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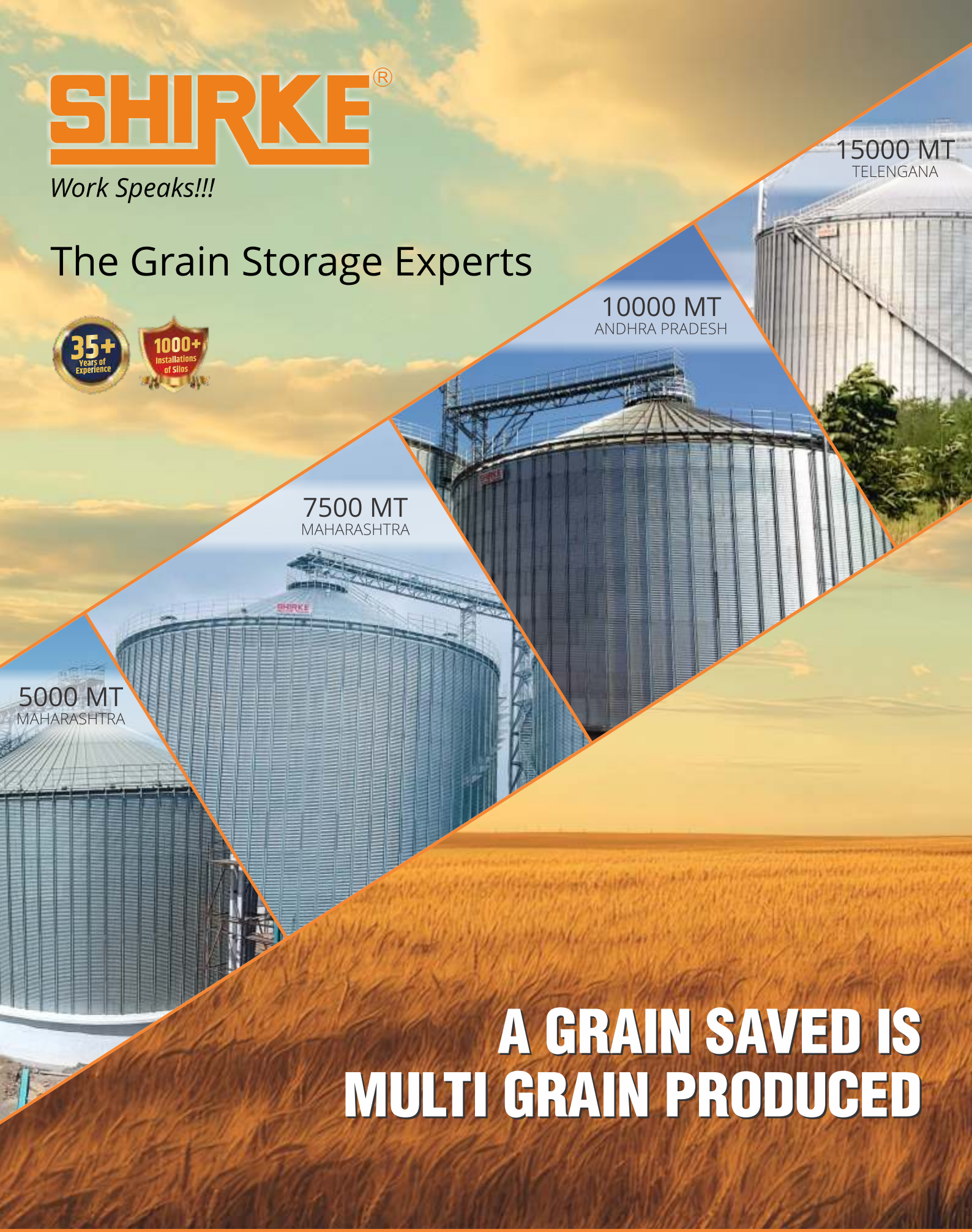

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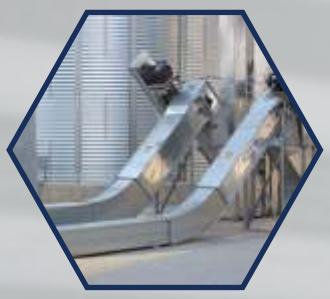

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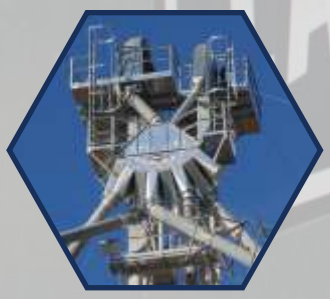

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Reimagining poultry nutrition with nature's overlooked protein powerhouse

Image Source: Britannica

In the face of rising global demand for animal protein and mounting pressure on traditional feed resources, researchers are turning to an unexpected source: grasshoppers. A recent opinion piece in Animal Science highlights how these insects could help transform poultry nutrition and contribute to a more resilient agricultural future.

Grasshoppers, especially those from the Acrididae family, are abundant worldwide and thrive on diverse plant materials. Unlike conventional feed ingredients such as fishmeal, soy, corn, and nuts—which compete directly with human food supplies—the use of grasshoppers could reduce pressure on vital crop and marine resources.

What sets grasshoppers apart is their nutrient profile. They're rich in high density protein and essential amino acids vital for poultry growth and health. For example, research shows that grasshopper meal contains higher levels of key amino acids like arginine, histidine, and threonine compared to traditional fishmeal. Poultry fed diets with grasshopper meal have demonstrated improved body weight gain and better feed conversion, suggesting strong potential for performance gains.

Beyond nutrition, grasshoppers bring environmental benefits. Producing insect protein typically requires less land, water, and feed inputs, while also emitting fewer greenhouse gases than conventional livestock feed production. These insects can be mass reared on low cost substrates and don't compete with crops destined for human consumption, making them an attractive option for scaling sustainable feed systems.

Despite these clear advantages, grasshopper based feeds are not yet mainstream in the poultry industry. Challenges remain, including optimizing inclusion rates in feed, ensuring safety and quality, and understanding long term impacts on poultry health. Ongoing research and supportive policy frameworks will be key to unlocking their full potential.

