 2001 providing direction for managing total FUMs ($FB_1 + FB_2 + FB_3$) in maize and maize-based products intended for human and animal consumption with good manufacturing and agricultural practices (FDA, 2001a). As shown in *Table 1*, some GLs are based on limited studies or insufficient data for low FUM exposure in certain animal species (FDA, 2001b).

Table 1: Summary of pivotal peer-reviewed studies used as basis of the current FUM guidance.

Animal or class	No of pivotal studies	Average year of publication
Equids	18	1992
Rabbits	2	1997
Swine	24	1995
Catfish	4	1995
Rainbow trout	1	1998
Ruminants (cattle, sheep, goats)	5	1996
Mink	3	1996
Poultry (turkeys, chickens, and ducklings)	23	1995
Rats and mice	1	1999
Domesticated species (cats and dogs)	-	-

Notably, the GL for cattle was set at 60mg/kg (with a limit of 50% of the diet on a dry matter basis), primarily selected based on Osweiler *et al*. (1993), which reported mild liver and immune system effects in calves fed 110,3mg/kg of FUM for 31 days. Missing data on ruminants exposed to intermediate doses (25 to 100mg/kg) led to the selection of a more conservative GL, 60mg/kg, under the assumption that higher levels may lead to adverse health effects such as reduced feed and water intake, hepatotoxicity, immunotoxicity, and pulmonary oedema (FDA, 2001b; Baker and Rottinghaus, 1999; Osweiler *et al*., 1993; Smith and Thakur, 1996).

Since the release of the 2001 GL, Jennings *et al*. (2020) have demonstrated that cattle fed up to 108,8mg/kg FUM for roughly 110 days did not exhibit significant adverse health effects. This finding challenges the current 60mg/kg, particularly for perennial hotspots of mycotoxin contamination, such as Texas High Plains that have experienced FUM levels more than three times greater than the 60mg/kg GL and are no longer authorised to maximise maize availability for feedlots and manage FUM contamination economically through blending permissions (Brown *et al*., 2024; Herrman *et al*., 2018).

This paper reviews recent advancements in FUM research related to cattle and evaluates their implications for the current GL, using meta-analysis and the EPA's

Table 2: PECO statement used in the systematic lit search.

Element	Inclusion criteria
Population	Cattle
Exposure	Total dietary fumonisin (FB_1 + FB_2 + FB_3) with restrictions on oral administration.
Comparison	A comparison of cattle exposed to various levels of fumonisin; experimental studies include at least one control group and one treatment group exposed to fumonisin only.
Outcome	Adverse effects on cattle performance[a], liver, and any other associated health outcomes[b].

[a] Adverse outcomes on cattle performance include bodyweight, body condition, feed intake, etc. [b] Other associated health outcomes may include those effects associated with cell autophagy and apoptosis, neurotoxicity, immunotoxicity, and tissue and organ toxicity.

Benchmark Dose Software (BMDS) to assess whether a revision of the GL is necessary.

Materials and methods

We conducted a literature search in the PubMed database using the following search terms: '(((((beef) OR (cattle)) OR (feedlot)) AND (fumonisin)) OR (FB1)) OR (fusarium).' Studies were screened using the PECO (population, exposure, comparator, and outcomes) criteria outlined in *Table 2*. We excluded studies that did not meet our criteria, investigated alternate exposure routes, or involved multiple contaminants due to differences in bioavailability and mode of action. Selected studies were used to compare acceptable levels derived from meta-analysis with those generated by BMDS to assess the impact of recent data on the 60mg/kg FUM GL for cattle.

Results

Literature review

Table 3 summarises the four experimental feeding studies identified in our literature search. Studies involving FUM toxicity through alternate routes of administration or examining FUM combined with other mycotoxins were excluded due to differences in bioavailability and mechanisms of action (Albonico *et al*., 2016; Awapak *et al*., 2021; Mathur *et al*., 2001; Roberts *et al*., 2021; Wang *et al*., 2020).

Three of the selected studies were available when the US FDA released the current GLs for cattle; however, two studies did not evaluate FUM concentrations close to 60mg/kg GL, making them unsuitable for assessing a safety breakpoint. Therefore, only two studies – Osweiler *et al*. (1993) and Jennings *et al*. (2020) – met the necessary criteria for comparison.

Osweiler *et al*. (1993) evaluated the effects of control (≤5mg/kg), low (31mg/kg), or high (148mg/kg) FUM diets fed at 2% BW (bodyweight) on cattle health for 31 days through performance tests, haematology, liver and neutrophil function, lymphocyte blastogenesis, and histopathological analyses. Jennings *et al*. (2020) investigated the health effects of FUM levels ranging from 8,1 to 108,8mg/kg for 110 days at 2% BW through performance tests, biomarker analyses, carcass grading, histopathology scoring, and FB_1 biomarker analyses, including the ratio of sphinganine (SA) to sphingosine (SO) (SA:SO). Both studies reported mild to moderate changes in liver enzyme activity for high- dose groups, but these changes did not significantly impact animal performance at any of the tested levels.

Additional observations from Osweiler *et al*. (1993) included impaired immune function, reduced feed intake, and slow weight gain. Jennings *et al*. (2020) did not investigate immunological changes but noted a slight increase in BWs as FUM contamination increased.

Comparative analysis

Studies deemed suitable for comparison exhibited insufficient overlap in the endpoints assessed, precluding a meaningful meta-analysis. Osweiler *et al*. (1993) measured feed intake, BW, bilirubin, cholesterol, and liver enzymes, aspartate transferase (AST), gamma-glutamyl transferase (GGT), and lactate dehydrogenase (LDH). In contrast, Jennings *et al*. (2020) used a histopathology scoring system to document FUM- induced liver, kidney, and skeletal damage, along with carcass characteristics, BW, and ratios of FB_1 biomarkers in liver samples. The erogeneity in BW trends across the studies further hindered the comparison of scientific data.

We evaluated the hepatic endpoints reported by Osweiler *et al*. (1993) and Jennings *et al*. (2020) using continuous model types in the BMDS with specific parameters on normal distribution and non-constant variance, respectively. The BMD analyses were run at the most common Benchmark Response (BMR) values of 1 standard deviation of 1 and 10% relative deviation (RD), providing six possible modelling options for each dataset (e.g., Exponential 3, Exponential 5, Hill, Linear, Polynomial, and Power). Changes in data deviation types did not affect results; thus, we only show findings generated at 10% RD.

The AST liver enzyme and SA:SO ratios were the most complicated endpoints to model as all options were deemed questionable or unusable, likely caused by high response variability in the high FUM dose groups, indicating the EPA's BMDS was unable to fit the data adequately. More specifically, modelling options for AST could not be graphed due to the extremely poor fitting. Common issues across modelling options for AST and SA:SO ratios included failed non-constant variance tests, poor goodness-of-fit, and zero degrees of freedom.

For GGT and LDH enzymes, Exponential 3 was the best fitting model based on the lowest Akaike Information Criterion (AIC). However, the 18,2mg/kg BMD value generated for GGT falls below the current 60mg/kg GL, revealing its irrelevancy in refining the current GL. On the other hand, the 64,3mg/kg BMD value generated for LDH supports the current 60mg/kg GL.

Discussion

In this paper, we determine whether the recent advancements in experimental data for fumonisin in cattle, as published by Jennings *et al*. (2020) influence the current regulatory GL of 60mg/kg using meta-analysis and the EPA's BMDS. While Jennings *et al*. (2020) provided valuable data, a meaningful meta-analysis was impossible due to the lack of overlap in measured hepatic endpoints and the

Table 3: Overview of available literature for experimental cattle exposed to dietary FUM.

Reference	No of cattle (dose groups)	Bodyweight (BW, kg)	Exposure duration (days)	Average FUM content: $FB_1 + FB_2 + FB_3$, (mg FUM/kg BW)[a]	Employed toxicological tests	Statistically significant findings associated with FUM
Studies used as basis of current US FDA ML for fumonisin						
Osweiler *et al*. (1993)	18 (3)	231 ± 5,7	31	• **Control:** <0,13 • **Treatment 1:** 0,78 • **Treatment 2:** 3,7	• Feed intake • Weight gain • Haematology test • Liver function test • Neutrophil function test • Lymphocyte blastogenesis • Histopathological analysis	• Liver function tests • Neutrophil function • Lymphocyte blastogenesis
Smith and Thakur (1996)[b]	6 (2)	217	30	• **Control:** <0,13 • **Treatment:** 5,15	• Liver function test • Organ-to-BW ratio • Feed-to-tissue ratio • Histopathological analysis	• Liver function tests
Baker and Rottinghaus (1999)[b]	5 (2)	86 to 127	239 to 253	• **Control:** <0,13 • **Treatment:** 11	• Liver function test • Biomarker analysis • Histopathological analysis • Haematology test	• Liver function tests
Literature advances since 2001						
Jennings *et al*. (2020)	50 (5)	361 ± 6,4	110	• **Control:** 0,2 • **Treatment 1:** 0,67 • **Treatment 2:** 1,02 • **Treatment 3:** 1,69 • **Treatment 4:** 2,72	• Feed intake • Performance test • Weight gain • Biomarker analysis • Carcass grading and evaluation • Histopathological analysis and scoring	• Biomarker analysis

[a] Average dietary FUM concentration is calculated with the assumption that experimental cattle consumed 2,5% of BW per day. [b] Studies did not investigate FUM concentrations proximate to the present regulatory limit of 0,75mg/kg BW/d and were excluded.

unclear BW trends with Osweiler *et al*. (1993). Likewise, although dose-response relationships for both datasets showed monotonic trends, significant inter-individual variability in responses of liver enzymes and FB_1 biomarkers for high-dose groups limited BMDS's ability to capture an effective toxicological response pattern.

