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Erratum: In the previous issue (Volume-12, Issue-7), an image on page 26 was printed incorrectly due to an editorial error. We regret the mistake and apologize to our readers and any individuals or organizations affected.

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Scientists Decode Why H5N1 Bird Flu Targets Dairy Cow Udders Instead of Lungs



A new study has uncovered the biological mechanism behind the unusual way H5N1 bird flu affects dairy cattle, where it primarily infects the udder rather than the respiratory system. The findings, published in *Science Advances* by researchers from the University of Pittsburgh School of Public Health in collaboration with Harvard Medical School and other institutions, provide the first clear explanation for this atypical disease pattern observed since outbreaks began in U.S. dairy herds in 2024.

Unlike typical mammalian influenza infections that target the lungs, H5N1 in cattle was found to cause severe necrotizing mastitis, a painful and damaging inflammation of the mammary glands. The disease spread rapidly across herds in regions such as the Texas Panhandle, with infected animals shedding

high levels of virus in milk, raising concerns about farm-level transmission and occupational exposure risks. The research revealed that the virus's ability to infect specific tissues depends on the presence of a particular class of receptors known as N-linked sialic acid glycans. Using advanced glycomics, binding studies and high-resolution imaging, scientists found that these receptors are largely absent in bovine respiratory tissues but highly concentrated in the udder, effectively making it the primary site of infection. Experts noted that this tissue-specific receptor distribution explains why infected cows do not develop severe respiratory illness despite the presence of viral receptors in their airways. The study highlights how subtle differences in receptor biology can determine not only species susceptibility but also the organ systems

affected.

Researchers emphasized that understanding these mechanisms could improve early detection of cross-species transmission risks. By mapping receptor patterns across different animals and tissues, scientists may be able to predict whether future infections will manifest as respiratory disease, mastitis, or even neurological disorders in other species. The findings also reinforce public health guidance that pasteurization effectively eliminates the virus from milk, reducing risks associated with dairy consumption and underscoring the importance of avoiding raw milk.

Overall, the study provides a significant advance in understanding H5N1 behavior in mammals and offers a predictive framework for anticipating future spillover events across species.

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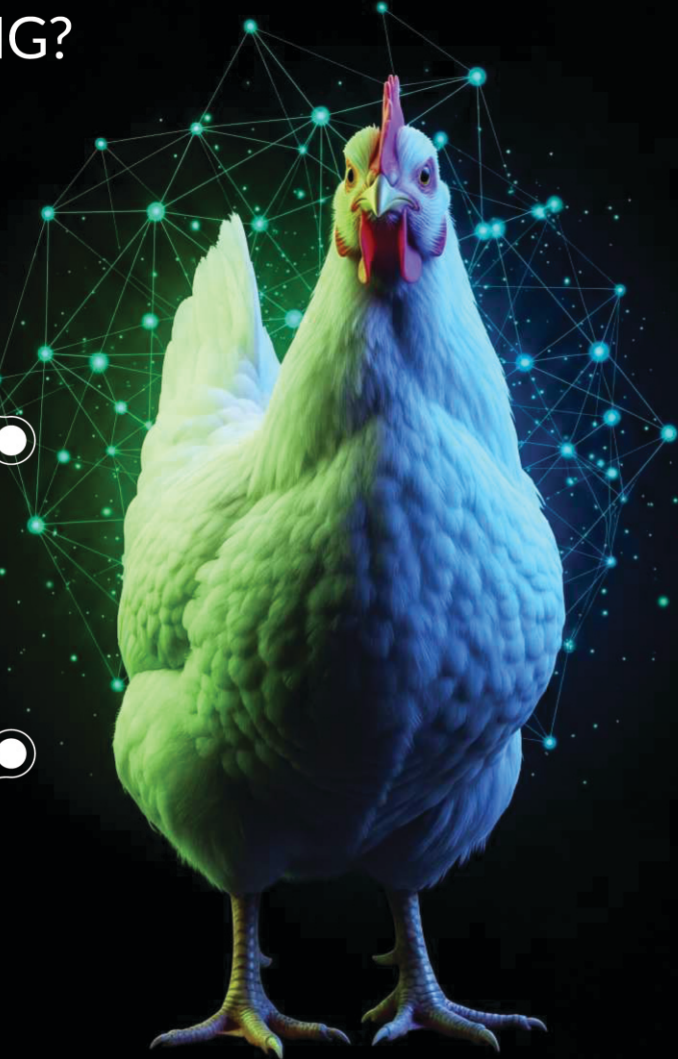
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India Takes Landmark Step in HPAI Preparedness with New Vaccine Regulatory Pathway



Dr. Shirish Nigam

The Department of Animal Husbandry & Dairying (DAHD), Government of India, has announced a significant policy advancement by establishing a structured regulatory pathway for the import, evaluation, and potential use of Highly Pathogenic Avian Influenza (HPAI) vaccines in India's poultry sector. This initiative marks a major milestone in strengthening

India's animal health preparedness and reflects a science-driven approach to disease prevention and control.

According to Dr. Shirish Nigam, the policy represents a forward-looking framework that balances innovation, biosecurity, and scientific validation while enhancing national readiness against HPAI.

Key Features of the New Regulatory Framework

The structured pathway includes:

- Approval from CDSCO for import of vaccine strains
- Bridging studies using circulating Indian field virus strains
- Evaluation under guidance of the High Security Animal Disease Laboratory (HSADL),



Bhopal

- Regulatory review prior to commercialization
- Mandatory surveillance, reporting, and data-sharing requirements post-deployment

The framework ensures that all vaccine candidates undergo rigorous scientific evaluation before being considered for field use.

Strengthening India's Poultry Health Ecosystem

The policy is expected to:

- Improve preparedness against HPAI outbreaks
- Support poultry farmers in safeguarding flock health
- Strengthen veterinary

disease control capabilities

- Enable access to scientifically validated vaccination tools where required
- Encourage participation from both Indian and global animal health companies

Dr. Nigam noted that the initiative reflects a balanced integration of innovation and biosecurity, which is essential for building a resilient poultry health system.

Industry Collaboration and Collective Effort

The development has been supported through sustained engagement by key industry bodies, including:

- INFAH
- Poultry Federation of India (PFI)
- CLFMA of India
- All India Poultry Breeders Association

Dr. Nigam also acknowledged the constructive role of Team INFAH, highlighting its continued technical inputs and policy advocacy in shaping industry perspectives.

He emphasized that the policy outcome reflects effective collaboration between government, industry, and scientific institutions.

Key Clarifications on Implementation

Timeline:

The framework establishes a phased regulatory process. Timelines will depend on completion of import approvals, bridging studies, and regulatory evaluations.

Role of Vaccination:

Vaccination will serve as a complementary tool and not a replacement for biosecurity measures such as

surveillance, hygiene, movement control, and good management practices.

Where scientifically justified and approved, vaccination can further complement these measures as part of an integrated disease-control strategy.

Efficacy Evaluation:

All vaccine candidates will undergo testing against Indian field strains at designated high-security laboratories, followed by post-introduction monitoring.

Industry Impact:

The policy is expected to promote investment in vaccine R&D and strengthen India's domestic veterinary biotechnology ecosystem. It will create opportunities for Indian manufacturers, research institutions and high-containment laboratories to work together in generating locally relevant scientific data, thereby enhancing India's preparedness against emerging animal diseases.

A Step Toward a Resilient Future

Dr. Nigam concluded that this initiative marks an important step toward a science-led, globally aligned, and resilient poultry health system. He emphasized that sustained success will depend on robust implementation, continuous surveillance, and strong collaboration among regulators, academia, and industry stakeholders.

About the Perspective

This statement reflects the professional views of Dr. Shirish Nigam, shared in the context of India's evolving poultry health and disease preparedness landscape.

The Golden Triad of Cattle Feed Manufacturing: Sourcing, Stocking & Pricing Strategy

By **Sandeep Badjatiya**, Bharat feeds & extraction



Sandeep Badjatiya

In the highly competitive cattle feed industry, profitability is determined long before the product reaches the farmer. The real battle is won through effective management of raw material procurement, inventory planning, and pricing strategy. When raw material markets become volatile, a single mistake in procurement or pricing can wipe out months of hard-earned margins. To build a resilient and profitable cattle feed business, manufacturers must master three critical pillars.

1. Pricing: Your First Line of Defense

There are periods when soaring raw material prices make it impossible to achieve ideal production costs. During such times, manufacturers must protect margins proactively rather than reactively. Maintain a healthy price buffer in the market. A stronger pricing structure provides the financial cushion needed to absorb sudden increases in raw material costs without immediately impacting profitability. This buffer acts as a shield, allowing the business to navigate market volatility

while maintaining operational stability.