Still, the idea of grasshopper enriched feeds represents a bold shift in thinking about agricultural inputs—one that aligns with global sustainability goals and could help make poultry production more efficient and ecologically sound.

Source: Toar WL, Riocerezo CP, de la Losa JN, Posangi J, Rumokoy L, Lopez Aban J (2025). Grasshopper enriched poultry feed: a new approach to sustainable nutrition. in Animal Science, 6:1619259.

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Applications and Impacts of Nanotechnology in Poultry Nutrition

Introduction

The poultry industry plays a crucial role in meeting the world's growing demand for animal-based protein amid rising populations, environmental challenges, and the need for sustainable food production. Traditional methods of improving poultry production — such as genetic selection, diet formulation, and pharmaceutical additives — have contributed significantly to industry growth. However, new technologies are sought to boost efficiency, health, and environmental sustainability even further.

Nanotechnology, the science of manipulating materials at the nanometer scale (1–100 nm), is emerging as a promising tool in this arena. At this scale, materials exhibit novel biological, physical, and chemical properties that can be harnessed to improve nutrient delivery, immune function, antimicrobial activity, and diagnostic precision in poultry nutrition and health management.

This article provides a detailed review of the current state of nanotechnology applications in poultry nutrition, the mechanisms through which nanoparticles operate, their benefits, risks, and potential future directions for research and industry implementation.

Understanding Nanotechnology in Poultry Nutrition

At its core, nanotechnology involves engineering materials at extremely small scales where unique properties such as increased surface area, enhanced reactivity, and improved absorption emerge. In poultry nutrition, these features can be applied to:

- Improve bioavailability of nutrients and micronutrients.
- Enhance digestive efficiency and metabolism.
- Modulate the immune system and gut health.
- Act as antimicrobials against

pathogens.

- Serve as biosensors for detecting contaminants.
- Enable targeted delivery of compounds to specific tissues or organs.

Unlike in human food systems — where consumer acceptance of nanoparticles in food remains limited — animal nutrition and feed technologies are less constrained by consumer perception, offering a unique opportunity to apply nanotechnologies for animal health and production benefits.

Mechanisms of Nanoparticles in Poultry

Absorption and Distribution

When nanoparticles are ingested or inhaled by poultry, they can pass through the digestive tract and be absorbed into the bloodstream. Their small size allows them to easily traverse intestinal cells, enter circulation, and reach target organs such as the liver and spleen. Particles <100 nm can reach tissues, while those <300 nm can circulate throughout the body.

Once internalized, nanoparticles can facilitate:

- Improved transport of nutrients and bioactive compounds.
- Enhanced cellular uptake of encapsulated substances.
- Reduced antagonistic interactions between minerals and other dietary components.
- Improved targeted delivery of drugs, growth promoters, and vaccines.

Types of Nanoparticles and Their Roles

Nanoparticles are diverse and can be categorized based on their composition and functional properties:

1. Polymer Nanoparticles

Polymer-based nanoparticles — often made from materials such as polyethylene glycol or polysaccharides like chitosan — can encapsulate vitamins, drugs, or other bioactive compounds. This encapsulation protects active ingredients from degradation during digestion and enables controlled release at target sites.

2. Nanoliposomes

These are spherical particles formed by lipid bilayers that trap hydrophilic and hydrophobic substances. Nanoliposomes can improve the delivery of nutrients and therapeutic agents, and even help in immunization strategies against viral diseases such as Newcastle disease by facilitating targeted delivery of antigens.

3. Lipid Nanoparticles

These include solid lipid nanoparticles and nanostructured lipid carriers. Their lipid nature enhances the stability of encapsulated nutrients and promotes efficient absorption. They also facilitate the delivery of fatty acids, fat-soluble vitamins, and bioactive plant compounds.

4. Nanoemulsions

Nanoemulsions consist of tiny droplets of oil and water stabilized by surfactants. They improve solubility and bioavailability of poorly soluble nutrients and exhibit bactericidal and virucidal properties, making them useful for pathogen control in feed.

5. Metallic and Inorganic Nanoparticles

These include nanoparticles of metals such as zinc oxide, selenium, copper, manganese, and silver. Due to their physicochemical properties, they can enhance immune responses, improve catalytic activity in metabolic processes, and exert antimicrobial effects.

6. Quantum Dots and Nanotubes

Quantum dots and similar nanostructures can serve in biosensing applications to detect pathogens or trace molecules, aiding in early disease detection and food safety monitoring.

Nanotechnology in Feed Additives

One of the most significant applications of nanotechnology in poultry is

the development of nano-feed additives — nutrient or non-nutrient ingredients engineered at the nanoscale to improve their function and effectiveness.

Enhancing Bioavailability

Nanoparticles improve the solubility, stability, and absorption of nutrients that otherwise have low bioavailability. For example:

- Water-insoluble vitamins and carotenoids become more easily absorbed when nano-encapsulated.
- Minerals like zinc and selenium in nano form show higher retention in tissues and reduced excretion, enhancing efficiency.

This improved bioavailability can lead to:

- Better growth performance.
- Higher egg quality and production.
- Enhanced immune status.
- Reduced feed costs due to more efficient nutrient usage.

Microbiome and Gut Health

Nanoparticles can influence gut microflora by:

- Reducing harmful bacteria (e.g., Campylobacter), improving food safety.
- Increasing beneficial bacteria, which enhances nutrient digestion and overall bird health.

Immune Modulation

By interacting with immune cells and improving gut integrity (such as increasing the number of goblet cells that secrete protective mucus), nanoparticles can strengthen the immune system. This can reduce the need for antibiotics and improve resistance to common diseases.

Practical Outcomes from Studies

A range of studies reviewed in the article highlight the positive effects of specific nano-mineral supplements:

- Nano Zinc Oxide: Improved growth performance, feed conversion, and immune parameters in broilers; increased egg shell quality in laying hens.
- Nano Selenium: Enhanced antioxidant status, growth performance, and selenium absorption compared to traditional sources.
- Nano Manganese: Improved enzyme activity and antioxidant function, critical for metabolic processes.
- Nano Copper: Showed beneficial effects on aminopeptidase activity, gut microflora balance, and meat quality indices.
- Nano Silver: Exhibited antimicrobial properties, modulating gut microbes and improving immune response.