We identified a BMD of 64,3mg/kg for the liver enzyme, LDH, aligning with the current GL. However, we were unable to substantiate this value with insight from SA:SO ratios reported in the most recently published feedlot study, as we aimed. The key differences in study designs and their potential impact on the response variability emphasise how these inconsistencies can create difficulty in refining regulatory guidelines.

The impacts of FUM contamination extend deep, particularly affecting cattle health and farmers reliant on harvesting crops primarily for livestock feed in areas most susceptible to FUM contamination, like the Texas High Plains (Brown *et al*., 2024). In recent efforts to help address such concerns, Qu *et al*. (2022) have shed light on the advantages of biodetoxification methods in mitigating mycotoxin nation in agricultural products. At a molecular level, Chen *et al*. (2021) have broadened the understanding of FB_1 disruption of cellular functions and its critical roles in signalling pathways and sphingolipid metabolism.

Further advancements include the availability of bioactivity data through online tools such as the EPA's Computational Toxicology (CompTox) Chemicals Dashboard, which has provided insights into the FB_1 interactions in single and multicell mutagenicity assays, as well as its carcinogenicity potential in rodent models. These assays have examined various aspects of FB_1's biological activity, including its potential to cause cellular damage, disrupt enzyme functions, and interfere with normal cellular communication pathways, further supporting its role in sphingolipid metabolism disruption (EPA, 2025). Despite these advances, complementing research that demonstrates how these findings can translate to practical exposure conditions and further help regulatory decision-making has yet to be released.

Conclusion

Our research indicates that the current 60mg/kg FUM GL for cattle remains supported by the available scientific data. The limitations of meta-analysis and BMD modelling indicate the need for more comprehensive studies and refined modelling options that address consistencies in experimental designs and endpoints. Given the potential impacts on both animal welfare and economic outcomes for the culture industry, we recommend that future regulatory assessments of FUM GLs are conducted as new and more robust data emerge. ❖

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The poultry industry 2026: *Quo vadis*?

By Izaak Breitenbach, CEO, South African Poultry Association

If the South African poultry industry were a bird, it would be a phoenix, rising repeatedly from the ashes of crises. After years of being battered by load shedding, highly pathogenic avian influenza (HPAI), infrastructure decay and cheap imports, the sector entered 2024 with one goal: survival.

Two years later, the story has evolved. In 2024 the industry regained operational stability and enjoyed temporary relief from power cuts, while 2025 was a year of consolidation, focussed on restoring balance sheets, implementing lessons from past disruptions, and preparing for renewed expansion. Now, as 2026 dawns, the question on everyone's mind is: Can this be the year of real growth?

Levelling the playing field

In late 2024, the Competition Commission launched a market inquiry into South Africa's poultry industry. The inquiry sought to uncover barriers to entry and expansion for small and emerging producers – a long-standing concern for policymakers and transformation advocates. The South African Poultry Association (Sapa) has been front and centre in this process, submitting a detailed report on behalf of producers. Sapa argues that while the industry has made strides in transformation, systemic issues such as access to finance, high input costs, and unreliable infrastructure continue to limit participation by small-scale players.

The inquiry is expected to deliver recommendations in 2026. Depending on its findings, it could reshape the industry's regulatory landscape, potentially opening up new opportunities for contract growers, cooperatives, and black-owned enterprises.

Infrastructure failures

Despite its progress, the poultry sector remains vulnerable to South Africa's crumbling infrastructure. Producers still face unreliable water supply, poor water quality, and frequent municipal power outages that are often the result of theft, vandalism, and illegal connections. Compounding these challenges is the lack of functional rail infrastructure, forcing producers to rely on costly road transport for feed and product distribution. The impact is clear: higher logistics and operational costs that eat into competitiveness.

While the private sector has invested heavily in generators, boreholes, and water treatment systems, these are stopgap measures. True progress will depend on long-term public investment and improved municipal governance.

Reduced competitiveness

South African poultry producers operate without the government subsidies or compensation packages available to competitors in the United States (US), Brazil, or the European Union (EU). The absence of compensation for HPAI culling, limited vaccine access, and lower domestic grain yields combine to raise local production costs.

These structural disadvantages mean South African producers must compete in a global market where others enjoy far lower input costs. Yet, despite this, the local industry has managed to stay afloat, thanks in part to trade protection measures and a focus on efficiency.

Trade measures

The industry achieved a major victory with the renewal of anti-dumping duties against nine countries, namely Brazil, Denmark, Ireland, Poland, Spain, Germany, the United Kingdom (UK), the Netherlands, and the US. These duties, aimed at countering unfairly priced imports, have stabilised the local market and prevented another flood of cheap bone-in portions.

However, trade tensions are never far away. President Donald Trump's return to office in 2025 brought renewed pressure on South Africa to extend the tariff rate quota (TRQ) for US poultry exports and remove the most-favoured-nation (MFN) duty. At the same time, US negotiators are pushing for self-regulation on HPAI, a measure that could undermine local biosecurity standards. For now, government and industry are standing firm, defending the delicate balance between trade compliance and domestic protection.

HPAI: Contained but not conquered

After the devastating outbreaks of 2023, 2024 brought a welcome reprieve: no reported HPAI outbreaks and the registration of three H5 vaccines. Yet the path to full vaccination remains fraught with red tape. Only one farm has so far received approval to vaccinate, as protocols are deemed overly onerous and costly. This remains a top priority for Sapa. A workable, science-based vaccination framework is essential not only for preventing future outbreaks but also for regaining international export status.

Unfortunately, South Africa's official HPAI-free status has yet to be restored. The delay stems from one infected flock that survived without being culled and five new outbreaks detected in 2025. These incidents, though limited, have continued to block access to key export markets.

Poultry Sector Masterplan

The *Poultry Sector Masterplan*, launched in 2019, remains the backbone of government-industry collaboration. Phase one concluded in 2024, having achieved milestones in investment, job creation, and anti-dumping enforcement. Now, as phase two begins, consultations are underway to refine the framework for the next five years.

Minister Parks Tau has emphasised four core priorities, namely transformation (expanding ownership and participation by black producers); localisation (increasing the share of locally produced poultry in domestic consumption); skills development (equipping new entrants with technical and business capabilities);

and export promotion (building South Africa's reputation as a reliable supplier to the global market).

The new *Poultry Value Chain Masterplan* also zeroes in on six operational areas: trade protection, export growth, VAT reform, SMME support, biosecurity, and competition monitoring.

Legal battles and illegal trade

The victory on anti-dumping duties has not gone unchallenged. The Association of Meat Importers and Exporters (AMIE) has launched legal action against all nine anti-dumping measures. The cases are still pending, creating uncertainty for producers and investors. Should the courts overturn these protections, the market could once again be flooded with cheap imports, reversing years of hard-won progress. The industry is watching closely.

Sapa and the South African Revenue Service (SARS) have stepped up cooperation to curb illegal poultry imports. Several instances of under-valued products from the US and Argentina are under investigation. In one notable case, 'round-tripping' at the Durban Harbour, where imported products were falsely declared for re-export, has resulted in a criminal probe. Such enforcement sends a clear message: The era of unchecked illegal poultry trade is ending.

Export markets

South Africa's export ambitions hinge on regaining HPAI-free status and passing a series of international inspections.

- Saudi Arabia has yet to complete its inspection of South African processing facilities, delaying access to one of the world's fastest-growing poultry markets.
- The United Arab Emirates currently accepts only cooked poultry from South Africa, pending raw meat approvals.
- The UK completed an inspection in May 2025, and its decision is expected early in 2026.
- The EU is also due to conduct an inspection, which could unlock access to premium markets.

If these efforts succeed, South Africa could double or even triple its poultry exports within three years.

Performance indicators

Despite the policy uncertainties, the fundamentals of the South African poultry industry have strengthened markedly:

- **Producer price:** R31,83/kg – still the most affordable animal protein in the country.
- **Broiler slaughter:** Up 4,7% in 2024, with 21,6 million birds processed weekly.
- **Feed costs:** Declined through 2024 and 2025, improving margins.
- **Chicken consumption:** Up 1,1% to 35,6kg/capita.
- **Gross industry value:** R72,09 billion, a 9,8% increase year-on-year.
- **Share of total animal protein:** 36,4%, confirming chicken's dominance.
- **Share of total agriculture:** 15,7%, underscoring poultry's national importance.
- **Imports:** 21,1% of production and 17,9% of consumption, both trending downward.
- **Exports:** 3% of total production and poised to rise.