2. Inventory Management: Stock Smart, Price Smart

Strategic stocking can create a competitive advantage, but only when it is aligned with current market realities. Consider a situation where a manufacturer purchases and stocks raw materials at lower prices sufficient for three months of production. If market prices subsequently rise but finished feed prices remain unchanged, dealers and customers may increase purchases aggressively to capitalize on the lower pricing.

As a result, inventory intended to last three months may be exhausted in just one month.

The solution is simple: when market raw material prices rise, finished goods prices should be adjusted immediately, even if production is still based on lower-cost inventory. This protects stock reserves, maintains market discipline, and ensures adequate working capital is available when replenishment is required at higher market rates.

3. Supplier Relationships: The Delivery Lifeline

The lowest raw material quote has little value if the

material does not arrive when required.

Production disruptions caused by delayed deliveries can damage customer relationships, disrupt supply chains, and erode market credibility.

Therefore, manufacturers should prioritize suppliers with a proven track record of reliability and goodwill rather than focusing solely on the lowest price.

Trusted suppliers honor commitments, especially during periods of market shortages and supply constraints. Their reliability ensures uninterrupted production and protects business continuity when it matters most.

The Bottom Line

Success in cattle feed manufacturing depends on maintaining a strong connection between procurement and sales strategy.

By building relationships with reliable suppliers, maintaining disciplined pricing, and aligning inventory management with market conditions, manufacturers can safeguard profitability, ensure business continuity, and create a sustainable competitive advantage in any market environment.



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Health in Poultry: Building Resilience Through Nutrition and Precision Feed Technologies



Dr. Rajib Upadhyaya

Regional Category Manager
Poultry, Indian Subcontinent, Adisseo

Dr. Rajib Upadhyaya is MVSc in Veterinary Pathology & handles Adisseo's Mycotoxin Management, Gut Health & Antioxidant portfolio in the Indian Subcontinent.



Dr Pascal Thiery

Technical Director – India
Middle East & Africa (IMEA), Adisseo

Dr. Pascal Thiery is a veterinarian with more than 30 years of experience in poultry production and nutrition. Since joining Adisseo in 2010, he has held several global and regional technical leadership positions.



Dr Tim Goossens

Global Technical &
Scientific Support Manager, Adisseo

Dr. Tim Goossens holds a Ph.D. in Biomedical Sciences and has more than 15 years of experience in animal nutrition. His expertise focuses on probiotics, fatty acid-based feed additives, and precision gut health solutions that enhance animal health and performance.



Dr Damien P. Préveraud

Global Technical Manager -
Feed Integrity, Adisseo

Dr. Damien P. Préveraud holds a Ph.D. in Physiology of Nutrition and an M.Sc. in Food & Health. Since joining Adisseo in 2009, he has focused on developing feed integrity solutions that help livestock producers improve feed safety, gut health, and production performance.

What are the biggest gut health challenges facing Indian poultry producers today, and how are these challenges evolving under current production systems?

Dr. Rajib: Gut health has become one of the most important determinants of poultry performance in India. Today, producers face several interconnected challenges that directly affect intestinal integrity, nutrient utilization, and overall flock productivity.

One of the most significant concerns is mycotoxin contamination. Feed ingredients such as maize, oilseed meals, and alternative raw materials are frequently contaminated with mycotoxins, which damage the intestinal lining, impair nutrient absorption, suppress immunity, and increase susceptibility to enteric diseases.

Another major challenge is necrotic enteritis and dysbiosis. As the poultry industry reduces reliance on antibiotic

growth promoters (AGPs), the incidence of *Clostridium perfringens*-associated enteritis has increased, making effective gut health management even more critical. Coccidiosis, both clinical and subclinical, continues to compromise intestinal integrity, reduce feed efficiency, and negatively affect flock performance. At the same time, greater dependence on alternative feed ingredients introduces higher fibre levels, anti-nutritional factors, and greater variability in nutrient composition, all of which can adversely affect gut function.

Modern intensive production systems add further complexity. Heat stress, vaccination programmes, high stocking densities, and environmental stressors disrupt the gut microbiota, weaken the intestinal barrier, and reduce the bird's ability to utilize nutrients efficiently.

As Indian poultry production adopts higher-performing genetics, reduced antibiotic use, and more sustainable production practices, gut health management has evolved from treating individual diseases to maintaining a resilient intestinal ecosystem. Today's successful programmes integrate balanced nutrition, targeted feed additives, biosecurity, coccidiosis control, and effective mycotoxin management to support microbiome stability, intestinal integrity, immunity, and long-term profitability.

Rising raw material and feed costs are forcing producers to optimize every nutritional intervention. How can feed additives be strategically integrated to maximize efficiency and profitability?

Dr. Rajib: Feed accounts for the largest share of poultry production costs,

making nutritional efficiency more important than ever. Rather than viewing feed additives as isolated products, producers should integrate them strategically to improve nutrient utilization and overall flock performance.

Feed enzymes enhance nutrient digestibility and allow birds to extract greater value from every kilogram of feed. Functional gut health additives—including probiotics, organic acids, and protected butyrate—help maintain intestinal integrity, improve microbial balance, and enhance feed conversion efficiency. At the same time, effective mycotoxin management and antioxidant supplementation minimize performance losses associated with feed contamination and environmental stress.

The emphasis should always be on scientifically validated additives that consistently improve feed conversion ratio (FCR), growth performance, health, and economic returns. Selecting the right combination of nutritional solutions enables producers to maximize profitability while maintaining sustainable production under increasingly challenging market conditions.

You have described intestinal barrier integrity as a cornerstone of gut health. What are the major factors compromising this barrier, and how can nutrition help restore and maintain it?

Dr Pascal: The intestinal barrier is fundamental to poultry health because it acts as the interface between the external environment within the gut and the bird's internal physiology. A healthy intestinal barrier supports efficient nutrient absorption, prevents the entry of pathogens and toxins, and helps regulate immune function. However, under modern commercial production systems, several factors continuously challenge its integrity. Enteric pathogens such as *Clostridium perfringens* and *Escherichia coli* can damage intestinal epithelial cells and disrupt tight junctions, resulting in

inflammation and microbial imbalance. Poorly digestible proteins, excessive non-starch polysaccharides (NSPs), and mycotoxins further irritate the intestinal lining and increase gut permeability. Undigested nutrients also provide substrates for pathogenic bacteria, worsening dysbiosis.

Environmental pressures—including heat stress, poor litter quality, and high stocking density—trigger physiological stress responses that weaken mucosal integrity and reduce immune competence. Chronic inflammation and oxidative stress further damage epithelial cells and tight junction proteins, while the reduction in antibiotic growth promoter use has increased the need for nutritional strategies that naturally support gut resilience.

Nutrition plays a central role in maintaining intestinal integrity. Highly digestible feed ingredients and balanced amino acid formulations reduce undigested substrates in the gut, while enzymes such as xylanases and phytases improve nutrient availability and digestive efficiency. Functional feed additives provide additional support. Probiotics and prebiotics promote a balanced intestinal microbiota and stimulate the production of beneficial metabolites as Niacin or pantothenate. Protected butyrate and other short-chain fatty acids deliver anti-inflammatory effects throughout the intestinal tract while strengthening tight junctions. NSP-degrading enzymes and phytase reduce the anti-nutritional effects of fibre and phytate, improving nutrient utilization and gut function. Effective mycotoxin management is equally important. Mycotoxin binders and biotransformation technologies help protect intestinal tissues from toxin-induced damage. In addition, vitamins A, D, and E, together with trace minerals, especially organic selenium, help maintain antioxidant balance, epithelial integrity, and immune competence. Amino acids such as methionine, cysteine,

glutamine, and threonine are essential for mucin synthesis, epithelial renewal, and antioxidant defence.

Maintaining intestinal barrier integrity therefore requires a comprehensive nutritional strategy that combines high-quality raw materials with targeted functional additives. Such an integrated approach improves resilience against production challenges while supporting sustainable, high-performance poultry production.

You have emphasized the importance of precision delivery of active ingredients. How can advancements in feed technology improve the efficacy and consistency of gut health additives under commercial conditions?

Dr Pascal: The effectiveness of gut health additives depends not only on the active ingredient itself but also on its ability to reach the correct site within the gastrointestinal tract in an active form. Precision delivery has therefore become a key factor in ensuring consistent performance under commercial production conditions. Many feed additives—including probiotics, enzymes, and medium- and short-chain fatty acids—face significant challenges before they can exert their intended effects. High pelleting temperatures may reduce biological activity, prolonged storage can cause oxidation or moisture damage, and variations in gut pH, digestive enzymes, and transit time influence where and when active compounds are released. Interactions with the feed matrix may also reduce their availability, contributing to inconsistent field performance.

Recent advances in feed technology are helping overcome these limitations. Microencapsulation and protected delivery systems shield sensitive ingredients from heat, oxygen, and moisture during feed manufacture and storage. This is particularly valuable for heat-sensitive enzymes and protected butyrate products.