Additionally, nanoparticles of calcium and phosphorus demonstrated improved bone quality and reduced environmental waste by enhancing dietary utilization.

Benefits of Nanotechnology in Poultry

The review highlights multiple potential benefits:

1. Enhanced Nutrient Utilization

Improved digestion and absorption of vitamins, minerals, and bioactives lead to better growth and performance.

2. Improved Feed Efficiency

More efficient nutrient use reduces the overall feed demand and lowers production costs.

3. Health and Immune Performance

Nanoparticles can strengthen immune responses, reduce disease incidence, and reduce reliance on antibiotics.

4. Environmental Impacts

With better nutrient retention and reduced excretion of minerals like phosphorus and nitrogen, nanotechnology can help mitigate environmental pollution.

5. Food Safety and Pathogen Control

Nano-based biosensors and antimicrobial agents can detect and control harmful microbes in feed and poultry environments.

Potential Risks and Challenges

Despite its promise, nanotechnology also presents concerns:

1. Biological and Toxicological Risks

Nanoparticles can interact with cells in unpredictable ways, potentially penetrating cellular DNA or stimulating oxidative stress. Their small size increases biological interaction but also raises safety concerns that must be evaluated thoroughly.

2. Regulatory and Ethical Considerations

Regulatory agencies such as the FAO, WHO, US FDA, EU REACH, and others are actively developing guidelines for nanomaterial use in agriculture and food

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systems. These frameworks are crucial to ensure safe application and consumer confidence.

3. Need for Standardization and Research

More research is needed to:

- Determine safe and optimal dosing strategies.
- Understand long-term effects on poultry health and welfare.
- Evaluate environmental impacts of nanoparticle release.

Future Perspectives

Nanotechnology holds great promise as a transformative tool in poultry nutrition and health management. Future research directions include:

- Developing targeted nano-delivery systems for vaccines and therapeutics.
- Integrating biosensors for real-time health monitoring.
- Conducting long-term toxicological assessments to ensure safety.
- Creating regulatory frameworks that balance innovation with health and environmental protection.

The authors emphasize that while many applications show positive preliminary results, careful, scientifically backed implementation paired with ongoing research is essential to harness nanotechnology's full potential safely and effectively.

Conclusion

Nanotechnology offers exciting opportunities to revolutionize poultry nutrition by enhancing nutrient bioavailability, improving health markers, reducing disease, and increasing production efficiency. However, its success depends on rigorous scientific validation, regulatory oversight, and responsible application.

As the poultry sector continues to grow to meet global food demand, nanotechnology could be a key enabler of future sustainability and animal health — provided its use is guided by evidence, safety, and ethical considerations.

Article Source

Hosseintabar-Ghasemabad, B., Ondrašovičová, S., Kvan, O. V., et al. (2025). Applications and impacts of nanotechnology in poultry nutrition. Discover Applied Sciences 7, 938. https://doi.org/10.1007/s42452-025-07254-0

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A Structured Approach to Shrimp Disease in India: The CoSDIP Initiative


Balasubramaniam V

The Indian shrimp sector has experienced a true rollercoaster in recent years—ranging from imposed trade tariffs to unexplained mortalities, growth collapse, and premature crop termination. These challenges have significantly eroded farmer profitability while simultaneously increasing their workload and operational risks.

As the industry works to boost domestic consumption, explore alternative export markets, and confront emerging disease challenges that remain difficult to identify, a landmark initiative has taken shape. The Collaborative Shrimp Disease Identification Program (CoSDIP) has emerged as India's first farmer-led, structured shrimp disease investigation platform, designed to address health challenges through collective action and scientific collaboration.

Think Grain Think Feed connected with Balasubramaniam V, General Secretary of the Prawn Farmers Federation of India, and one of the key driving forces behind this initiative, to understand the vision, objectives, and expected impact of CoSDIP.

1. Could you please share details about the Collaborative Shrimp Disease Investigation Program?

The Collaborative Shrimp Disease Identification Program (CoSDIP) is India's first farmer-led, structured shrimp disease investigation initiative, created to systematically understand and address emerging disease syndromes affecting shrimp farms across the country.

The program was conceived following widespread reports of unexplained mortalities, growth collapse, and early crop termination—issues that could not be adequately explained through routine diagnostic testing alone. Recognising the need for a deeper, field-linked scientific approach, farmer organisations initiated discussions in June–July 2025 with national research institutions.

A formal MoU was signed with ICAR–Central Institute of Brackishwater Aquaculture (CIBA) on

29 July 2025, and the program was officially launched on 10 August 2025. The MPEDA–Rajiv Gandhi Centre for Aquaculture (RGCA) joined as a key institutional partner, working closely with CIBA and farmer organisations on diagnostics, epidemiology, and field validation. In parallel, a technical collaboration with the University of Arizona (USA) was established to support advanced pathogen characterisation and complementary scientific analysis.

CoSDIP follows a field-to-lab investigation model, integrating structured epidemiological data, clinical and environmental observations, and laboratory analyses including pathology, microbiology, and molecular diagnostics.

The pilot study is currently being implemented in Nagapattinam District, Tamil Nadu. Based on scientific learnings and budget availability, the program is designed to expand in stages, with Andhra Pradesh proposed as the next region in 2026, followed by other shrimp-producing regions.

Importantly, CoSDIP is not a one-time study but a continuous, collaborative platform, bringing together farmers, scientists, and industry stakeholders to generate credible, evidence-based insights that support long-term sector resilience.

2. How have disease patterns evolved compared to previous years?

Over the past few years, shrimp disease challenges in India have shifted in character rather than simply increased in incidence.

Earlier, disease outbreaks were largely pathogen-specific and episodic, with identifiable causes and predictable outcomes. In contrast, the recent pattern — particularly observed during 2024–25 — has been marked by complex, multi-factor syndromes that do not always fit classical disease definitions.

Farmers are increasingly reporting persistent low-grade mortalities that suddenly escalate, an inability to extend crops beyond 65–75 days despite normal early growth, and chronic production stress that forces early harvests.