Successes and challenges

The list of achievements over the past two years is impressive:

- Industry value grew to R72,1 billion.
- HPAI outbreaks were limited and contained.
- Load shedding was suspended, restoring stable operations.
- Anti-dumping duties were renewed.
- No tariff rebates were granted to importers.
- Concrete progress was made on export readiness for the EU and UK.

Each of these wins contributes to renewed optimism heading into 2026.

However, significant hurdles persist:

- No compensation for producers forced to cull flocks due to HPAI.
- Deteriorating infrastructure in key agricultural regions.
- Ongoing legal battles with AMIE.
- Lack of practical vaccination protocols.
- Persistently high feed prices, despite improvement.
- Rising imports of mechanically deboned meat (MDM) and offal, which distort the value chain.

These challenges underscore that resilience remains as vital as ever.

Outlook for 2026

Looking ahead, the year 2026 will be defined by several pivotal developments:

- The outcome of the Competition Commission inquiry.
- A workable HPAI vaccination strategy and potentially broader rollout.
- The implementation of phase two of the *Poultry Masterplan*.
- Expansion of production to match installed processing capacity.
- A potential VAT exemption for bone-in portions and offal.
- Gaining export access to the UK, EU, and Saudi Arabia.

If these milestones align, the sector could enter a sustained period of growth not seen in over a decade.

The ingredients for success are finally converging:

- Dumped imports are under control.
- Plants are running near full capacity.
- Feed prices are favourable.
- HPAI vaccination is beginning.
- Export potential is real and expanding.

Investors are taking notice. New projects in processing, cold storage, and contract farming are being planned. The mood, cautiously, has shifted from defence to opportunity.

Conclusion

Few industries in South Africa have faced as much adversity as poultry, and fewer still have responded with such resilience. The sector has endured power crises, disease outbreaks, and unfair global competition, yet continues to feed the nation and sustain thousands of jobs.

As the industry stands at the threshold of 2026, the sense of determination is palpable. The lessons of the past few years have hardened resolve and sharpened focus. If HPAI remains under control and policy alignment holds, 2026 could indeed be the long-awaited growth year.❖

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Recent advances in enzyme technologies for mitigating mycotoxin contamination in poultry feed

By Christiane Gruber-Dorninger, Markus Aleschko, Andreas Höbartner-Gußl, Sebastian Fruhauf, Michaela Thamhesl, Barbara Doupovec, Dian Schatzmayr, Wulf-Dieter Moll and Chasity Pender

Animal feed is prone to contamination with mycotoxins, i.e., toxic secondary metabolites of fungi. As fungal infestation and mycotoxin production can occur both during the growth of crop plants and during storage of grain or compound feed (Bryden, 2012; Jouany, 2007), mycotoxins are very frequent contaminants of animal feed (Eskola *et al*., 2019; Gruber-Dorninger *et al*., 2019).

The most prevalent mycotoxins in animal feed are deoxynivalenol (DON), zearalenone (ZEN), fumonisins, aflatoxins, and ochratoxin A (OTA). The molecular structures and toxicological effects of these mycotoxins vary significantly. For example, DON causes feed refusal and impairs gut health and immunity (Payros *et al*., 2016), ZEN causes estrogenic effects that can compromise reproductive health (Fink-Gremmels and Malekinejad, 2007; Metzler *et al*., 2010), fumonisins cause hepatotoxic, nephrotoxic, and neurotoxic effects (Stockmann-Juvala and Savolainen, 2008; Voss *et al*., 2007), and aflatoxins are well known for their carcinogenicity and hepatotoxicity (Jacevic *et al*., 2023).

Given this plethora of adverse effects, it is crucial to take measures to counteract the exposure of farm animals to mycotoxins.

Strategies to counteract exposure

Accumulation of mycotoxins in grains and compound feed should be minimised by implementing good agricultural practices and suitable storage conditions, but complete prevention of mycotoxin formation is nearly impossible (Bryden, 2012; Palumbo *et al*., 2020). Therefore, considerable effort has been made to develop strategies for the inactivation of mycotoxins in feed materials, with varying success.

Thermal treatment was found to be ineffective, as mycotoxins show a high degree of thermal stability and even the application of high temperatures and pressure during extrusion processing achieves only a moderate reduction in mycotoxin levels (Bullerman and Bianchini, 2007; Wolf-Hall *et al*., 1999). Furthermore, chemical treatments for mycotoxin inactivation are of limited use due to the high costs of such methods, negative effects on feed quality, and impracticability of large-scale application (Jard *et al*., 2011). Physical methods such as sorting, washing, or dehulling have proven quite effective in reducing mycotoxin levels in agricultural products, yet fail to remove the entire mycotoxin load and lead to losses of feed material (Karlovsky *et al*., 2016).

In summary, despite best efforts, complete prevention of mycotoxin formation in feed and feed raw materials is not possible and removal of mycotoxins from feed is challenging. Therefore, mycotoxin-inactivating feed additives that prevent the absorption of mycotoxins from feed in the animal's gastrointestinal tract are an important addition to the toolbox of mycotoxin counteraction methods.

Mycotoxin-inactivating feed additives generally follow one of two strategies, i.e., adsorption or biotransformation. Adsorbents, such as bentonite, have been shown to effectively bind aflatoxins and prevent their absorption from the gastrointestinal tract, but they bind other mycotoxins such as DON, ZEN, fumonisins, or OTA less effectively (Di Gregorio *et al*., 2014; Murugesan *et al*., 2015; Phillips *et al*., 2019). The mycotoxin-binding capacity of clay minerals can be increased by chemical modification of their surface structure (Di Gregorio *et al*., 2014; Rogowska *et al*., 2019). However, the safety of modified clays is uncertain (Elliott *et al*., 2020). Therefore, an alternative strategy is explored for inactivation of DON, ZEN, fumonisins, and OTA, namely biotransformation by enzymes or microorganisms.

Mycotoxin-degrading enzymes or microorganisms added to feed are meant to convert mycotoxins to non-toxic compounds in the gastrointestinal tract of animals before absorption of mycotoxins would take place. Given appropriate development and testing, mycotoxin-degrading enzymes can be an effective strategy to inactivate mycotoxins in feed specifically and irreversibly (Loi *et al*., 2017; Moll, 2019; Moll and Hartinger, 2011; Zhu *et al*., 2017).

Mycotoxin-inactivating enzymes

As mycotoxin-producing fungi are widespread, many organisms encounter mycotoxins in their natural habitat. As a result, mycotoxin-degrading enzymes evolved in various bacteria, fungi, plants, and animals, either as a defence mechanism enabling the detoxification of harmful mycotoxins, or to make use of mycotoxins as substrates for growth.

Many enzymatic reactions for mycotoxin inactivation have been described, and novel enzymes are being discovered every year. For example, the bacterium *Sphingopyxis* sp. MTA144 harbours fumonisin esterase FumD for fumonisin degradation (Heinl *et al*., 2010). The fungus *Gliocladium roseum* (also known as *Clonostachys rosea*) and the bacterium *Rhodococcus erythropolis* PFA D8-1 harbour ZEN-degrading lactonases ZHD101 (Takahashi-Ando *et al*., 2004; Vekiru *et al*., 2016) and ZenA (Fruhauf *et al*., 2024), respectively. Furthermore, OTA-hydrolysing enzymes were discovered

in different bacteria and animals (e.g., Dellafiora *et al*., 2020; Dobritzsch *et al*., 2014; Gonaus *et al*., 2023).

Moreover, diverse DON-degrading enzymatic reactions were discovered in different organisms. For example, bacterium *Devosia mutans* 17-2-E-8 catalyses the epimerisation of DON (He *et al*., 2015), *Eubacterium* strain BBSH 797 catalyses the de-epoxidation of DON (Schatzmayr *et al*., 2006), and certain wheat varieties harbour DON-detoxifying glutathione S-transferases that enable *Fusarium* head blight resistance (Wang *et al*., 2020). These examples illustrate the diverse arsenal of mycotoxin-inactivating enzymes shaped by evolution. Harnessing these enzymes for biotechnological application holds great promise.