Innovative carrier systems based on lipid matrices, mineral supports, or polysaccharide coatings provide controlled release of active compounds throughout the digestive tract. For butyrate-based products, effective protection is especially important to ensure that adequate concentrations reach the distal intestine, where they exert their greatest biological benefits.

Improvements in enzyme engineering and thermostable formulations have also enhanced enzyme survival during pelleting. Meanwhile, advances in feed manufacturing allow more accurate dosing and uniform distribution of additives, ensuring consistent intake by every bird.

These technological developments improve bioavailability, enhance the consistency of production results, reduce the required inclusion rates of certain additives, and strengthen birds' resilience to nutritional, environmental, and pathogenic stress. As poultry production continues to move towards reduced antibiotic use and greater production efficiency, precision delivery technologies will play an increasingly important role. By ensuring that active ingredients are protected and released at their intended site of action, modern feed technologies help unlock the full potential of nutritional interventions while supporting sustainable poultry production.

With an increasing number of feed additives entering the market, what criteria

should nutritionists consider when evaluating the effectiveness of different delivery technologies?

Dr. Tim: The first step is to clearly define the objective of supplementation.

Nutritionists and veterinarians should identify the specific challenge they are trying to address, establish measurable performance targets, and determine how success will be evaluated. Without a clear understanding of the production constraints and desired outcomes, selecting the right feed additive becomes largely a matter of trial and error.

Once these objectives are established, it is important to engage with additive suppliers and review the scientific evidence supporting their products. Delivery technology should be evaluated not only on the basis of the active ingredient but also on its ability to protect the compound during feed processing, maintain stability during storage, and deliver it effectively to the intended site within the gastrointestinal tract. Well-designed delivery systems should demonstrate consistent performance under commercial conditions, be supported by robust scientific data, and provide measurable improvements in bird health, feed efficiency, and overall profitability. Ultimately, the most effective solution is one that aligns with the production goals of the farm while delivering a clear return on investment.

Your research suggests that butyrate formulations capable of increasing caecal butyrate concentrations offer superior protection against Salmonella Enteritidis colonization. Why is the caecum such a critical target, and how can nutritionists ensure effective site-specific delivery of butyrate?

Dr. Tim: Salmonella Enteritidis primarily colonizes the hindgut of monogastric animals, particularly the caecum. Increasing butyrate concentrations in this region creates an environment that is less favourable for Salmonella survival and colonization. Research has shown that butyrate can downregulate bacterial genes involved in colonization and virulence, thereby reducing the pathogen's ability to establish itself within the intestine.

However, these benefits depend on delivering sufficient concentrations of butyrate to the site where the bacteria reside. Conventional butyrate sources are often absorbed in the upper digestive tract before reaching the hindgut, limiting their effectiveness. To achieve site-specific activity, nutritionists should select well-protected butyrate formulations that resist early absorption and release the active compound in the distal intestine and caecum. In addition to direct delivery, certain nutritional strategies can stimulate beneficial caecal microbiota to produce endogenous butyrate, further enhancing

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gut health and supporting natural resistance against pathogenic bacteria.

Mycotoxins are often referred to as 'hidden disruptors' of gut health because their effects are not always immediately visible. How do mycotoxins impair intestinal integrity and immune function, and what constitutes an ideal gut health management programme to mitigate these challenges?

Dr. Damien: Mycotoxins are often described as hidden disruptors because they can compromise gut health even at concentrations below current regulatory limits. Although clinical signs may not always be evident, these toxins can significantly impair intestinal function, immune competence, and overall productivity. Several mycotoxins, including deoxynivalenol (DON), aflatoxins, and ochratoxin A, damage the intestinal barrier by disrupting tight junction proteins such as claudins and occludins. This increases intestinal permeability, commonly referred to as "leaky gut," while promoting oxidative stress and enterocyte apoptosis. At the same time, mycotoxins interfere with both innate and adaptive immune responses by altering cytokine production, suppressing immunoglobulin synthesis, and disrupting gut-associated lymphoid tissue (GALT). Collectively, these effects increase susceptibility to inflammation, secondary infections, and reduced production performance. An effective gut health

management programme should therefore adopt a preventive, integrated approach. This begins with predictive risk assessment to anticipate mycotoxin contamination, followed by rigorous quality control of raw materials using reliable analytical methods. Depending on the type and concentration of mycotoxins present, scientifically validated mycotoxin deactivators should be incorporated into the feeding programme. Equally important is nutritional support aimed at strengthening intestinal barrier function and promoting a balanced gut microbiota. Functional feed ingredients that support epithelial integrity, microbial stability, and immune resilience help counteract both the direct and indirect effects of mycotoxin exposure.

Many feed additives are marketed as alternatives to antibiotic growth promoters (AGPs), yet their efficacy varies considerably. How can a better understanding of their mechanisms of action help producers make more informed and targeted decisions?

Dr. Damien: A clear understanding of how feed additives work enables producers to move beyond a trial-and-error approach and adopt solutions tailored to the specific challenges within their production systems. Different additives act through distinct biological mechanisms. Some primarily modulate the gut microbiota, others strengthen intestinal barrier function, improve

nutrient digestibility, reduce oxidative stress, or influence immune responses. Understanding these mechanisms allows nutritionists to select products that address the underlying causes of performance losses rather than simply treating their symptoms. Mechanistic knowledge also helps predict how additives will perform across different diets, environmental conditions, and disease challenges. This improves consistency, reduces unnecessary supplementation, and increases confidence in product selection. As the poultry industry continues to reduce antibiotic use, evidence-based nutritional strategies have become increasingly important. Selecting feed additives based on their scientifically proven mode of action enables producers to optimize bird health, improve production efficiency, and enhance sustainability while maintaining profitability.

Closing note:

The insights shared by Dr. Rajib Upadhyaya, Dr. Pascal Thiery, Dr. Tim Goossens, and Dr. Damien Prévéraud reflect the key discussions at the Adisseo Gut Health Academy held in Kolkata. The programme provided a collaborative platform for poultry professionals to explore the latest scientific advances in gut health, precision nutrition, feed integrity, and sustainable production practices, bridging laboratory research with practical field applications.

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The Architecture of India's Digital Feed Mill

Part 1: The Smart Storage Hub Bridging Advanced Automation and Autonomous AI in Feed Manufacturing

By V. Sivakumar, Founder, Feed Tech Engineering, Coimbatore



V. Sivakumar

Introduction

The Indian animal feed industry operates under one of the world's most demanding combinations of climate volatility, raw-material variability, and supply-chain pressure.

Unlike highly standardized Western milling systems, an Indian feed mill cannot assume that grain entering the plant will be uniform. On any given day, intake hoppers may receive dense, low-moisture winter maize from Bihar alongside unstable, high-moisture monsoon grain from Madhya Pradesh or Karnataka, with each lot differing in kernel size, density, and moisture profile.

Once this heterogeneous material stream enters bulk silos, a second challenge emerges: tropical thermodynamics. Intense daytime solar loading followed by sharp night-time cooling drives moisture migration inside the stored grain mass. These internal convection loops trap water vapour beneath the silo roof, creating microclimates that accelerate crust formation, mold growth, and mycotoxin risk.

"Protecting grain biology is no longer enough. A modern feed mill must also protect traceability, inventory accuracy, and profit."

For more than two decades, the industry's

standard response has been mechanization through programmable logic controllers (PLCs) and SCADA dashboards. However, conventional automation remains largely reactive. It depends on static, rule-based thresholds that raise alarms only after a critical hot spot has already compromised grain condition. It also fails to identify hidden financial losses developing within the bin, because it cannot distinguish natural thermodynamic moisture shrinkage during aeration from physical process loss caused by conveyors, friction, and dust aspiration.

The implication is clear: a modern feed mill must move beyond basic digital control toward autonomous intelligence built on a fundamentally different factory data architecture.

1. Structural Material Science: Defeating the Tropical Convection Loop

Before deploying advanced software algorithms, the physical repository must be engineered to withstand severe tropical stress. In Indian coastal and high-humidity interior zones, standard Z275 galvanized steel sheets degrade rapidly at bolted seams and joints where condensation pathways develop. Long-term structural integrity requires Z600 galvanization or, preferably, ZM310 (Magnelis) coatings, a zinc-aluminum-magnesium alloy which provide superior corrosion resistance.

The structural engineering must actively combat moisture migration. Solar heating and night-time cooling create convection currents inside the silo. Moist air rises, condenses beneath the roof, and falls back onto the grain surface, creating moisture pockets that encourage mould-prone crust.

Defeating this loop requires a high-performance ventilation layout. The system must move away from passive gravity vents to motorized roof exhausters linked to ambient humidity sensors, combined with heavy-duty aeration fans. Air must be distributed uniformly through a fully perforated flush steel floor, preventing dead zones caused by the fine dust and dockage variations typical of multi-state grain shipments.