What distinguishes the current situation is that routine diagnostic tests often fail to provide conclusive answers, suggesting that these outcomes are driven by a combination of interacting factors — including biological stress, environmental pressures, microbial imbalance, and management intensity — rather than a single new disease agent.

This shift has reduced farmer confidence in traditional responses and underlines the need for field-linked, longitudinal investigation, which is precisely what CoSDIP aims to address.

3. What impact are these disease trends having on shrimp production numbers?

The impact of these disease trends is not reflected as a sharp decline in overall production volumes, but rather in how production is being achieved and the value realised from it.

Farmers are increasingly unable to grow shrimp to larger, more remunerative sizes, as crops are being curtailed around 70–75 days to avoid sudden losses. Since shrimp pricing and profitability are closely linked to size, this directly affects farm-level returns.

To compensate, farmers are taking more crop cycles per year — often 2.5 to 3.5 crops instead of the usual two — increasing stocking densities and compressing turnaround times to maintain volumes and cash flow.

As a result, headline production volumes may appear stable, but each crop delivers lower margins, and farmers are exposed to significantly higher biological and financial risk. In effect, farmers are working harder, cycling faster, and taking greater risks to earn less than what fewer, longer crops delivered earlier.

Thus, while volumes are not falling, there is a clear erosion in value realisation per kilogram and economic sustainability, which is a more serious concern for farmer livelihoods.

4. What are the key findings of the epidemiological study, and which regions are the most severely affected?

The epidemiological study under CoSDIP has largely validated what farmers have been reporting from the field.

Structured data confirm shortened crop durations, repeated disease onslaughts across successive cycles, and

forced early harvests, even where early growth appears normal.

Importantly, while external clinical symptoms have been consistently documented, detailed laboratory screening has so far not linked these outcomes to any single known pathogen. This indicates that the sector is likely dealing with an as-yet uncharacterised disease syndrome, possibly involving complex pathogen interactions or stress-driven expressions rather than a classical, single-agent disease.

The pilot study is currently focused on Nagapattinam District, Tamil Nadu. Reports of similar symptoms from other major shrimp-producing regions have prompted plans for phased expansion, with Andhra Pradesh proposed as the first expansion region in 2026.

The objective of this work is not to prematurely label diseases or regions, but to establish a scientifically defensible understanding that can guide future diagnostics, management protocols, and prevention strategies.

5. What solutions or recommendations are being suggested by field experts?

Given the complexity of the disease patterns observed, experts are recommending a risk-management and resilience-building approach, rather than quick fixes.

Key recommendations include:

- Early risk recognition and timely decision-making, avoiding attempts to force crop duration beyond safe limits
- Improved biosecurity and pond preparation, especially with more frequent crop cycles
- Reducing cumulative management stress, including excessive densities and abrupt interventions
- Farm-specific responses, recognising that no single solution fits all systems
- Continuous monitoring and data-driven adjustments, using CoSDIP as a feedback platform

Experts caution against unverified products or "miracle solutions", emphasising instead evidence-based management, vigilance, and gradual system correction.

6. Are there any eligibility criteria for farmers to register under this program, such as pond size or farm scale?

There are no restrictive eligibility criteria based on pond size or farm scale. CoSDIP is designed to be inclusive and representative of India's diverse shrimp farming systems.

For the pilot phase, the study was conducted across the entire Nagapattinam District, which was divided into six geographic zones. In each zone, two farms were selected, and within each farm two to four ponds were chosen for continuous monitoring.

Farms were selected based on severity of disease occurrence, willingness to cooperate throughout the study period, and ability to support regular sampling of water, shrimp, and soil, along with periodic visits by program technical coordinators. Care was taken to ensure geographic balance across the district.

As the program expands to other regions, a similar structured approach will be followed. No participation fee is charged to farmers, and participation is based on partnership and transparency, not inspection.

7. What long-term impact could this program have on the Indian shrimp sector?

In the long term, CoSDIP is expected to evolve into the country's flagship shrimp disease investigation and surveillance platform.

Beyond addressing current unexplained disease events, the program is designed to continuously track emerging disease patterns, provide early warnings, and help pre-empt large-scale disease crises before they escalate.

By integrating field intelligence, epidemiology, and laboratory science on a continuous basis, CoSDIP can enable early detection, faster response, targeted advisories, and improved preparedness.

Over time, this approach can reduce production shocks, restore farmer confidence, and strengthen the biological and economic resilience of India's shrimp sector, shifting the industry from a reactive posture to a preventive, knowledge-driven model of disease management.

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Transforming Forage Nutrition: Advances in Silage Additives for Enhanced Preservation and Feed Quality

by **U S P K Reddy[1], T Selvakumar[2]*, K R V Sathyasheela[2], N Satheeshkumar[2] & M Thirunavukkarasu[1]**

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Introduction

Forage crops are foundational to livestock nutrition, directly influencing animal health, productivity, and food quality. As global demand for animal products grows, so does the need for high-quality fodder. Urbanization and shrinking agricultural lands intensify pressure on feed supply, prompting farmers and researchers to maximize use of available forages and crop residues. One of the most effective ways to preserve fodder year-round and improve its nutritional profile is through ensiling—the anaerobic fermentation of green forage to produce silage, a stable, nutritious feed that can be stored for long periods.

However, producing consistently high-quality silage is challenging due to variable forage composition, environmental conditions, and microbial activity. To address these challenges, researchers have developed and evaluated silage additives—compounds added during ensiling to improve fermentation, preservation, and feed quality. These additives range from microbial inoculants and enzymes to chemical preservatives and nutrient sources. The review article by Reddy et al. comprehensively summarizes recent advances in silage additive science, describing how different types of additives improve fermentation, extend storage life, enhance nutrient retention, and ultimately support better livestock performance.

The Role of Silage in Livestock Systems

Silage production plays an essential role in global livestock feeding systems by:

- Ensuring a reliable feed source throughout the year, especially during periods of forage scarcity caused by seasonal changes and climate variability.

- Reducing reliance on concentrated feed, thereby lowering feed costs and supporting economic viability.
- Preserving forage nutrient content while minimizing nutrient loss and environmental pollution from residue burning.
- Stabilizing feed availability and helping maintain consistent livestock productivity.