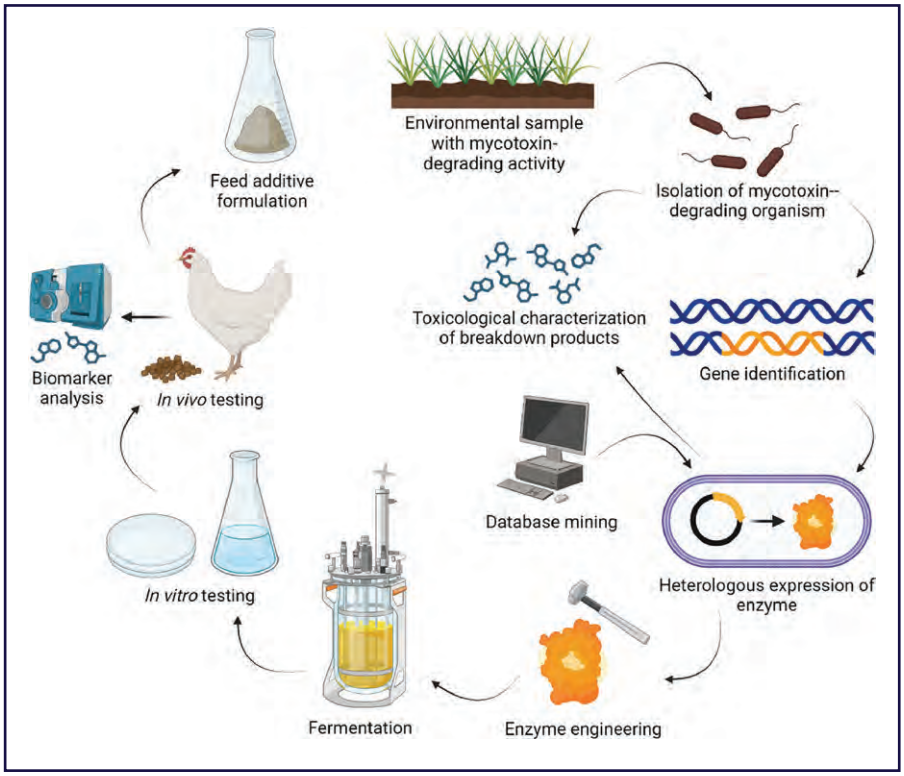
Development of enzymes

A wealth of mycotoxin-inactivating enzymes has been documented, but it is a long way from the discovery of a naturally occurring enzyme to the development of a mycotoxin-inactivating feed additive. A mycotoxin-inactivating feed enzyme that is effective and safe for use must fulfil certain requirements (Loi *et al*., 2017; Moll, 2019; Moll and Hartinger, 2011; Zhu *et al*., 2017):

- The enzymatic reaction must be proven to be irreversible and specific to the target mycotoxin.
- To ensure the safety of the enzyme, it is indispensable to identify the hydrolytic products of mycotoxins formed by the enzyme and characterise the extent of their toxicity. The hydrolytic products must be non-toxic or significantly less toxic than their parent compound.
- The enzyme needs to be active in the gastrointestinal tract to readily degrade the target mycotoxin and prevent its absorption into the bloodstream.
- The efficacy of the enzyme needs to be demonstrated in feeding trials with the target animal using biomarker methods.
- The enzyme needs to remain stable during storage and feed processing. A suitable development process ensures that these criteria are met, as will be described in the following.

A typical path to a mycotoxin-inactivating feed enzyme is outlined in *Figure 1*. This simplified path is based on our experience in the development of

Figure 1: The typical path to a mycotoxin-degrading feed enzyme. (Created with BioRender.com/m84r917)



mycotoxin-inactivating feed enzymes (Moll, 2019). An environmental sample (e.g., soil) that shows mycotoxin-degrading activity is a possible starting point. In a first step, the mycotoxin-degrading microorganism is isolated from this sample. To determine whether the detected mycotoxin-degrading activity shows promise for the development of a mycotoxin-inactivating feed additive, mycotoxin breakdown products must be identified and found to be non-toxic or significantly less toxic than the parent mycotoxin (Fruhauf *et al*., 2019; Grenier *et al*., 2012).

Subsequently, the mycotoxin-degrading enzyme is identified using genome sequencing, as well as bioinformatic, biochemical, and molecular genetics methods. An alternative approach for the identification of promising enzyme candidates is data mining of publicly available sequence and enzyme structure databases. In either case, recombinant enzyme is then produced by heterologous expression and is characterised. In many cases it will then be necessary to modify the enzyme using enzyme engineering, e.g. to improve its catalytic efficiency or temperature stability.

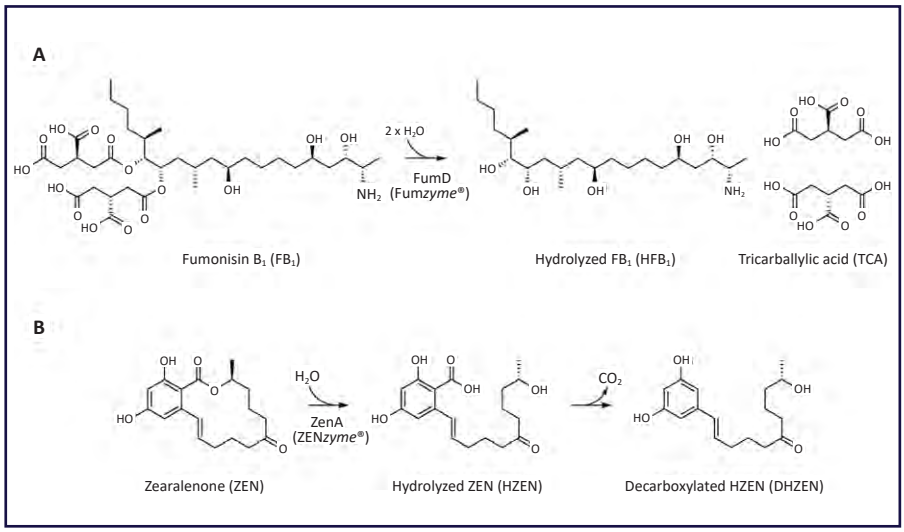
Thereafter, great amounts of the enzyme are produced by fermentation to enable testing of the enzyme as a mycotoxin-inactivating feed additive, first *in vitro* (e.g. in an artificial digestion model), and subsequently *in vivo* in the target animal. *In vivo* efficacy of mycotoxin-inactivating feed additives should be demonstrated using scientifically recognised biomarker methods (e.g. analysis of mycotoxins and breakdown products in blood, urine, or gastrointestinal content, or analysis of sphinganine to sphingosine ratio in blood or tissues) (Dänicke *et al*., 2023; Schwartz-Zimmermann *et al*., 2018).

Finally, feed additive formulation must be optimised to ensure stability of the enzyme during storage and feed processing and optimal activity in the gastrointestinal tract of the target animal. The production process of the final product must be cost-effective at large scale.

Successful application of enzymes

Two mycotoxin-degrading enzymes have recently been developed for application as mycotoxin-inactivating feed additives in poultry, namely fumonisin esterase FumD (commercial name FUM*zyme*®)

Figure 2: Mycotoxin inactivation by feed enzymes FUM*zyme*® (panel A) and ZEN*zyme*® (panel B).



and zearalenone lactonase ZenA (commercial name ZEN*zyme*®). FUM*zyme*® catalyses the conversion of fumonisins to hydrolysed fumonisins by removal of both tricarballylic acid side chains (*Figure 2A*). In this reaction, partially hydrolysed fumonisins, which still contain one of the two tricarballylic acid side chains, are formed as intermediate products. Both hydrolysed fumonisins and partially hydrolysed fumonisins showed significantly reduced toxicity compared to fumonisins in *in vivo* studies (Grenier *et al*., 2012; Hahn *et al*., 2015; Howard *et al*., 2002; Voss *et al*., 2009).

ZEN*zyme*® converts ZEN to hydrolysed ZEN (HZEN), which slowly degrades to decarboxylated HZEN (DHZEN) in a spontaneous reaction (*Figure 2B*). HZEN and DHZEN show dramatically reduced toxicity compared to their parent compound ZEN, both with respect to estrogenicity (Fruhauf *et al*., 2019; Kakeya *et al*., 2002) and other toxic effects (Pierron *et al*., 2024; Tassis *et al*., 2022). Thus, feed enzymes FUM*zyme*® and ZEN*zyme*® enable the inactivation of fumonisins and ZEN, respectively.

The efficacy of FUM*zyme*® in poultry has been investigated in published studies using biomarker methods. In both chickens (Grenier *et al*., 2017) and turkeys (Masching *et al*., 2016) addition of FUM*zyme*® to fumonisin-contaminated feed caused a significant decrease in fumonisin concentrations and concomitant increase in concentrations of hydrolysed fumonisins in digestive tract content and excreta indicative of gastrointestinal degradation of fumonisins by the enzyme.

In addition to such direct evidence for enzymatic fumonisin degradation, based on a biomarker of fumonisin exposure, detoxification can also be verified with a biomarker of effect. For fumonisins, such a biomarker of effect is available because the molecular mechanism of toxicity, binding to and competitive inhibition of ceramide synthase, causes an aberration of sphingolipid concentrations, which can best be measured as the sphinganine to sphingosine ratio (Sa/So) in blood (Riley *et al*., 1994; Voss and Riley, 2013).

Although there is considerable natural variation, this biomarker reveals fumonisin toxicity also in birds when they are exposed to sufficiently high fumonisin concentrations for long enough. In two feeding trials with chickens and ducks, fumonisin exposure significantly increased the Sa/So ratio in blood, whereas FUM*zyme*® addition to the diet counteracted this increase and thus significantly reduced the toxic effect (Grenier *et al*., 2017; Masching *et al*., 2016).