2. Operational Asset vs. Long-Term Vault

A critical engineering mistake in plant layouts is treating all silos as functionally identical. An intelligent mill explicitly separates the design parameters between two distinct assets:

Continuous Flow Silos: The Processing Engine

These silos act as buffer bins between grain intake and the grinding line. Grain retention time is typically only 12 to 72 hours. Because these bins are filled and emptied multiple times a week, the dominant risk is mechanical abrasive wear on the walls. The digital twin focus here is high-speed volumetric level tracking and gate positioning to keep the

downstream hammer mill line balanced.

Seasonal Storage Silos: The Long-Term Vault

These silos hold grain for 3 to 9 months to hedge against seasonal price shifts. Because the grain mass remains largely static, thermodynamic convection loops become the dominant risk. The digital twin focus shifts entirely to thermodynamic trend profiling and micro-climate control.

"A system designed to protect fast-moving operational assets cannot use the same data cadence or control priorities as one designed to safeguard long-duration inventory value."

3. The Architecture of the Decoupled Digital Twin

Dumping operations, maintenance data, and accounting records onto a single SCADA screen causes data fatigue and system latency. True Industry 4.0 demands a decoupled cyber-physical system where tasks are split across two specialized, communicating virtual platforms connected via secure API layers.

Twin A: The Physical Execution Twin

This twin operates in milliseconds and interfaces directly with high-density multi-node digital thermocouple cables, headspace carbon dioxide sensors, and 3D acoustic surface scanners.

Its intelligence includes continuous calculation of Equilibrium Moisture Content (EMC), automatic lockout of aeration fans when outdoor relative humidity is too high, and early detection of organic respiration through headspace CO₂ spikes before thermal cables register a measurable temperature increase.

Twin B: The Analytical Twin

This twin operates on an hourly or daily cadence and links the physical silo to the mill's ERP and weighbridge records. It tracks the grain's commercial profile from origin to processing, creating a data-driven birth certificate for every batch.



"True Industry 4.0 demands a decoupled cyber-physical system."

This separation is more than a software design choice. It is the foundation for financial clarity. Once the Physical Execution Twin controls the storage environment and the Analytical Twin records mass movement, the mill can begin distinguishing biological stability from commercial loss with precision.

4. The Math of Profit Protection: Moisture Shrinkage vs. Process Loss

To bridge the gap between factory physics and financial accounting, the Analytical Twin tracks and quantifies mass changes across two categories.

Thermodynamic Moisture Shrinkage

When high-moisture grain is aerated down to a stable storage baseline, weight is lost purely through water vapour evaporation. The Analytical Twin tracks this using a water-mass balance relationship between incoming moisture content and final verified moisture content.

For example, if a mill receives 2,000 tonnes of maize at 16% moisture and aerates it down to 13%, the true weight loss is 3.45%. Simply subtracting moisture percentages (16% – 13% = 3%) creates a 0.45% accounting blind spot, hiding 9 tonnes of missing grain that would otherwise disrupt inventory reconciliation.

Mechanical Process Loss

Unlike moisture evaporation, process loss represents the physical disappearance of dry matter during handling. This occurs through dust extraction systems at the dump hopper, friction damage in high-speed bucket elevators, and terminal residuals. The system therefore compares actual discharge against moisture-adjusted expected stock to isolate true mechanical loss.

24-Hour Continuous Verification

To achieve high accuracy, the Digital Twin uses 24-hour continuous inline Near-Infrared (NIR) moisture sensors mounted at both the intake drag conveyor and the reclaiming discharge chute. By continuously sampling the moisture profile of the moving material stream, the system isolates exactly how much weight loss was natural water evaporation versus physical mechanical leakage.

“In a 500-ton-per-day feed mill, an untracked 0.5% variance can leak more than 75 tonnes of raw-material value annually.”

5. Quantifying the Three Phases of Emptying

A final inventory blind spot occurs during the silo discharge sequence. The Analytical Twin monitors and quantifies this process across three distinct physical phases:

Gravity Flow

This phase accounts for approximately 80% to 85% of total

mass through central funnel flow. It is monitored via linear proximity sensors on the rack-and-pinion gates and quantified using inline solids impact flow meters that integrate deflection force over time.

Sweep Auger Operation

This phase clears the leftover peripheral grain cone, typically 10% to 14% of total mass. Because inline weight sensors cannot be placed inside a rotating arm, the system uses a motor amperage integration proxy.

Manual Seepage

This final floor cleanup accounts for less than 1% of total mass. The digital twin tracks this using top-mounted 3D acoustic surface differential mapping or by routing the cleanout batch to an isolated scale downstream to close the mass balance loop completely.

By quantifying each discharge phase separately, the Digital Twin converts what was once treated as residual handling noise into traceable operational data. That closes the analytical chain from grain intake to final cleanout and sets up a dashboard that leadership can use for both daily control and strategic decision-making.

Why the Smart Storage Hub Matters

The Smart Storage Hub is more than a storage concept. It is a practical framework for protecting grain quality, improving inventory accuracy, and reducing hidden losses in Indian feed mills. By separating the physical execution layer from the analytical business layer, the mill can monitor temperature, moisture, gas activity, and mass movement in real time while also reconciling commercial stock with greater precision.

- Detect hot spots before crusting begins
- Distinguish moisture shrinkage from process loss
- Improve traceability from intake to discharge
- Support better procurement decisions with origin-based performance data

Conclusion

A decoupled digital twin converts storage data into actionable intelligence, enabling better grain preservation, inventory control, and commercial decision-making.

“By decoupling physical silo operations from inventory logistics analytics, a cyber-physical Digital Twin transforms storage from a historical black box into a precise, transparent, and self-optimizing profit center.”

About the author

V. Sivakumar is the founder of Feed Tech Engineering, Coimbatore, and a freelance silo, feed milling & automation consultant and writes on feed mill systems, grain storage engineering, and digital process intelligence in the Indian feed industry.

PAU Launches Hybrid Maize PMH 17 to Promote Crop Diversification and Save Groundwater

Punjab Agricultural University (PAU) has introduced a new dual-purpose hybrid maize variety, PMH 17, aimed at promoting crop diversification and reducing groundwater consumption in the state. The initiative supports government efforts to encourage farmers to shift from water-intensive paddy cultivation to more sustainable alternatives during the kharif season. PMH 17 has been developed as a high-yielding, dual-purpose hybrid suitable for both grain production and silage use, addressing rising demand from Punjab's rapidly expanding dairy sector. The variety matures in around 96 days and can yield approximately 25 quintals per acre under recommended agronomic practices. It is adaptable to diverse soil conditions and has been recommended for cultivation across Punjab. Agriculture experts highlight that while Punjab officially recommends maize on about 2.5 lakh acres during kharif, a much larger area of 6–7 lakh acres is currently under summer maize cultivation, largely driven by silage demand. However, this off-season cultivation places additional pressure on already stressed groundwater reserves. PAU scientists estimate that



paddy requires around 125–140 cm of water per season, whereas maize needs only 30–40 cm, making PMH 17 a significantly more water-efficient alternative. The university expects the new hybrid to encourage a shift toward kharif maize cultivation, where rainfall can supplement irrigation needs and reduce groundwater extraction. The hybrid is characterised by tall, vigorous plants, broad leaves and long cobs with high starch content of over 65%, enhancing its value for both feed and industrial applications, including ethanol production. Its strong

biomass output also makes it particularly suitable for high-quality silage production. Farmers are advised to adopt recommended agronomic practices, including timely sowing by June 20 and bed planting using pneumatic planters to improve drainage and reduce risks of lodging and waterlogging during heavy monsoon periods. By combining improved productivity with lower water requirements, PMH 17 is positioned as a strategic intervention to support sustainable agriculture, strengthen the dairy feed ecosystem and advance crop diversification in Punjab.

Guarding the Flock: Evidence-Based Strategies for Mycotoxin Control in Poultry Production

By **Dr B. Rajender**, Techno Commercial Manager, Nanovet Nutrition



Dr B. Rajender

The Invisible Threat in Poultry Feed

Modern poultry production has witnessed remarkable advancements in genetics, nutrition, housing, and health management, enabling producers to achieve unprecedented levels of productivity and efficiency. However, despite these gains, one persistent and often overlooked challenge continues to compromise flock performance and profitability worldwide—mycotoxins.

Unlike infectious diseases that spread visibly through a flock, mycotoxins enter the production system silently through contaminated feed ingredients. Once ingested, they can impair growth, compromise immunity, damage gut integrity, reduce reproductive performance, and increase susceptibility to disease. Their effects are often subtle and non-specific, making them difficult to diagnose until significant economic losses have already occurred.

The challenge is further compounded by the fact that feed ingredients are rarely contaminated with a single toxin. Global surveillance studies consistently reveal

the co-occurrence of multiple mycotoxins in feedstuffs, resulting in additive or synergistic interactions that can amplify their detrimental effects on poultry health and performance.