Silage contributes an estimated 10–25 % of livestock feed globally and is particularly valuable in regions with distinct dry seasons or limited pasture availability. Unlike hay, silage can be harvested and ensiled under a wider range of conditions without dependence on weather, enabling multiple harvests and increased utilization of crop residues and by-products.

Despite its advantages, silage quality can suffer due to inadequate fermentation, exposure to air, and proliferation of undesirable microbes such as yeasts and molds. These issues can lead to nutrient loss, reduced palatability, and spoilage during storage or feeding. Effective use of additives can dramatically improve silage outcomes.

What Are Silage Additives?

Silage additives are substances introduced during the ensiling process to:

- Accelerate fermentation
- Suppress growth of undesirable organisms (e.g., spoilage yeasts and molds)
- Preserve nutrients
- Improve aerobic stability (resistance to spoilage when exposed to air)
- Optimize the feed quality and palatability to livestock

Additives can be natural or synthetic, liquid or solid, and are selected based on forage type, moisture content, and desired fermentation outcomes. They fall into several major categories: microbial inoculants, enzymes, chemical additives, nutrients, and fermentation stimulants.

Microbial Inoculants

Role in Silage Fermentation

Microbial inoculants are among the most widely studied and used silage additives. The key aim in ensiling is to promote the rapid production of lactic acid by lactic acid bacteria (LAB), lowering pH to below ~4.2, which stabilizes the forage and inhibits growth of spoilage organisms. LAB also changes the microbial ecology in silage, favoring beneficial bacteria and suppressing harmful ones.

Common microbial inoculants include:

- Lactobacillus species (e.g., L. plantarum, L. acidophilus)
- Lactococcus species
- Yeast strains (e.g., Saccharomyces cerevisiae)

These organisms accelerate production of lactic acid and other beneficial metabolites, reduce fermentation losses, enhance nutrient preservation, and increase aerobic stability. For example, combining bacterial and yeast inoculants has been shown to produce high-quality silage in maize and other forages.

Studies also highlight how different strains and combinations of LAB can be selected for specific forage types. Certain strains improve dry matter preservation, increase beneficial bacterial populations, and enhance the palatability of silage. Some inoculants help reduce toxins such as mycotoxins and improve overall fermentation dynamics.

Enzyme Additives

Enzyme additives contribute to silage quality by breaking down complex plant components into simpler sugars that LAB can more easily ferment. By enhancing the availability of fermentable carbohydrate substrates, enzymes support stronger and faster lactic acid production.

Examples include:

- Cellulase and hemicellulase enzymes: Break down fiber complexes, releasing sugars and improving digestibility.
- Xylanases and glucanases: Target hemicellulose and glucan structures, increasing soluble sugars and lactic acid content.
- Proteases and amylases: Improve protein and starch breakdown, enhancing nutrient availability.

Enzyme treatments have been shown to lower pH, increase crude protein and

lactic acid content, reduce fiber fractions such as neutral detergent fiber (NDF) and acid detergent fiber (ADF), and improve silage quality parameters, including digestibility and aerobic stability. Enzymes also alter the bacterial community structure, promoting growth of beneficial LAB species.

Chemical Additives

Chemical additives influence silage fermentation by directly lowering pH, inhibiting spoilage organisms, and preserving nutrients:

Organic and Mineral Acids

- Formic acid can quickly lower silage pH, reducing proteolysis and ammonia formation, lowering fiber content, and improving storage quality.
- Sorbic acid and potassium sorbate inhibit yeasts and molds, improving aerobic stability and reducing nutrient losses.
- Hydrochloric acid (in controlled amounts) can reduce pH and improve physical and nutritive qualities of silage.

These acids enhance fermentation outcomes and help ensure more stable silage with extended storage life.

Salt-Based Additives

Salts such as sodium chloride, sodium diacetate, and urea also play roles in modifying the ensiling environment, influencing fermentation dynamics, nutrient breakdown, and microbial populations. Urea and ammonia can increase nitrogen content in silage, benefiting protein availability when used carefully.

Fermentation Stimulants

Fermentable carbohydrates act as feed for microbes during ensiling. Because many forages have insufficient sugar to fuel optimal fermentation, fermentation stimulants are often added:

- Molasses is a widely available and cost-effective source of fermentable sugars, supporting lactic acid production and enhancing fermentation quality.
- Grains and starchy substances provide carbohydrate substrates for LAB fermentation and can improve aerobic stability.

Adding molasses has been shown to increase lactic acid production, reduce dry matter loss, suppress undesirable microbes, and improve aerobic stability. When combined with LAB inoculants, molasses can produce synergistic improvements in silage fermentation and nutrient preservation.

Other fermentable carbohydrate sources, including potato processing waste and grain cereals, have also improved silage quality by providing substrate for fermentation and enhancing microbial activity.

Impact on Silage Quality and Livestock

Well-managed silage with effective additives offers numerous benefits:

Improved Fermentation and Storage

- Rapid pH drop (<4.2) limits undesirable microbes.
- Reduced proteolysis and ammonia volatility preserve proteins.
- Enhanced aerobic stability prolongs shelf life after silo opening (typically increased by 2¬–5 days).

Nutrient Retention

Additives help retain nutrients that would otherwise be lost, including carbohydrates and proteins, resulting in higher feed quality.

Animal Performance

- Silage with optimal fermentation and nutrients supports better rumen function.
- Improved feed quality can lead to 5 – 20 % increases in milk production and lactation period in dairy cattle.
- Beneficial rumen microbial populations are promoted, supporting overall health and productivity.

Economic and Environmental Benefits

- Reduced need for expensive concentrates.
- Better use of crop residues and by-products supports sustainable production.
- Less feed waste and lower nutrient runoff reduce environmental impact.

Challenges and Considerations

While silage additives provide clear advantages, their effectiveness depends on multiple factors:

Forage Characteristics

Forages vary in sugar content, moisture, and native microbial populations, which influence fermentation success and additive efficiency.

Environmental Conditions

Temperature, humidity, and harvest timing affect silage fermentation, often requiring tailored additive strategies.