Fumonisin esterase is currently the only mycotoxin-inactivating enzyme that has been authorised for use in feed for poultry in the European Union, the United States, and Canada. Historically, the first hurdle for obtaining regulatory approval for a mycotoxin-inactivating feed additive has been in several cases the establishment of a respective classification within the regulatory framework. Subsequently, to fulfil the stringent regulatory requirements of authorities such as the European Food Safety Authority (EFSA) the Food and Drug Administration (FDA), and the Canadian Food Inspection Agency (CFIA), the catalytic activity of the enzyme as well as the degradation products of the mycotoxin have to be very well characterised.

Numerous experiments have to be performed, *in vitro* and/or *in vivo*, to sufficiently prove safety for the target animal, the consumer, workers and for the environment. Furthermore, effectiveness of the product must be demonstrated in the target species, usually based on relevant biomarkers (Canadian Food Inspection Agency, 2024; EFSA FEEDAP Panel, 2024) which requires development of sensitive and reliable analytical methods. It has to be noted that the compilation as well as the assessment of the complex dossier for a novel mycotoxin-inactivating enzyme is time-consuming and requires expertise on both sides, applicant and authority.

Following the successful application of FUM*zyme*®, ZEN-inactivating feed enzyme ZEN*zyme*® was developed. Results of recent biomarker studies indicate that ZEN*zyme*® effectively degrades ZEN in the gastrointestinal tract of various animal species, including chickens, and therefore shows great potential as mycotoxin-inactivating feed additive (Dänicke *et al*., 2023; Gruber-Dorninger *et al*., 2021; Gruber-Dorninger *et al*., 2023).

In conclusion

Enzymes FUM*zyme*® and ZEN*zyme*® are effective as mycotoxin-inactivating feed additives in poultry. These successful developments highlight the great potential of mycotoxin-degrading feed enzymes. The availability of FUM*zyme*® and ZEN*zyme*® should not reduce efforts to prevent problems of mycotoxin contamination in animal feed by best agricultural practices and continued plant resistance breeding. However, these two enzymes are the first examples of a new technology to help prevent the compromise of flock health, feed efficiency, and commercial success caused by mycotoxin contamination of feed.❖

For references or the full article, visit *www.doi.org/10.1016/j.japr.2025.100544* or send an email to chasity.pender@dsm-firmenich.com

sappo

Pork 360 is an assurance scheme demonstrating the commitment of farmers and the South African pork value chain to best practices, from farm to consumer.

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Strategic management of antimicrobial resistance in South Africa's pork industry

By Dr Thandi Chiappero, head: consumer assurance, SAPPO

Antimicrobial resistance (AMR) poses a significant threat to both human and animal health. AMR is a hot topic globally alongside One Health threats, such as emerging zoonotic diseases and global warming. The United Nations released a political declaration on AMR in September 2024, illustrating the international urgency of the situation.

Effective antibiotics make it possible for us to live the way we do on Earth. They are the reason the average human life expectancy can continue to climb. But what if they stop working? According to the World Organisation for Animal Health (WOAH) in 2019, there were five million human deaths linked to antimicrobial resistance.

What if we can't treat our illnesses effectively anymore? Without certain antibiotics, it is impossible to farm on the scale we do. AMR does not just threaten human health but also food security.

Some AMR genes are a natural feature of microbial species, but in many cases, low-level exposure to antibiotics has allowed bacteria with the genes for resistance to survive, and these resistant bacteria have consequently become more prevalent.

Livestock industry efforts

The danger, therefore, is not that antibiotics are used, but rather when they are used incorrectly or injudiciously. The agricultural sector often bears the blame due to the sheer volume of antibiotics required to treat an entire herd. So, how do we maintain our integrity in this regard?

There are a few ways to reduce the risk of AMR on farms: ensuring that the right antibiotics are given only when necessary, ensuring that a good record is kept of antibiotic usage to confirm the correct usage, and reducing the need for antibiotics by implementing preventative medicine.

What is the livestock sector already doing? AMR discussions are ongoing among the veterinary fraternity in South Africa, with antimicrobial usage guidelines formulated by various specialist groups, including the Pig Vet Society under the South African Veterinary Association (SAVA). The World Health Organisation (WHO) has published a list of medically important antibiotics, which veterinarians in South Africa reference. This guide outlines which antibiotics are permitted for use in animals. This ensures that antibiotics, which are critical for human health, do not bear the risk of becoming ineffective.

The South African Animal Health Association (SAAHA) represents companies that supply the animal health industry with products. AMR is one of their chief interests, and investigating antimicrobial usage is a priority for the AMR alliance.

Preventative medicine in practice is the implementation of a good vaccination schedule and, for the pig industry, comprehensive biosecurity systems. If a disease can be prevented by vaccination, fewer antibiotics will be necessary for treatment. If the introduction of the disease can be prevented altogether by the strict implementation of biosecurity protocols, this can significantly reduce the need for antibiotic treatments.

Pork 360: Setting the standard

South African livestock remains in the foundational 'stock-taking' phase, gathering essential AMU (antimicrobial use) data. SAPPO's Pork 360 programme, which covers over 60% of commercially farmed pigs, sets a benchmark for responsible AMU management. Anchored by five pillars, including biosecurity and antimicrobial stewardship, the programme emphasises sustainability, animal welfare, food safety, and environmental care.

Pork 360's audit platform, *World of Pork*, has tracked trends since 2022, identifying persistent challenges such as feed testing and record-keeping. Veterinarians play a vital role as auditors under the South African Veterinary Council and SAHPRA, ensuring responsible antimicrobial use through valid prescriptions and oversight.

Farm standards require quarterly testing for antimicrobial residues in feed given to market-ready pigs. Since 2024, record-keeping now logs medications by active ingredient and WHO classification. 'Per millilitre' reconciliation promotes precise usage, making record-keeping a cornerstone of AMU oversight.

Environmental accountability encompasses soil testing for heavy metals in slurry-irrigated areas and monthly meat sampling for residues at abattoirs, in accordance with *Codex Alimentarius* standards. Positive tests prompt a detailed investigation.

Though Pork 360-certified pork does not guarantee premium pricing, the certification functions as a 'license to sell', widely adopted by retailers and abattoirs. Non-compliance risks certification loss, encouraging adherence.

Ultimately, Pork 360 demonstrates how voluntary standards can drive impactful change. By promoting responsible AMU, the programme strengthens public health and environmental sustainability, positioning South Africa's pork industry as a leader in global AMR mitigation. ❖

Contact the South African Pork Producers' Organisation (SAPPO) on 012 100 3035 or send an email to info@sappo.co.za for more information.

Protein kinetics *in vivo:* The use of fast protein in diets of weaned pigs

By Daan van der Heijden, sales manager EMEA, Hamlet Protein

Protein kinetics refers to the dynamics of the digestion and absorption of protein and most importantly how fast this happens. The faster a protein source is digested and absorbed the faster it becomes available to the animal. We know from recent scientific findings that the biological value (how much of the protein can be used for deposition) is higher for faster proteins, which means less protein is wasted. Faster proteins are therefore also better for the environment as less nitrogen is excreted.

Over the last years a renowned Danish animal nutrition company has conducted trials to find out which protein ingredients classify as fast and which as slow. The results of these studies were rather surprising. Some protein ingredients generally considered as highly digestible were quite slow when it came to protein kinetics. Moreover, it was also discovered that the fastest vegetable protein source was an enzymatically treated soya bean meal (ESBM). (The results of this research were published at the ASAS-CSAS-WSASAS 2023 meeting in the United Sates.)

Testing of performance

Now, we are ready to see whether weaned pigs on a diet containing fast protein outperformed pigs on a diet containing slow protein. To test this we formulated four diets, using as the differentiating protein source either ESBM (fastest vegetable protein) or a soya protein concentrate (SPC), that was previously tested as very slow (*Table 1, Figure 1A*). The four diets differed in protein source and in protein level (16 vs 19%), creating SLOW LOW, SLOW HIGH, FAST LOW and FAST HIGH (*Table 1*) treatments. All diets were supplemented with synthetic amino acids to meet the requirements.

The next step in our process was to check whether the inclusion of either ESBM or SPC was enough to create protein kinetics differences in the final diets. The results were very good. There was a 45% difference in protein digestion speed between SLOW LOW and FAST LOW and a 63% difference in digestion speed between SLOW HIGH and FAST HIGH, which was sufficient to provide digestion speed contrast in the *in vivo* trial (*Figure 1*).

For the following *in vivo* test 256 weaned, intact male piglets (YxL; age 28d

Table 1: Description of the diets.

Treatment code	Description	Estimated CP%	Analysed CP %	Analysed moisture %
SLOW LOW	Slow and low CP	16,99	16,01	11,7
SLOW HIGH	Slow and high CP	20,03	19,24	11,7
FAST LOW	Fast and low CP	16,99	16,72	11,9
FAST HIGH	Fast and high CP	20	18,95	11,9

Figure 1A: Protein kinetics for SBM, ESBM and SPC.