What Are Mycotoxins?

Mycotoxins are toxic compounds naturally produced by certain molds, primarily *Aspergillus*, *Fusarium*, and *Penicillium* species. These fungi can infect crops before harvest or develop during storage, especially when environmental conditions favor mold growth. Warm temperatures, high humidity, and poor storage management create ideal conditions for mycotoxin formation.

Several factors increase the risk of contamination, including excessive grain moisture, elevated temperatures, inadequate ventilation, mechanical damage to grains, and prolonged storage under suboptimal conditions. Since poultry consume feed continuously throughout their production cycle, even relatively low concentrations of mycotoxins can accumulate over time and adversely

affect health, productivity, and profitability.

Major Mycotoxins of Concern in Poultry Production

Aflatoxins: The Silent Liver Damagers

Produced mainly by *Aspergillus* species, aflatoxins are among the most prevalent and economically damaging mycotoxins affecting poultry worldwide. The liver is their primary target, making them particularly detrimental to growth, metabolism, and immune function.

Birds exposed to aflatoxins often exhibit reduced feed intake, poor weight gain, inferior feed conversion, liver enlargement, fatty liver degeneration, weakened immune responses, reduced vaccine efficacy, and lower egg production and hatchability. By compromising immunity, aflatoxins also increase susceptibility to coccidiosis and secondary bacterial infections.

Trichothecenes (DON and T-2 Toxin): Disrupting Feed Intake and Gut Health

Trichothecenes, particularly deoxynivalenol (DON) and T-2 toxin, primarily affect the gastrointestinal tract and protein synthesis. Birds exposed to these toxins frequently show reduced feed consumption, oral lesions, impaired nutrient absorption, slower growth, feathering abnormalities, and diminished reproductive performance.

Among this group, T-2 toxin is especially concerning due to its strong immunosuppressive effects, which can significantly impair flock resilience and disease resistance.

Ochratoxin: A Threat to Kidney Function

Ochratoxin predominantly targets the kidneys and disrupts protein metabolism. Clinical manifestations may include poor growth, dehydration, enlarged kidneys, increased uric acid accumulation, gout-like lesions, and reduced flock uniformity. Young birds are particularly vulnerable, often experiencing more severe production losses following exposure.

Fumonisin and Zearalenone

Fumonisin interferes with lipid metabolism and cellular function, resulting in liver damage, impaired intestinal integrity, reduced growth performance, and, under severe exposure, increased mortality.

Zearalenone, although generally less toxic to poultry than to other livestock species, possesses estrogenic activity that can negatively influence reproductive performance, fertility, hatchability, and egg production, particularly in breeder flocks.

The Challenge of Multiple Mycotoxin Exposure

In commercial poultry production, contamination by a single mycotoxin is the exception rather than the rule. Feed ingredients frequently contain multiple mycotoxins simultaneously, creating complex interactions that may amplify their harmful effects.

For example, the combination of aflatoxin and ochratoxin can intensify liver and kidney damage, while aflatoxin and T-2 toxin together can cause profound immunosuppression. Similarly, DON and fumonisins may act synergistically to compromise intestinal integrity and nutrient absorption. As a result, feed that appears compliant when individual toxins are assessed may still adversely affect bird performance due to the cumulative impact of multiple contaminants.

How Mycotoxins Affect Poultry Health

Liver Health and Metabolism

The liver serves as the body's primary detoxification organ and is highly susceptible to mycotoxin damage. Exposure can lead to fatty liver changes, impaired nutrient metabolism, reduced detoxification capacity, and increased vulnerability to disease challenges.

Gut Integrity and Nutrient Utilization

The gastrointestinal tract is the first line of contact for

Table 1: Comparative Mycotoxin Prevalence in Indian Feed Ingredients (Jan–Mar 2026)

Raw Material / Feed Type	AFLA (%)	A-Trichothecenes (%)	B-Trichothecenes (%)	FUM (%)	OTA (%)	ZEN (%)	Highest Risk Toxin
Corn DDGS	97	25	0	34	78	53	Aflatoxins
Corn Gluten Feed/M meal	100	38	0	100	97	38	Aflatoxins & Fumonisin
Corn Kernels/M meal	37	14	6	73	33	10	Fumonisin
DDGS (Non-Corn)	100	27	27	60	93	67	Aflatoxins
Compound Ruminant Feed	100	8	0	12	12	8	Aflatoxins
Poultry Feed	87	35	0	79	90	39	Ochratoxin
Rapeseed/Canola Meal	92	71	0	4	50	8	Aflatoxins
Rice Bran	86	33	0	67	74	85	Aflatoxins & ZEN
Soybean Meal	29	50	0	9	95	56	Ochratoxin

ingested mycotoxins. Damage to intestinal villi, increased gut permeability, altered microbial balance, and reduced digestive efficiency can significantly impair nutrient utilization and feed conversion efficiency.

Immune Competence

Many mycotoxins compromise both cellular and humoral immunity, reducing vaccine responsiveness and increasing susceptibility to infectious diseases. Consequently, affected flocks often experience higher treatment costs, greater production variability, and diminished overall performance.

Reproductive Performance

Chronic exposure to mycotoxins can negatively influence fertility, hatchability, embryonic development, and egg production, making breeders and layers particularly vulnerable to economic losses.

Detecting the Hidden Enemy

Diagnosing mycotoxicosis remains challenging because its clinical signs often resemble those of nutritional deficiencies, management problems, or infectious diseases. Accurate diagnosis therefore requires laboratory confirmation.

Common diagnostic tools include ELISA for rapid screening, HPLC and GC-MS for precise toxin quantification, and LC-MS/MS for comprehensive multi-mycotoxin analysis. Equally important is proper feed sampling, as mycotoxins are typically distributed unevenly throughout feed batches, making representative sampling essential for reliable results.

Prevention: The First Line of Defense

The most effective strategy against mycotoxins is prevention. Control measures should begin at the farm level and continue throughout storage and feed manufacturing. Good agricultural practices such as crop rotation, cultivation of resistant varieties, and timely harvesting can reduce field contamination. During storage, maintaining low grain moisture, ensuring adequate ventilation, regularly monitoring grain condition, and keeping facilities clean are critical to minimizing fungal growth.

It is important to note that while mold inhibitors can suppress fungal proliferation, they cannot neutralize toxins that have already been produced.

Nutritional Support During Exposure

When complete avoidance of mycotoxins is not possible, targeted nutritional interventions can help mitigate their adverse effects. Antioxidants and liver-support nutrients such as Vitamins A, C, and E, selenium, methionine, 25-hydroxy Vitamin D₃, curcumin, and silymarin can strengthen

antioxidant defenses, support tissue repair, enhance immune function, and improve resilience during toxin exposure.

Modern Mycotoxin Detoxification Strategies

Adsorbents and Binders

Mycotoxin binders remain one of the most widely adopted mitigation tools in poultry nutrition. Materials such as hydrated sodium calcium aluminosilicate (HSCAS), bentonite, activated clay minerals, yeast cell wall derivatives, and glucomannans can bind specific toxins within the gastrointestinal tract, thereby reducing their absorption and systemic effects.

Biological Detoxification

Advances in biotechnology have led to the development of biological detoxification approaches that actively transform certain mycotoxins into less toxic compounds. These solutions utilize specialized enzymes, beneficial microorganisms, and biotransformation technologies to provide broader-spectrum protection, particularly against toxins that are difficult to bind effectively.

When integrated with good feed management practices, biological detoxification strategies offer a promising and sustainable approach to managing the growing challenge of multi-mycotoxin contamination in poultry production.

Conclusion

Mycotoxins remain among the most significant hidden threats to poultry production, silently eroding flock health, feed efficiency, immunity, reproductive performance, and farm profitability. Their impact is often underestimated because clinical signs are subtle, while the economic consequences accumulate gradually over time.

With the increasing prevalence of multi-mycotoxin contamination driven by changing climatic conditions, global trade, and extended storage periods, poultry producers can no longer rely solely on visual feed inspection or reactive interventions. Effective control requires a proactive and integrated strategy encompassing quality raw material sourcing, proper storage management, routine monitoring, nutritional support, and scientifically validated detoxification solutions.

Ultimately, successful mycotoxin management is not simply about preventing losses; it is about protecting bird welfare, enhancing production efficiency, and ensuring long-term sustainability. In an increasingly competitive poultry industry, investing in evidence-based mycotoxin control is an investment in flock resilience, profitability, and future growth.