Additive Selection and Costs

Choosing the right additive type and dose is critical; inappropriate use can be ineffective or economically unjustified.

Safety and Environmental Risks

Further research is needed to assess long-term impacts of additives, potential residues, and environmental safety considerations.

Conclusion

Ensiling remains a cornerstone of sustainable livestock nutrition, transforming perishable fodder into a stable, nutritious feed source. Advances in silage additive technology—including microbial inoculants, enzymes, chemical preservatives, and fermentation stimulants—have significantly enhanced silage quality, storage stability, and nutrient retention. These improvements translate to better animal performance, economic advantages for producers, and environmental benefits.

As research continues to optimize additive formulations and application strategies, incorporating silage additives based on forage type, climate, and production goals will remain a key practice in modern livestock systems.

Source

Reddy U.S.P.K., Selvakumar T., Sathyasheela K.R.V., Satheeshkumar N. & Thirunavukkarasu M. (2025). Transforming forage nutrition: Advances in silage additives for enhanced preservation and feed quality. Plant Science Today (CC BY 4.0). DOI:10.14719/pst.8548.

The New Frontier in Phytogenics: The Rise of Second-Generation Technologies

Enhancing animal performance through advanced manufacturing and natural ingredients—delivering greater transparency, efficacy, and profitability

by NUQO team

The Evolution and Impact of Phytogenic Feed Additives

Over the past few decades, the market for phytogenic feed additives has undergone a significant transformation, driven by evolving regulations, shifting consumer expectations, and advances in scientific research. The pioneering work of the late twentieth century laid the foundation for the growth of this sector. However, in recent years, industry consolidation has contributed to a noticeable slowdown in true innovation.

The use of phytogenics in animal nutrition expanded rapidly following global bans on antibiotics as growth promoters (AGPs). In response, nutritionists increasingly turned to plant-based additives to replicate AGP-like performance in broilers and other species. Initially valued mainly for their antimicrobial properties, phytogenic compounds have since demonstrated a much broader range of benefits for gut health.

Research has shown that plant extracts can modulate gut microbiota by selectively inhibiting harmful pathogens while preserving beneficial bacteria. They stimulate digestive processes by enhancing enzyme activity and nutrient absorption and can modulate immune responses, helping to reduce inflammation while supporting immune function. In addition, phytogenics contribute to gut integrity by promoting mucus production and epithelial cell regeneration.

Derived from various plant parts—including leaves, seeds, roots, and bark—and extracted using methods ranging from simple milling to advanced distillation techniques, phytogenic ingredients exhibit diverse properties. These differences influence their purity, stability, and ultimately their efficacy in animal nutrition.

This shift toward "green" solutions has opened new opportunities for the feed industry. However, in some cases, these solutions relied on opaque formulations or lacked robust scientific validation. Phytogenics, which first gained commercial traction in the late 1980s, experienced a sharp increase in demand over the past decade, fueled by consumer interest in sustainability and natural ingredients. This period marked a transition from so-called "black-box" solutions to more transparent, scientifically supported, and technologically advanced products.

Where Does Innovation Lie for the Future of Phytogenics?

From Phytogenics to Phycogenics

While extensive research has been conducted on phytogenics—derived from the Greek word phyto, meaning plant—the emerging field of phycogenics, derived from phyko, meaning algae, remains relatively unexplored. Increasing attention is now being directed toward the potential of marine algae, with some studies focusing on seaweeds as nutrient sources and others investigating their functional bioactive properties.

A novel approach within this field involves identifying specific algae-derived metabolites capable of enhancing animal gut health, rather than treating algae simply as a raw material. This research seeks to establish clear links between seaweed

metabolites and their physiological effects in animals. Collaboration with academic and industrial experts enables the exchange of knowledge and accelerates the identification of promising compounds, while also advancing innovative bioprocessing technologies.

Although still in its early stages, phycogenics represents a rapidly emerging area of interest. Alongside algae-based solutions, future innovation in phytogenics may also come from developing new methods for producing plant-derived metabolites, refining processing techniques, or enhancing the biological activity and delivery of natural compounds.

Manufacturing Expertise Is Key

As the phytogenics market expanded, early solutions were often developed using relatively simple technologies. While these first-generation products addressed the growing demand for natural and sustainable feed additives, they also faced notable limitations. Key challenges included ensuring stability during storage and feed processing—particularly under harsh conditions such as pelleting or extrusion—as well as avoiding negative effects on feed intake and palatability.

Many early phytogenic products contained volatile compounds that were unstable during processing, dusty or irritating for workers, or poorly accepted by animals. Although these products provided value at the time, their limitations became increasingly evident. Some remain on the market today, but they no longer meet the requirements of modern, performance-driven animal production systems.

Recent technological advancements have helped overcome many of these challenges. In particular, innovations in micro-encapsulation have led to the development of high-concentration, highly stable products that remain effective at low inclusion rates—even under demanding feed manufacturing conditions. These next-generation

products are dust-free, safe to handle, and designed to release their active ingredients precisely where needed in the digestive tract, maximizing efficacy.

However, as encapsulation has become a popular marketing term, it is increasingly important for customers to verify supplier claims. Not all "encapsulated" products rely on robust, scientifically validated manufacturing technologies.

(Plants + Algae) × Micro-Encapsulation Technology: A New Standard

This technology combines a high concentration of metabolites derived from both plants and seaweed, delivered through an advanced and transparent formulation. It offers one of the highest active ingredient concentrations available on the market, together with exceptional stability. As a result, it achieves high efficacy at low inclusion rates compared with other solutions.

The product's protective technology has been evaluated under a wide range of feed processing conditions—including mash, pelleting, and extrusion—and across multiple species. These evaluations demonstrate consistent recovery of active

compounds over time. Importantly, the product does not negatively affect feed quality or palatability and is safe and easy to handle for feed mill operators.

Extensive research has been conducted to demonstrate not only the performance benefits of this technology but also its mode of action. Published studies show that the encapsulated metabolites are released precisely in the gastrointestinal tract, where they stimulate digestive processes, strengthen gut integrity, and support immune function. These effects optimize energy and nutrient utilization, ultimately improving feed efficiency and farm profitability.