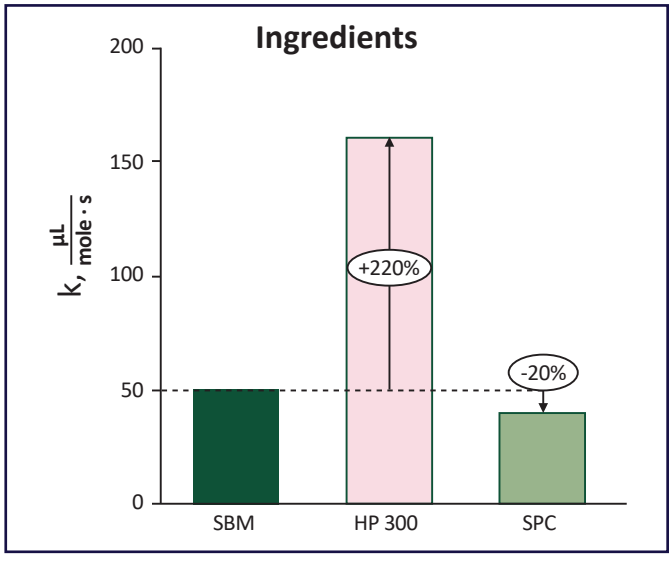


Figure 1B: Protein kinetics for the four diets.

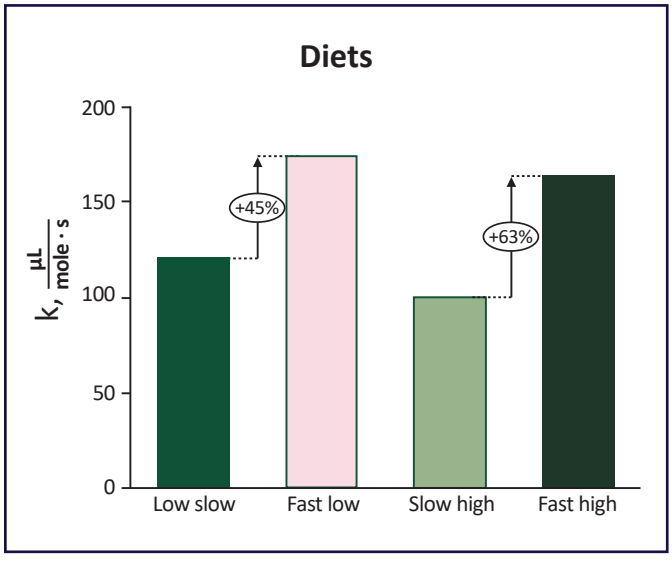
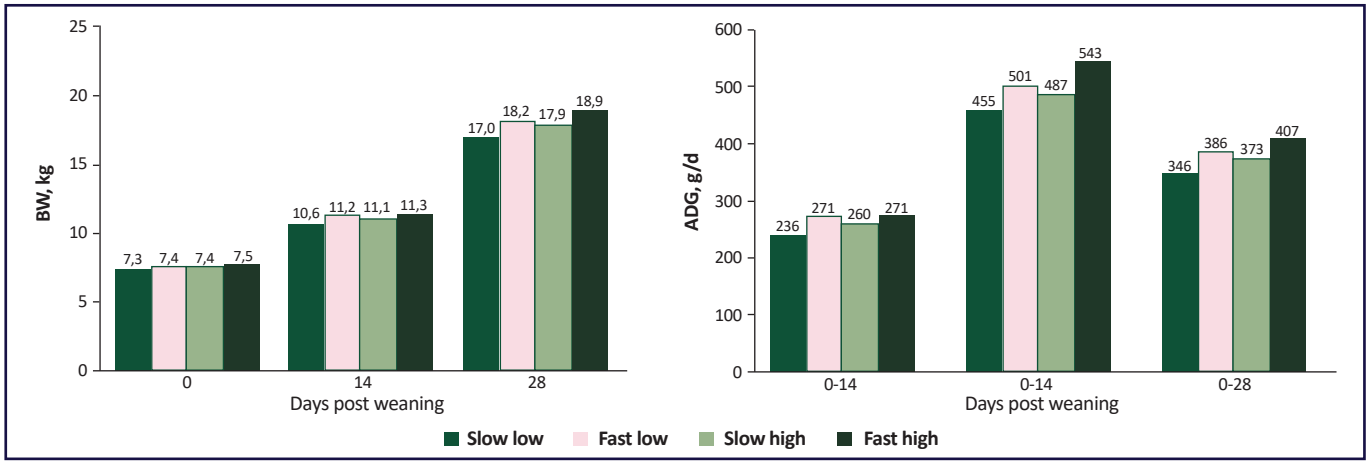


Table 2: Growth performance: The use of FAST protein from ESBM results in better weight gain and BW compared to SLOW protein from SPC.

Diet	BW d0 (kg)	BW d14 (kg)	BW d28 (kg)	ADG d0-14	ADG d14-28	ADG d0-28
FAST	7,43 ± 1,2	11,21 ± 2,2	18,52 ± 3,1	271 ± 80	521 ± 77	396 ± 71
SLOW	7,25 ± 1,1	10,6 ± 1,6	17,02 ± 2,6	239 ± 64	458 ± 105	349 ±74
P value	0,57	0,22	0,04	0,1	0,1	0,1

Figure 2AB: Growth performance for the four individual diets (Figure 2A:BW and Figure 2B: ADG).



at 7,3kg) were allocated to one of the four diets based on weight. When analysing the data after a trial duration of 28 days we saw that there was no interaction between protein levels and protein digestion speeds for growth performance. Feed intake did not differ for FAST or SLOW for d0-14 and there was only a numerical difference in feed conversion ratio (FCR) between FAST and SLOW (1,26 vs 1,3, d0-14 and 1,31 vs 1,32 for d0-28, respectively; P>0,05). There was, however, a strong effect of protein speed noticeable in the growth performance results.

Total weight gain was positively influenced by digestion speed with higher gains for FAST 11,1 ± 2kg compared to SLOW 9,8 ± 2,1kg, respectively (P<0,05) (*Table 2*). Bodyweight (BW) on d28 was higher for pigs fed FAST diets compared to SLOW (18,5 ± 3,1 vs 17 ± 2,6kg; P<0,05) (*Table 2*).

Protein performance

An interesting aspect when looking at the individual diets (*Figures 2A* and *2B*) is that FAST LOW numerically outperformed the growth performance of SLOW HIGH. Even at lower protein levels (16 vs 19% crude protein [CP]) the FAST LOW showed higher BW and better average daily gain (ADG). So, this means that when using a fast protein source, one can lower CP levels without losing performance. This is probably related to better synchronisation in absorption with the supplemented synthetic amino acids in the diet.

Zhang *et al*., 2022 showed that the better the synchronisation in absorption of total amino acids is, the higher the nitrogen deposition rate and the higher the apparent biological value of the protein source is. This indicates that faster protein is better utilised than slow protein. This was confirmed by lower nitrogen levels in faeces for FAST diets.

Average nitrogen levels in faeces from d14-28 tended to be lower for FAST compared to SLOW (326 vs 343mg/g DM faeces/CP intake, P=0,1). On d28 FAST LOW had less nitrogen (mg/g)/DM faeces/CP intake than SLOW LOW (303 vs 390mg, P<0,05, respectively). So, from fast protein less nitrogen is wasted. Therefore, protein kinetics are more indicative of feed efficiency and protein deposition than the digestibility coefficient of the protein ingredient.

In conclusion

The results of this study indicate that differences in *in vitro* protein kinetics between protein ingredients created differences in protein kinetics in final diets which are related to the *in vivo* performance of weaned pigs on these diets.

Table 3: Nitrogen excretion in faeces (mg/g DM faeces/ CP intake).

Diets	Faecal nitrogen (mg/g DM faeces/ CP intake)
FAST HIGH	358,3^{ab}
FAST LOW	303^{a}
SLOW HIGH	337,3^{ab}
SLOW LOG	390,3^{b}

^{ab}P<0,05 – Ducan test was used.

Pigs on FAST protein showed better growth performance than pigs on SLOW protein. The use of FAST protein allows for the reduction of CP levels without losing performance. This argues in favour of a better protein efficiency for FAST protein; a finding that was supported by lower nitrogen excretions for FAST protein.

It is therefore safe to say that not only young animals have a requirement for FAST protein from a physiological point of view – nutritionists also have a requirement for FAST protein to optimise the use of synthetic amino acids in diets and to meet the requirements regarding total nitrogen excretion reduction.

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Mycotoxins in feed: A hidden threat demanding modern solutions

By Judi Rosenstrauch, technical support scientist (Can. Sci. Nat. 118654), Envarto

Mycotoxins represent one of the most deceptive challenges facing the global feed industry today. These toxic fungal metabolites contaminate feed ingredients at various stages of production, often remaining invisible until they've already compromised animal health and performance. The economic toll can be felt through reduced productivity, increased veterinary expenses, and rejected shipments.

For feed manufacturers, the question is no longer whether mycotoxins pose a risk, but rather how to implement systematic, data-driven strategies to minimise their impact and protect both animals and profit margins.