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Smart Farming, Sustainable Future

How AI-Powered Precision Technologies Are Reshaping Animal Agriculture

By **Dr. Sandeep Dwivedi**, Consultant – Precision Services, dsm-firmenich Animal Nutrition & Health



Dr. Sandeep Dwivedi

The livestock industry is entering a new era where decisions are increasingly guided by data rather than intuition. As global demand for animal protein continues to grow, producers face the dual challenge of improving productivity while reducing environmental impact and maintaining high standards of animal health and welfare. Meeting these expectations requires more than incremental improvements in

farm management. It demands precision agriculture powered by artificial intelligence (AI), biomarker science, cloud computing, and predictive analytics. Together, these technologies are transforming livestock production from a reactive system, where interventions occur after problems arise, to a proactive model that predicts risks, optimizes performance, and supports sustainable production.



From Observation to Prediction

Modern livestock farms generate enormous volumes of information, from feed intake and growth performance to environmental conditions and health records. Today, AI-powered platforms can integrate these data with blood biomarkers and physiological indicators to provide a comprehensive picture of animal health. Rather than waiting for visible clinical signs, producers can identify subtle

biological changes associated with inflammation, nutritional imbalances, metabolic disorders, or disease long before production losses become evident. Imagine identifying, early detection, which flocks are at risk of developing coccidiosis or detecting deficiencies in essential minerals, amino acids, or proteins even when feed formulations appear nutritionally balanced. Such early insights allow producers to intervene before health challenges escalate, reducing mortality, improving productivity, and minimizing economic losses. This shift from reactive treatment to predictive management represents one of the most significant advances in modern livestock production.

Turning Biology into Better Decisions

Precision livestock technologies do more than collect data, they convert biological information into actionable intelligence. Blood biomarkers provide valuable insights into immune function, metabolic health, nutrient utilization, inflammation, and physiological stress. Portable diagnostic devices, cloud-based platforms, and AI algorithms analyse these biomarkers against extensive reference databases, delivering practical recommendations within hours. These insights help producers make informed decisions about nutrition, health management, housing

conditions, and environmental control, enabling faster, evidence-based responses that improve productivity and reduce uncertainty.

Precision Nutrition: Maximizing Feed Efficiency

Feed remains the largest operating cost in animal production, making nutritional efficiency critical for both profitability and sustainability. Advances in biological analytics now enable nutritionists to evaluate how animals respond metabolically to different feeding programmes rather than relying solely on feed formulation. This allows diets to be fine-tuned according to the animals' actual nutritional requirements. The result is:

- Improved feed conversion efficiency
- Enhanced nutrient utilization
- Better growth performance
- Reduced feed waste
- Lower production costs

Precision nutrition also ensures that feed additives are used more strategically, maximizing their biological benefits while improving economic returns.

AI as a Decision-Support Tool

Artificial intelligence is rapidly becoming an indispensable component of livestock management. Machine-learning algorithms continuously analyse production data, identify hidden trends, predict disease risks, and generate recommendations that support informed decision-

making. Instead of replacing human expertise, AI strengthens it by helping producers detect problems earlier and evaluate management options with greater confidence.

AI-supported systems can assist producers in:

- Predicting disease outbreaks
- Optimizing feeding strategies
- Improving production efficiency
- Reducing operational risks
- Supporting evidence-based farm management

As these systems continue to learn from expanding datasets, their predictive accuracy and practical value will continue to improve.

Better Health, Better Welfare, Better Sustainability

Healthy animals are naturally more productive and more efficient users of feed and other resources. Precision technologies strengthen this relationship by enabling continuous monitoring of physiological stress, metabolic status, and environmental conditions. Real-time insights allow farmers to adjust ventilation, nutrition, housing, water availability, and management practices before animal welfare is compromised. Earlier intervention improves resilience, enhances productivity, and supports responsible livestock management.

The sustainability benefits are equally significant. Animals maintained in optimal health convert feed more efficiently, reducing

resource consumption and greenhouse gas emissions per unit of production. Improved nutrient utilization also decreases nitrogen and phosphorus excretion while reducing ammonia emissions.

In this way, sustainability becomes an outcome of better biological management rather than a separate production objective.

The Future of Precision Livestock Farming

The next generation of livestock production will combine biological monitoring with environmental sensors, imaging technologies, automation, robotics, and AI-driven decision-support systems.

These integrated platforms will provide producers with a real-time understanding of animal health, nutrition, welfare, environmental conditions, and production

performance. As digital technologies become more affordable and accessible, precision farming will no longer be limited to large commercial operations but will increasingly benefit producers of all sizes. Significant investment across the global livestock industry is accelerating the development of these technologies, enabling farms to anticipate challenges, optimize resources, and make confident management decisions based on scientific evidence rather than assumptions. The future of livestock production belongs to producers who can transform data into timely action. By combining biological science with artificial intelligence and precision technologies, the industry is building farming systems that are more productive, resilient, and environmentally sustainable than ever before. Know more, Sooner.



Dr. Sandeep Dwivedi, Dr. Mongkol Kaewsutas, Dr. Nattawadee Jantasila, and their team demonstrate blood biomarker workflow analysis, where advanced diagnostic technologies convert biological samples into real-time data for AI-driven decision support and precision livestock management.



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From Survival to Scale: Strategic Takeaways for India's Poultry Industry

The 3rd National Symposium of Vets in Poultry (VIP), held under the theme Future Ready Poultry: Managing Risks, Maximizing Resilience, brought together industry leaders, veterinarians, researchers, policymakers, and entrepreneurs to discuss the future of India's poultry sector. Through keynote addresses, technical sessions, and panel discussions, participants identified the key opportunities, risks, and strategic priorities needed to build a resilient, sustainable, and globally competitive poultry industry. The following sections summarize the symposium's key takeaways.

Poultry Industry Outlook



KG Anand
VH Group

1. Strong Industry Fundamentals Support Long-Term Growth

The Indian poultry industry remains one of the fastest-growing segments of

agriculture, backed by decades of consistent growth, strong demand fundamentals, and increasing consumer acceptance of poultry products. Despite periodic market disruptions, the industry's long-term growth outlook remains positive.

2. Managing Uncertainty is Critical

Production cycles, climate variability, feed prices and changing consumer demand have made traditional market cycles increasingly unpredictable. Future competitiveness will depend on proactive risk management, better forecasting and agile business planning.

3. Feed Security will Shape Future Competitiveness

Feed availability and affordability emerged as the most significant strategic challenge. With feed accounting for nearly 70% of production costs, fluctuations in corn and soybean markets, climate-related crop risks, and increasing competition from alternative uses such as ethanol production could significantly influence industry profitability in the coming years.

4. Growth is Shifting Towards Consumption-Centric Regions

Future expansion is expected to be driven by emerging consumption centers, particularly in states such as Uttar Pradesh, West Bengal, Odisha, and Bihar, where

rising incomes and urbanisation are expanding poultry demand.

5. Disease Management and Biosecurity Require Greater Attention

Disease risks, particularly highly pathogenic avian influenza (HPAI), continue to pose a serious threat. Strengthening biosecurity measures, improving surveillance systems, and developing long-term disease-control strategies were identified as critical priorities for sustainable industry growth.

6. Processing, Technology and Value Addition Will Shape the Future

The industry is gradually transitioning from traditional wet markets toward processed poultry products. Investments in processing, cold-chain infrastructure, organised retail, automation, artificial intelligence and precision farming will improve productivity, reduce costs and create higher-value market opportunities.

7. Consumer Awareness and Food Safety are Growing Priorities

The growing threat of diseases such as Highly Pathogenic Avian Influenza (HPAI), coupled with increasing consumer expectations around food safety and responsible antibiotic use, requires stronger biosecurity, surveillance, traceability and quality assurance systems.

8. Collaboration will be Essential

Now more than ever, stronger coordination among producers, integrators, veterinarians, industry associations, and policymakers is essential. Collective action will be necessary to address common challenges, mitigate risks, and ensure the industry's continued growth and resilience.

Broiler Integration: Operational Excellence, Risk Management, and Sustainable Profitability

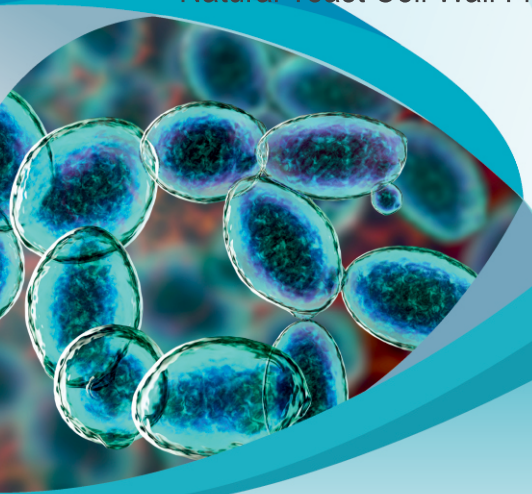
1. Poultry Industry: A Key Driver of Economic Growth

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Dr Ajay Deshpande
Siddhivinayak Poultry Breeding
Farm & Hatcheries

contributes significantly to agriculture through demand for feed ingredients and allied industries.