Research Confirms the Added Value of New Phytogenic Technologies

This new generation of phytogenic technology has gained significant market traction in recent years. From both technical and economic perspectives, formulators and nutritionists have recognized its value, as confirmed by numerous trials and peer-reviewed publications conducted across Asia, Europe, North America, the Middle East, and Latin America.

One recent trial conducted at the University of Arkansas (USA) evaluated the technology over a 39-day period in male Cobb 500 broilers during the autumn season. Birds were fed a standard U.S. three-phase diet (starter, grower, finisher). Starter diets were pelleted and crumbled, while grower and finisher diets were fed as pellets. The new technology was added on top of the basal diet from day 0 to day 39, resulting in two treatments: a negative control (NC) and the new technology at 100 g/ton (NQ).

At day 39, broilers in the trial performed close to their genetic potential for body weight gain (BWG). The NQ treatment significantly improved BWG (+57 g) and feed conversion ratio (−2.1 points) compared with the control. These improvements brought birds closer to their genetic potential for FCR and beyond their genetic benchmark for BWG.

Based on current U.S. feed ingredient prices and the performance results observed, the use of the technology generated an estimated return on investment (ROI) of 3:1. In addition, the technology improved carcass and breast yield without increasing the incidence of woody breast or white striping and without negatively affecting other meat quality parameters. Overall, the technology enhanced growth performance and feed efficiency, leading to improved farm profitability.

With more than 30 trials conducted worldwide, the technology has consistently demonstrated advantages over older phytogenic solutions. It is now used in broilers, laying hens, and other species, both as a standalone additive and as a tool to optimize feed formulations.

Conclusion: Embracing the Next Generation of Phytogenic Technologies

Two decades ago, the phytogenic feed additive market was still in its infancy. Since then, it has evolved significantly in response to regulatory pressures, consumer expectations, and technological progress. Early pioneers laid the groundwork by demonstrating the value of plant-derived compounds in animal nutrition. Today, however, new technologies have raised the bar.

Through the discovery and application of novel metabolites from both plants and seaweed, combined with advanced manufacturing and delivery technologies, the industry now offers more reliable and effective solutions. These next-generation phytogenics deliver higher concentrations, greater stability, improved safety for workers and animals, and consistent performance with superior economic returns.

Extensive research supports these advancements, leaving little justification for continued reliance on outdated technologies. As innovation continues in sourcing natural molecules and refining processing methods, the future of phytogenics will be defined by greater transparency, stronger scientific foundations, and a continued commitment to sustainable animal nutrition.

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AMINO ACID | FEED SUPPLEMENTS | POULTRY VITAMINS | POULTRY ANTIBIOTICS | MEALS

(OUR BEST SELLERS)

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- ZINC OXIDE
- FERROUS SULPHATE
- MANGANESE SULPHATE
- MANGANESE OXIDE
- COPPER SULPHATE
- COBALT SULPHATE
- CALCIUM IODATE
- SODIUM SELENITE
- COBALT CARBONATE

VITAMINS

- VITAMIN - E
- VITAMIN - A
- VITAMIN -C
- VITAMIN - K
- VITAMIN - B9

BULK PRODUCTS

- DI CALCIUM PHOSPHATE (DCP)
- MONO CALCIUM PHOSPHATE (MCP)
- SODIUM BI CARBONATE (SBC)

AMINO ACID

- DL-METHIONINE
- L-LYSINE HCL
- L-THREONINE
- L-TRYPTOPHAN

ANTIBIOTICS

- ENROFLOXACIN
- FLORFENICOL
- AZITHROMYCIN
- CIPRFLOXACIN
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- TIAMULIN 10, 45, 80%
- TYLOSIN
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What Drives Market Growth in the Cattle Feed Business?

by Dr Manish Pathak, Carus Laboratories

Dr Manish Pathak

The New Economics of Dairy Nutrition

The cattle feed industry is undergoing a quiet revolution. Changing farmer expectations, evolving dairy economics, and the rise of scientific nutrition are transforming what was once a largely unorganized market into a structured, technology-driven sector. As India maintains its position as the world's largest milk producer, the demand for high-quality, performance-oriented cattle feed continues to surge.

Below are the major forces shaping this multi-billion-rupee industry.

1. Rising Milk Demand and the Pursuit of Productivity

India's per capita milk consumption continues to climb, driven by urbanization, lifestyle shifts, and the growth of organized dairies. Farmers are under pressure to deliver consistent milk supply, and scientifically balanced feed is no longer optional—it's essential. Traditional mixtures like bran and churi just can't meet today's productivity expectations.

2. Shift from Conventional Feeding to Compound Feed

A major growth driver is the shift from conventional home-mixes to compound cattle feed. Inconsistent home-made rations often lead to nutrient gaps, metabolic stress, and lower milk yields. Scientific feeds, by contrast, offer:

- Balanced nutrition
- Reliable energy and protein supply
- Improved rumen efficiency
- Higher feed-to-milk conversion

This shift is opening the market to a whole new class of performance-focused products.

3. Growth of Medium and Large Dairy Farms

The Indian dairy landscape is witnessing the rise of commercial and semi-commercial dairy units. Farms with 50–300 animals are rapidly adopting:

- TMR (Total Mixed Ration) feeding
- Silage-based systems
- Automated milking and feeding technologies

Such operations require consistent, high-quality feed in bulk, fueling demand for organized, branded feed products.

4. Increased Nutritional Awareness Among Farmers

Modern dairy farmers are more informed than ever before. Awareness about topics like:

- Negative DCAD (Dietary Cation-Anion Difference)
- Rumen pH and acidosis
- Feeding of Bypass fat and protein
- Mycotoxin contamination
- Use of Chelated minerals
- Feeding of Transition cow diets

All these points mentioned above have been influencing the buying behaviour towards premium nutritional solutions rather than low-cost feed options.

5. Expanding Silage Adoption

Once a niche concept, silage feeding is now widespread. With green fodder shortages in many states, farmers use silage to ensure year-round fodder availability. This practice increases the need for concentrate feed to maintain balanced nutrition, indirectly driving feed demand.