Mapping the contamination chain

Understanding where and how mycotoxins enter the feed supply chain is the first step towards effective control. Contamination begins in the field, where environmental stressors such as drought, humidity, and insect damage create ideal conditions for fungal growth. Wet conditions before harvest or drought stress during grain development can trigger explosive fungal proliferation. Post-harvest, poor storage practices like high moisture content above 14% and inadequate aeration can accelerate toxin production. Transport and feed processing add further risk when contaminated residues accumulate in storage bins, mixers, and conveyors.

Because mycotoxin formation is dynamic and often invisible, monitoring must be continuous and multi-staged. Studies have shown that more than 70% of cereal grains globally are contaminated by mycotoxins. These toxins often occur in mixtures, creating complex exposure scenarios that can amplify their effects.

New emerging mycotoxins are identified periodically, and little is known about their toxicity, effects, and synergism with other mycotoxins. However, the more we analyse for these emerging compounds through advanced screening methods, the better we can understand their biological effects, decode previously unexplained symptoms in animals, and develop targeted mitigation strategies. This proactive analytical approach transforms unknown threats into manageable risks.

The power of routine testing

Routine testing of feed and raw materials is essential for managing risk effectively. Forward-thinking manufacturers recognise testing as a strategic investment that allows them to track seasonal and regional contamination patterns, adjust sourcing strategies, benchmark supplier reliability, make informed formulation decisions, and guide selection of appropriate mycotoxin programmes, binders and detoxifiers.

By building a comprehensive mycotoxin database over multiple seasons, manufacturers can identify high-risk suppliers, anticipate contamination based on weather patterns, and time purchases to minimise exposure. Modern analytical methods using liquid chromatography-mass spectrometry (LC-MS/MS) can simultaneously detect dozens of mycotoxins in a single sample. The cost of testing is minimal compared to a mycotoxicosis outbreak, production losses, or rejected feed shipment.

Testing frequency should be risk-based: High-risk ingredients like maize, wheat, and their by-products warrant testing with every new lot or at minimum monthly, while lower-risk ingredients may require only quarterly screening. Seasonal adjustments are critical, with more intensive monitoring during harvest periods and after unusual weather events.

Low levels also pose a risk

Regulatory limits do not necessarily represent safe thresholds for optimal animal performance. Over three years, researchers conducted 18 broiler performance trials investigating low-level mycotoxin mixtures in poultry feed. Despite all feed samples complying with European Union regulatory limits, even subclinical levels of mycotoxins, particularly deoxynivalenol (DON), zearalenone (ZEN), fumonisins (FBs), diacetoxyscirpenol (DAS), enniatins (ENNs), and beauvericin (BEV), were associated with reduced feed efficiency.

Feed efficiency, measured as feed conversion ratio (FCR) is a critical economic indicator. Notably, 90% of feed samples contained more than ten mycotoxins, and 75% had 20 or more. Statistical analysis showed strong correlations between FCR and individual mycotoxins, and significant interaction effects when DON, ZEN, and either FBs or DAS were present together.

These findings underscore the importance of monitoring combined effects, as subclinical exposure can impair growth and productivity without visible symptoms. A mixture of different mycotoxins, even at low levels, could have a synergistic effect, resulting in higher toxicity than expected from a single mycotoxin.

Prevention starts in the field

Preventing excessive contamination requires a holistic, research-backed strategy beginning long before ingredients reach the feed mill. Key preventive strategies include crop management practices such as rotating crops to break fungal life cycles, selecting resistant hybrids, and managing drought and insect stress.

Storage control is equally critical at every level, from on-farm grain storage to large commercial facilities: keeping moisture below 14%, ensuring good aeration, and inspecting bins or bags regularly for mould or pest activity. Even small-scale storage requires attention to basic principles, such as dry conditions, proper ventilation, regular inspection, and prompt use of older stock. Feed mill hygiene must be rigorous, with regular cleaning of silos, conveyors, and conditioning systems to prevent contaminated residue buildup.

Supplier agreements implementing testing protocols for incoming ingredients create accountability throughout the

supply chain. Risk mapping, building a mycotoxin database tracking contamination patterns by region, season, supplier, and ingredient type, enables manufacturers to predict and pre-empt future issues. This data-driven approach transforms mycotoxin management from reactive firefighting to proactive risk mitigation.

Detoxification strategies

Even with best preventive measures, some mycotoxin contamination is often inevitable. Animals detoxify mycotoxins through two primary mechanisms: adsorption in the gut and enzymatic metabolism in the liver. Certain feed additives, such as bentonite and other clay minerals, activated charcoal, and yeast cell wall components, can bind to mycotoxins, reducing their bioavailability. However, not all mycotoxins bind equally well; while aflatoxins show binding rates exceeding 90% with quality adsorbents, toxins like DON and ZEN show much lower efficiency, often below 20 to 30%.

Once mycotoxins enter the bloodstream, the liver metabolises them through biotransformation. Phase I involves modifying the toxin structure via oxidation, reduction, or hydrolysis. Phase II neutralises these through conjugation reactions, making toxins more water-soluble and easier to excrete.

A well-designed feed additive strategy supports both pathways, by binding toxins in the gut and supplying nutrients or cofactors that enhance liver detoxification capacity. The investment in quality mycotoxin mitigation products, typically costing R80 to R180/t of feed, is generally far less expensive than the performance losses they prevent. It is, however, important that the products are effective in mitigating the specific toxins that an animal is exposed to.

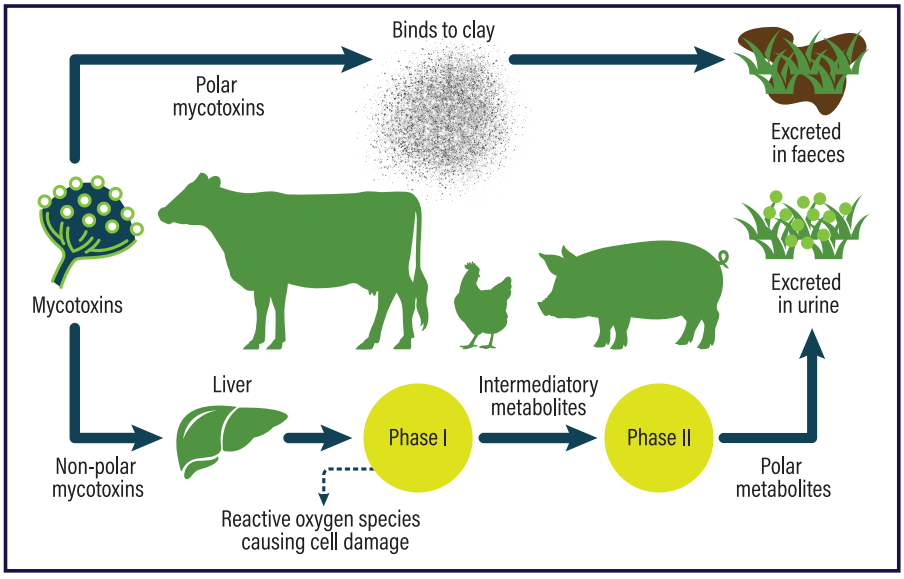
Monitoring what matters most

Feed analysis shows potential exposure but doesn't reveal what toxins have actually entered the animal's system. Masked mycotoxins, biologically modified forms of toxins, are produced by plants as a defence mechanism and often escape detection in standard feed analysis. These compounds can be converted back into toxic parent forms in the animal's digestive tract.

Biomonitoring through blood, urine, or tissue biomarkers offers a more direct solution, reflecting the actual internal dose absorbed and metabolised. Biomonitoring can measure parent toxins like aflatoxin B_1 or DON in plasma, metabolites such as aflatoxin M_1 in milk or DOM-1 in urine, and physiological markers like elevated liver enzymes or oxidative stress indicators.

Using both feed testing and biomonitoring creates a feedback loop between feed quality and animal health, allowing producers to detect early signs of toxicosis, evaluate mitigation strategy effectiveness, and protect performance before economic losses occur.

Figure1: Detoxification of mycotoxins in the animal.



Building a culture of safety

Mycotoxin control should be part of a broader feed biosecurity and quality culture, not a once-off intervention. Successful feed manufacturers treat mycotoxin management as continuous improvement, integrating it into quality management systems, standard operating procedures, and staff training programmes.

Implementation includes establishing clear protocols for sampling, testing, and decision-making; training staff to recognise high-risk situations; implementing early-warning systems; and maintaining detailed records enabling trend analysis and continuous improvement.

The return on investment is compelling. While direct costs of testing, mitigation products, and occasionally rejecting contaminated ingredients are tangible, the avoided costs, including improved feed efficiency, reduced mortality, lower veterinary expenses, and protected brand reputation, typically far exceed the investment.

Looking forward, the feed industry will likely see continued advancement in rapid testing technologies, more sophisticated risk modelling incorporating weather data and predictive analytics, and greater regulatory scrutiny of mycotoxin mixtures. Manufacturers who invest now in precision monitoring tools, advanced analytics, and accredited laboratory partnerships signal commitment to safety that goes beyond compliance.