2. Operational Excellence and Loss Prevention Drive Profitability

Sustainable profitability depends on efficient processes, continuous improvement, and disciplined execution. In this context, loss prevention is even more critical than profit generation, as recovery from setbacks becomes increasingly difficult. Early problem detection and timely corrective actions are essential to maintain financial stability and protect long-term performance.

3. Breeder Health is the Foundation of Broiler Performance

Healthy breeder flocks form the foundation of successful broiler production. Strong nutrition, effective vaccination, disease prevention and continuous health monitoring improve chick quality and minimise downstream production risks.

4. Data, Traceability, and Precision Nutrition Drive

Performance

Real-time data, end-to-end traceability, and precision nutrition enable producers to identify performance gaps quickly, optimize feed strategies, improve feed efficiency, and make informed management decisions that enhance productivity and profitability.

5. Good Farm Management Creates Competitive Advantage

Good farm management practices—including optimal stocking density, adequate feeder and drinker space, and effective grower incentive programmes—improve bird welfare and production efficiency. Delivering consistent bird quality, higher dressing yields, and reliable supply also strengthens customer confidence.

6. Biosecurity and Risk Management Must Continuously Evolve

Region-specific vaccination programmes, robust biosecurity, disease surveillance and proactive management of operational, financial and supply-chain risks are essential for long-term resilience.

7. People and Financial Discipline Drive Business Success

Investment in skilled people, leadership development, standard operating procedures, internal controls, regular audits and prudent financial management strengthens organisational

performance and safeguards profitability.

8. Consistent Execution Delivers Long-Term Success

Successful broiler integration depends on consistent execution across every stage of the value chain. Organisations that combine operational excellence, disciplined management and continuous learning will remain competitive in an increasingly dynamic industry.

The Evolving Landscape of Poultry Diseases in India



Dr. V. Gowthaman
Associate Professor & Head of
Veterinary Pathology at the Veterinary
College & Research Institute, Udumalpet

1. Disease Dynamics are Becoming More Complex

Increasing farm density and intensified production have heightened disease pressure, leading to the emergence of new pathogens, greater endemicity of existing diseases and more complex disease syndromes.

Continuous surveillance and adaptive health management are essential for sustainable poultry production.

2. Disease Control Must Be Region-Specific

The continued prevalence of Highly Pathogenic Avian

Influenza (HPAI), Newcastle Disease (ND), Infectious Bronchitis (IB) and Low Pathogenic Avian Influenza (H9N2) demands region-specific vaccination programmes supported by continuous surveillance and regular updates based on circulating viral strains.

3. Vaccination Strategies Must Evolve with Emerging Pathogens

Conventional vaccination alone is no longer sufficient to control rapidly mutating viruses. Genotype-matched, recombinant, and next-generation vaccine technologies, including mRNA platforms, offer greater potential for improving protection while reducing virus shedding and mutation.

4. Infectious Bronchitis Remains an Underestimated Economic Threat

Often causing chronic production losses rather than dramatic outbreaks, Infectious Bronchitis can significantly affect mortality, egg quality, and flock performance. Effective control is also important for reducing the impact of other respiratory diseases, including avian influenza.

5. Antimicrobial Resistance Requires Responsible Disease Management

The increasing prevalence of multidrug-resistant bacterial pathogens, including *E. coli*, *Coryza*, *Mycoplasma*, *Salmonella*, and *Campylobacter*, underscores

the urgent need to reduce antibiotic dependence through improved breeder health, biosecurity, vaccination, and alternative health management strategies.

6. Breeder Health Determines Broiler Performance

Maintaining disease-free breeder flocks through rigorous monitoring, vaccination, and health management remains one of the most effective strategies for improving chick quality, reducing disease transmission, and enhancing overall production efficiency.

7. Alternatives to Antibiotics Will Shape the Future of Poultry Health

Scientifically validated alternatives such as probiotics, prebiotics, organic acids, bacteriophages and other gut-health interventions will play an increasingly important role in maintaining flock health while supporting antimicrobial stewardship.

8. Integrated Health Management is the Way Forward

Sustainable poultry production requires an integrated approach combining advanced vaccination, robust biosecurity, continuous disease surveillance, responsible antimicrobial use and evidence-based management practices to improve bird health, productivity and food safety.

Human Capital and Digital Transformation



1. Human Capital Will Shape the Future of Poultry

Demographic changes, including declining birth rates and an ageing population, are expected to reduce the availability of skilled manpower. Building a future-ready workforce should therefore become a strategic priority for the poultry industry.

2. Labour Shortages Demand New Workforce Strategies

Urban migration and rising wages are creating increasing labour shortages in rural poultry operations. Agriculture wages have already grown by approximately 9-10% annually over the last decade. India is further moving toward "living wages" and a "national floor wage," which will further increase labor costs by 25-30%. Improving productivity through better workforce planning, mechanisation and automation will be essential to manage rising labour costs.

3. Industry-Academia

Collaboration Must Bridge the Skills Gap

Closer collaboration between educational institutions and industry is needed to develop commercially relevant curricula, strengthen internships and practical training, and equip graduates with both technical and business management skills.

4. Digital Technologies Must Deliver Actionable Intelligence

Artificial intelligence, automation, digital monitoring, ERP systems and predictive analytics are transforming poultry management. The competitive advantage will come not from collecting data, but from converting it into timely business insights that improve productivity and decision-making.

5. Investing in People and Technology Will Drive Long-Term Success

The future of the poultry industry will depend on balancing technological advancement with continuous investment in human capital. Organizations that successfully integrate skilled talent, digital innovation, and collaborative learning will be better positioned to achieve sustainable growth and operational excellence.

Consumer Perception, Branding and Market Expansion

1. The Poultry Industry Must Evolve from Commodity to Consumer

Brand

The industry is moving beyond a traditional focus on production costs and feed conversion ratio (FCR) toward creating differentiated consumer brands. Building brand identity and delivering value-added products will be essential for improving profitability and expanding market reach.



Sameer Aggarwal
Shalimar Group

2. Consumer Trust Will Drive Future Growth

Addressing consumer concerns around food safety, antibiotic use, and product quality requires transparent communication, attractive packaging, and credible certifications such as FSSAI, GMP, and ISO. Strong branding can enhance consumer confidence and support premium pricing.

3. Modern Retail and E-Commerce are Transforming the Market

The rapid expansion of supermarkets, exclusive retail outlets, and quick-commerce platforms is transforming how poultry products reach consumers. Social media and digital engagement have made consumers active brand advocates, increasing the importance of effective

communication and customer experience.

4. The 'Protein Revolution' Creates New Growth Opportunities

Increasing awareness of health and nutrition is driving demand for high-quality protein. Promoting the nutritional benefits of chicken and eggs through effective branding, packaging and consumer education can significantly expand consumption.

5. Urbanisation and Value Addition Will Fuel Future Growth

Rising urbanisation and changing lifestyles are increasing demand for convenient, processed and branded poultry products. Investments in processing, packaging and product innovation will help companies move beyond price-based competition while unlocking India's considerable growth potential.

Key takeaways from Panel Discussion:

Future Ready Poultry – Survival to Scale, moderated by Prof. (Dr.) P.K. Shukla, President of the Indian Poultry Science Association, Chairman of FSSAI Scientific Panel-13, and former Joint Commissioner (Poultry), GOI

1. Biosecurity and Data-Driven Management Must Become Industry Priorities

Sustainable poultry production requires stronger biosecurity, effective waste management, accurate production data, and state-wise demand-supply planning. Better coordination

can help minimize disease risks while avoiding market imbalances caused by overproduction or panic-driven decisions.

2. Data and Technology Adoption will Drive the Next Phase of Growth

Modern poultry farming must embrace automation, artificial intelligence, precision farming, digital management systems, real-time diagnostics and unified industry databases. Both small-scale producers and large integrators will need to invest in technology to improve productivity, efficiency, and long-term competitiveness.

3. Feed Economics Remains the Foundation of Profitability

Since feed accounts for nearly three-fourths of broiler production costs, effective grain procurement, feed management, and unified industry data are essential. Reliable production statistics will support better planning, pricing, and sustainable industry growth.

4. The Industry Must Build Technology, Trust, and Transformation

Future growth will depend on adopting digital platforms, improving transparency, and strengthening consumer confidence. Leveraging initiatives such as ONDC and expanding processed, branded poultry products can help producers connect directly with consumers while reducing dependence on traditional retail channels.

5. Direct-to-Consumer



Marketing will Create Greater Value

Eliminating unnecessary intermediaries through online platforms, e-commerce, and branded retail models can improve market access, strengthen customer relationships, and enhance profitability across the poultry value chain.

6. Export Competitiveness Requires Policy Support and Infrastructure

Building a resilient export sector will require stronger government support, improved logistics, dedicated industry institutions, and policies that enable Indian poultry products to compete effectively in global markets despite geopolitical and supply chain disruptions.

7. Sustainability Begins with Better Resource Management

Water quality, environmental monitoring, waste utilization, and circular economy practices should become integral components of poultry production. Regular water testing, biogas generation from poultry litter, and efficient waste management can improve both sustainability and farm profitability.

8. Innovation and Precision Diagnostics will Strengthen

Disease Control

Future veterinary practice will increasingly rely on advanced diagnostic technologies such as real-time PCR, genome sequencing, and precision vaccine selection. Greater investment in research, innovation, and technical expertise will be essential to address evolving disease challenges.

9. Reliable Data and Disease Surveillance are Essential for Future Preparedness

Mandatory farm registration, regional microbial databanks, updated vaccine protocols, and continuous disease surveillance will strengthen national preparedness and enable more effective responses to emerging poultry health challenges.

10. Collective Industry Leadership will Shape Long-Term Growth

Achieving sustainable growth will require stronger collaboration among producers, veterinarians, researchers, industry associations, and policymakers. Coordinated advocacy, science-based regulations, and continuous innovation will be critical for building a resilient and globally competitive poultry sector.

ILRI–Innoterra Partnership to Convert Crop Residues into Sustainable Livestock Feed

The International Livestock Research Institute (ILRI) and Innoterra Limited have launched a collaborative biotechnology initiative to convert underutilized crop residues into high-quality livestock feed, aiming to improve animal productivity, enhance farmer incomes and reduce agriculture's environmental footprint.

The project will combine ILRI's expertise in livestock nutrition with Innoterra's feed manufacturing capabilities to develop scientifically validated feed solutions for dairy farmers. Research will be undertaken in collaboration with P.V. Narasimha Rao Telangana Veterinary University and Palampur Genetic Services to evaluate the nutritional value and field performance of upgraded feed materials.

The initiative focuses on enhancing the digestibility of crop residues through bio-fermentation using lactic acid bacteria, microalgae and molasses, along with thermo-chemical and anhydrous ammonia treatments. These technologies are expected to improve feed intake, nutrient utilization and animal productivity while lowering methane emissions from livestock.

Beyond technology development, the partners will undertake commercialization studies covering market potential, economic feasibility, farmer acceptance, willingness to pay and policy support. A structured validation process will ensure that the developed feed solutions are scientifically robust, locally relevant and economically viable.

According to ILRI, the collaboration seeks to create new value chains for crop residues, helping farmers derive greater value from agricultural by-products while contributing to climate-smart livestock production. Innoterra noted that the partnership reflects its commitment to translating research into practical, scalable solutions that benefit farmers, livestock health and the environment.

The initiative represents an important step towards sustainable livestock production by integrating biotechnology, scientific research and commercial innovation to improve feed security, reduce greenhouse gas emissions and strengthen the resilience of dairy farming systems.

Indian Poultry Industry Cuts Production Amid Sharp Rise in Soybean Meal Prices

India's poultry industry has announced a 25% reduction in

production following a sharp increase in soybean meal prices, which have risen by more than 40% over the past month, significantly escalating feed costs. The decision was taken jointly by leading poultry industry associations, including AIPBA, CLFMA, KPFBA, IPEMA, the Telangana Poultry Breeders Association and the Broiler Coordination Committee, Tamil Nadu.

Feed accounts for the largest share of poultry production costs, with soybean meal serving as the primary protein source in broiler and layer diets. The unprecedented price surge has severely impacted producer margins, prompting coordinated action to reduce output and balance supply with the expected seasonal decline in poultry consumption during July to October, when several religious festivals influence consumer demand.

As part of the strategy, producers have begun culling parent breeder stocks to reduce future chick placements. Industry reports indicate that breeder birds, previously sold at around USD 1.47 each, are now being liquidated for approximately USD 0.68 per bird, reflecting efforts to curb oversupply and manage escalating production costs.

Industry representatives have also expressed concern over domestic soybean market dynamics, arguing that production is adequate to meet national demand. They have alleged that speculative trading and hoarding have contributed to the recent price escalation and have urged the Central Government to intervene.

The industry has renewed its demand for permitting imports of genetically modified (GM) soybean meal to ease feed shortages and stabilize prices. The current situation underscores the vulnerability of India's poultry sector to feed-price volatility and highlights the need for long-term strategies to ensure feed security and sustainable industry growth.

Silage Adoption Transforms Dairy Feeding Practices in Punjab

Silage is rapidly becoming the preferred feed for dairy farmers in Punjab, replacing conventional green fodder as commercial and small-scale producers seek a reliable, year-round source of nutritious feed. The shift has helped dairy farms overcome seasonal fodder shortages, stabilize feed costs and improve livestock productivity, while creating a new business opportunity through interstate sales.

Maize has emerged as the principal crop for silage production, with an estimated 60–70% of Punjab's maize acreage expected to be harvested for silage. The crop is cut at the unripe stage to achieve optimal fermentation, preserving its nutritional value for long-term storage.

Growing demand has also positioned Punjab as a major supplier of silage to states such as Maharashtra and Karnataka.

Industry leaders attribute the rapid adoption to the economic and operational benefits of silage. By ensuring a consistent supply of quality feed, dairy farmers can reduce dependence on fluctuating green fodder markets and maintain stable milk production throughout the year.

Veterinary experts, however, stress that the benefits of silage depend on scientific preparation and proper management. Successful silage production requires airtight storage to support anaerobic fermentation and prevent spoilage.

Properly fermented silage improves rumen function, enhances feed digestion and supports higher milk yields.

Experts also dispel concerns that silage affects milk quality, noting that unpleasant odours result from poor farm hygiene rather than the feed itself. Feeding silage immediately after milking and storing it away from the milking area can effectively prevent odour contamination.

The increasing adoption of silage reflects a broader shift towards scientific feeding practices that improve feed security, enhance dairy productivity and generate new income opportunities for farmers and rural entrepreneurs.

China Emerges as a Major Market for Indian Oil Meal Exports

China has rapidly emerged as a key destination for Indian oil meal exports, with shipments rising to USD 157 million in 2025, up from just USD 6.1 million in 2024. Over the past decade, exports have increased nearly tenfold, reflecting China's growing demand for protein-rich feed ingredients used in its livestock, poultry and aquaculture sectors.

Industry experts attribute the surge to India's competitive pricing of rapeseed and soybean meal, coupled with China's efforts to diversify feed imports and reduce dependence on traditional suppliers such as the United States, Brazil, Argentina and, more recently, Canada. Restrictions on Canadian canola imports have further created opportunities for Indian exporters to bridge the supply gap.

Oil meal, the protein-rich by-product obtained after extracting oil from oilseeds such as soybean, rapeseed and groundnut, is an important ingredient in animal feed due to its high protein content. Increased demand from China's expanding livestock industry has strengthened India's position as a reliable alternative supplier.

The export growth is particularly noteworthy because it occurred despite a decline in India's overall oil meal exports, which fell from USD 1.48 billion in 2024 to USD 1.16 billion in 2025. China's share of India's oil meal exports increased

significantly during this period, underscoring its growing importance as a strategic market.

Analysts also view the development as an indicator of gradually improving commercial engagement between India and China. While geopolitical issues remain, agricultural commodities are increasingly facilitating trade cooperation driven by market demand.

EU Approves Continued Market Access for Indian Aquaculture Exports

The European Union (EU) has approved India's continued inclusion in its list of authorised countries for exporting aquaculture products, eggs, honey and animal casings, allowing trade access to the 27-nation bloc beyond September under its revised regulatory framework.

The decision comes as part of amendments to EU Regulation (EU) 2021/405, which introduces stricter requirements for animal-origin imports in response to growing concerns over antimicrobial resistance. The updated framework will come into effect from September and applies enhanced compliance standards for exporting countries.

India's inclusion is particularly significant for the fisheries sector, with current exports of fish and fishery products to the EU valued at approximately USD 1.59 billion. The continuation of market access is expected to provide stability to one of India's key agri-export segments.

The Indian government has been actively engaging with the European Commission to ensure compliance with evolving EU norms. The Department of Commerce, along with the Export Inspection Council (EIC), has strengthened official control systems through improved inspection, testing and certification processes aligned with EU sanitary and phytosanitary standards.

Officials noted that the move reflects India's ability to meet stringent international food safety and quality requirements, particularly in a regulatory environment increasingly shaped by antimicrobial resistance concerns and traceability expectations.

The decision also underscores the importance of regulatory preparedness in sustaining access to high-value global markets. Continued alignment with international standards is expected to support long-term growth of India's seafood exports and reinforce its position as a reliable supplier of safe and certified aquaculture products.

Overall, the development provides continuity for India's seafood trade with the EU while reinforcing the need for sustained investment in quality systems, compliance infrastructure and export competitiveness in the animal-origin food sector.



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