As the industry evolves, feed safety must start with awareness, data, and proactive management. The mycotoxin challenge is complex and ever-changing, but with the right tools, knowledge, and commitment, it can be effectively managed to protect animal welfare, production efficiency, and economic sustainability. ❖

Judi Rosenstrauch.

References available on request. Send an email to judi@envarto.co.za for more information.

Dealing with misconduct, disciplinary hearings, and CCMA cases

By Tiaan Botes, Meyer Louw, Anneline Scriven, and Xander Levendal, LWO Employers Organisation

Dismissal is a critical decision by employers that impacts the business and the lives of employees. The *Labour Relations Act, 1995 (Act 66 of 1995)* or *LRA*, as amended, offers a framework in *Schedule 8: Code of Good Practice: Dismissal* (the *Code*) to ensure fairness. This *Code* outlines important principles to balance justice with the operational needs of businesses, and employers need to take note.

The *Code* requires employers to establish clear disciplinary rules in the workplace that set the standard of conduct expected from employees. These rules may vary based on the size and nature of the business. The key is ensuring that the rules are easy to understand, fair, and thoroughly communicated to and shared with employees.

Every workplace must have a relevant disciplinary code. It is a clear set of rules with appropriate sanctions that all employees must comply with. If employees contravene these rules, the employer has the right to act.

The employer's responsibilities are to:

- Maintain discipline within the framework of the procedures in a fair, equitable and consistent manner, with an emphasis on progressive discipline.
- Prevent unacceptable behaviour.
- Change unacceptable behaviour through a positive influence.
- Maximise productivity within the workplace.

Employees must be made aware of the disciplinary code:

- Hold a meeting with all employees or hold smaller group meetings if there are many employees.
- Circulate an attendance register as proof of who attended the meeting.
- Discuss the disciplinary code with employees and highlight the possible consequences of different offences.
- Keep minutes of the meeting as a record.

Disciplinary sanctions provide guidelines for the consistent application of disciplinary action by employers. Progressive discipline is emphasised, as discipline in the workplace aims to adjust and improve behaviour through correction, consultations and warnings rather than punishing or dismissing an employee. Dismissal should always be the last option.

Progressive discipline

The *Code* encourages progressive discipline, reserving dismissal for serious cases and as a matter of last resort. Progressive discipline focusses on guiding employees to meet required standards through measures such as counselling and warnings. An informal discussion is often sufficient for minor infractions, while repeated or more serious misconduct may lead to formal written warnings, or other disciplinary actions short of dismissal. Dismissal is generally reserved for serious misconduct or repeated offences.

Dismissal for a first offence is rare and typically applies only in cases of severe misconduct that renders continued employment intolerable, such as gross dishonesty, wilful property damage, endangering safety, physical assault, gross insubordination, etc.

When considering dismissal, employers should weigh the seriousness of the misconduct alongside the employee's personal and mitigating circumstances (e.g., length of service and disciplinary record), nature of the job, and context of the offence. Consistency in applying disciplinary actions, both in similar cases and among employees involved in the same incident, is essential to ensure fairness.

Fair or unfair

The *Code* provides that, when determining whether a dismissal for misconduct is unfair, the following should be considered:

- Did the employee contravene a workplace rule or standard?
- Was the rule valid and reasonable?
- Was the employee aware of, or could reasonably have been expected to know about the rule?
- Was the rule consistently applied by the employer?
- Was dismissal an appropriate sanction for the offence.

Many employers often refer to 'immediate dismissals' or similar actions. However, under South African labour law, there is no such thing as a valid on-the-spot 'you're fired' dismissal.

To ensure fair procedure in dismissal cases, employers should follow a process that includes the following:

- *Investigation*: Investigate to determine whether there are valid grounds for dismissal. This process does not need to be overly formal but should be thorough enough to gather all relevant facts and evidence to support the decision.
- *Notification*: Inform the employee of the allegations by way of a written notice to attend a hearing and explain this to the employee in clear, understandable language and terms.
- *Opportunity to respond*: Allow the employee sufficient time to prepare for the hearing; the opportunity to state their side of the case and respond to the allegations; and the option to have assistance or representation, such as their workplace trade union representative (shop steward) or a colleague, to support them during the process.
- *Communicating decisions*: Once the inquiry is complete, communicate the decision clearly and in writing, outlining the reasons behind it. Also remind the employee of his/her right to refer the matter to the Commission for Conciliation, Mediation and Arbitration (CCMA).

Employers should ensure their actions align with the guidelines in Schedule 8 of the *LRA*, balancing operational needs with employee rights. By following the principles outlined in the *Code*, both employers and employees can navigate dismissals with integrity and fairness.

Dismissal and presenting evidence

During disciplinary and arbitration proceedings, the employer has a responsibility to present evidence to the chairperson or commissioner to prove its case. Evidence is defined as "the available body of facts or information indicating whether a belief or proposition is true or valid". It is thus the proof of the employer's argument and not just the argument itself.

However, employers tend to neglect this responsibility of adducing evidence to acquire, compile, and prepare evidence for the disciplinary hearing or arbitration. This consequently negates the chairperson's ability to conduct the hearing since he/she will need to hear evidence from both sides to make an objective decision regarding the matter. This neglect will also negatively affect the employer's case should the matter be referred to the CCMA.

Important notes

- Appoint a person qualified to chair disciplinary hearings and who is knowledgeable in both labour law as well as the law of evidence.
- Evidence presented at hearings must meet the requirements in terms of the law of evidence to be admissible.
- Accused employees should be given the chance to cross examine or dispute evidence presented by the employer.
- If inadmissible evidence is considered when dismissing an employee, the dismissal would be unfair.

Should an employer not introduce or present evidence correctly at disciplinary hearings or arbitrations, it may have dire consequences such as the employee's dismissal being declared unfair. The employee may further be awarded compensation or even reinstated.

It is important that employers deal with issues in the workplace as quickly and effectively as possible, while taking care to act objectively and consistently. By being proactive, the employer can contribute towards the business's sustainability and profitability and ensure a working environment with reduced conflict, friction, and misunderstanding, which in turn creates a structured environment receptive to growth.

CCMA case after dismissal

A dismissed employee can refer a dispute to the CCMA to challenge the fairness of their dismissal. Therefore, prior to dismissal, employers should ensure that they follow the correct procedure and have sufficient grounds for dismissal.

An employee who refers a case to the CCMA becomes the applicant and the employer the respondent. The applicant has 30 calendar days after the date of dismissal to refer a dispute online or in person to the CCMA. A completed referral form sets out the basis of the claim and is served on the employer and filed with the CCMA.

"Should an employer not introduce or present evidence correctly at disciplinary hearings or arbitrations, it may have dire consequences such as the employee's dismissal being declared unfair.

After the 30-day period has lapsed, the applicant may still refer the matter but must show good cause for the late referral. This is usually done as an application for condonation of the late filing of the referral, which the respondent (employer) can oppose through a written submission. The commissioner dealing with the matter will address the late filing and decide on the outcome.

Upon receipt of the referral form, the CCMA sets the matter down on a date and time that parties need to attend for either a conciliation or a Con-arb process. The CCMA must provide parties with 14 days' written notice of the proceedings in case of a conciliation or Con/arb, and 21 days' written notice in case of an arbitration, with an additional seven days' notice if sent via registered mail.

CCMA processes

- *Conciliation*: The commissioner will attempt to resolve the matter on an informal basis. Conciliation proceedings are private and confidential. No person may refer to anything said during conciliation proceedings in any subsequent proceedings, unless agreed to by the parties in writing or if ordered by a court of law.
- *Arbitration*: A formal hearing where a commissioner will give both parties the opportunity to present their case, including witnesses and evidence. Once concluded, the commissioner has 14 days to make a ruling as to the fairness of the dismissal.

- *Con/arb*: Conciliation and arbitration is heard on the same day. If the matter is not resolved at conciliation, arbitration will follow directly thereafter. Either party can object to arbitration immediately after conciliation in an unfair dismissal dispute by written notice to the CCMA and the other party, no later than seven days prior to the scheduled date.

The respondent (employer) must prove the following at the CCMA:

- *Procedural fairness*: Includes presenting the employee with a notice of disciplinary hearing setting out the charges and allowing the employee reasonable time to prepare for the hearing. At the hearing, the employee may request an interpreter, to be represented, to state his/her case, to call witnesses, to question the evidence of the employer's witnesses, etc. An independent chairperson should then hear the evidence and make a finding on the charge(s).
- *Substantive fairness*: Proof that the employee was guilty of misconduct which was serious enough to warrant a sanction of dismissal in the specific circumstances.

If an employer fails to follow fair procedures, it may result in a CCMA order made against the employer of up to 12 months' salary to the employee. Likewise, if a dismissal is found to be substantively unfair, the CCMA may either order the employee's reinstatement or re-employment, or, if returning to work is not feasible, award the employee compensation.

CCMA processes can be intimidating, and it is a good idea to get expert advice. An employer can be represented by any employee/director of the business, or by an office bearer/official of an employers' organisation that is registered with the Department of Employment and Labour.

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