6. Feed Safety and Quality Regulations

With stringent monitoring of aflatoxin levels in milk by dairy cooperatives and processors, farmers are paying more attention to feed safety. Demand is growing for:

- Mycotoxin binders
- Tested, safe raw materials
- Scientifically formulated feeds

As food safety norms tighten, quality feed is no longer a luxury—it's a necessity.

7. Value-Added Feed Products Gaining Traction

The market for high-performance nutritional product, rather feed additives for dairy animals is expanding faster than traditional feed categories. Products like:

- Rumen-protected choline
- Yeast culture
- DCAD supplements
- Methionine, lysine boosters
- Chelated mineral mixtures
- Energy boosters

Which is helping dairy farmers to optimize productivity during peak lactation, transition periods, and stress phases, thereby, opening up new growth verticals.

8. Government Support and Sector Modernization

Programs from NDDB, NABARD, and state dairy boards are promoting scientific feeding. Grants for farm modernization, fodder development, and veterinary outreach are encouraging farmers to adopt structured feed solutions, driving organized market growth.

9. Digital Influence, Branding, and Emotional Marketing

Farmers today rely heavily on:

- YouTube
- WhatsApp groups
- Community pages
- Digital influencers

Brand trust has become a key currency. Companies that leverage emotional storytelling, farmer success stories, and user-generated content are seeing faster adoption and stronger retention.

The Road Ahead

With rising milk production costs and competitive dairy markets, farmers can no longer rely on low-nutrition feed ingredients. The industry is moving toward precision nutrition, data-backed formulation, and value-driven feeding strategies.

The cattle feed business is poised for strong growth, powered by scientific innovation and a new generation of progressive farmers. The next decade will belong to brands that combine nutrition expertise, farmer education, and trusted relationships.

Punjab Achieves Breakthrough in Hybrid Maize Seed Production

ICAR–Indian Institute of Maize Research (ICAR-IIMR), Ludhiana, has successfully completed its first maize hybrid seed production trial in Punjab, using the variety DMRH 1308 in a farmer's field in Gajiana village, District Moga.

Currently, nearly all hybrid maize seed in Punjab—priced at Rs 800–1000 per kg—is sourced from southern India, mainly Telangana and Andhra Pradesh, raising cultivation costs. The successful trial proves that hybrid seed can be produced locally, even during the late Kharif season. Harvested seed can be directly used for spring crops, reducing storage expenses.

Local seed production is expected to cut costs, boost productivity, and increase farmers' income, with potential returns of INR 2.5–3 lakh per hectare—almost double that of commercial maize cultivation.

This initiative marks a significant step toward self-reliance in hybrid maize seed production, meeting the growing demand in Punjab and neighbouring states while offering substantial economic benefits to farmers.

ICAR-IIMR is also extending similar trials to other states, including Uttar Pradesh, Rajasthan, Jharkhand, Bihar, West Bengal, and Assam, aiming to diversify seed production beyond southern India.

Maharashtra Plans New Fodder Policy to Safeguard Dairy Farmers

Maharashtra is set to introduce a new fodder policy aimed at strengthening the state's dairy sector, Minister of State Ashish Jaiswal announced. The initiative comes in response to widespread losses caused by this year's unseasonal rains, which led to fodder shortages and significant cattle mortality.

Jaiswal highlighted that the state's rapidly growing population has increased demand for milk and dairy products, intensifying the need for a stable supply chain. "Many dairy farmers incurred heavy losses during the floods. To stabilise production and ensure fodder security, we are formulating a long-term policy," he said. Compensation for lost cattle has already been disbursed to affected farmers.

The minister also noted that 100% agristack integration has been completed in most districts, except Sindhudurg, Ratnagiri, and Pune. Once fully implemented, farmers will no longer need repeated e-KYC updates. In addition, the state has revived wells in flood-affected regions to support agricultural and livestock requirements.

Addressing concerns over wild animal attacks, Jaiswal said the cabinet has approved the Baliraja Shet Bandhan Rasta Yojana, which will build internal roads to farmlands as part of the broader Amritkaal Rasta Yojana, with road numbering already underway.

Reiterating government support, Jaiswal affirmed, "Whatever the challenge, the government stands firmly with farmers. There is no shortage of funds for them."

India–Norway Backed Elmentoz Research Raises Seed Funding to Advance Smart Feed Technology

Elmentoz Research Pvt. Ltd., a deep-tech biotechnology startup focused on precision animal nutrition and smart feed solutions, has secured its first seed funding round from a consortium of angel investors in India and Norway. The funding marks a significant milestone in the company's plans to scale sustainable, next-generation feed ingredients for poultry, aquaculture, and pet food sectors.

With the fresh capital, Elmentoz is establishing what it calls India's largest Black Soldier Fly (BSF)-based smart protein facility in Mysuru. The facility, slated to begin operations in January 2026, will process nearly 2,000 metric tonnes of industrial byproducts monthly, leveraging advanced automation and controlled manufacturing systems. The company aims to reduce India's dependence on imported functional feed additives, mitigate biosecurity risks such as antimicrobial resistance, and enhance farm-level productivity. Its insect-protein platform is designed to minimize land and water use while lowering the carbon footprint compared to conventional feed ingredients.

Elmentoz's technology combines genomics, proteomics, and cGMP-compliant manufacturing to produce antimicrobial peptide (AMP)-fortified feed premixes, smart protein formulations, and functional oils. These products target improved gut health, feed conversion efficiency, and disease resilience in animals, while replacing antibiotic growth promoters.

The seed funding will support the scaling of automated manufacturing infrastructure, product portfolio expansion, AMP research, international collaborations, and team building across research, manufacturing, and commercial functions.

Soybean Gyan to Boost Soybean Yields for Farmers

The National Soybean Research Institute (NSRI) in Indore has developed an artificial intelligence (AI)-enabled mobile app to help farmers improve soybean crop yields. Principal

PROMOIS ПРОМОИС INTERNATIONAL

AMINO ACID *(BEST SELLER CATEGORY)*

- DL-Methionine
- L-Lysine Hcl
- L-Threonine
- L-Tryptophan
- L-Valine
- L-Isoleucine

BULK PRODUCTS

- Di Calcium Phosphate (DCP)
- Monocalcium Phosphate (MCP)
- Sodium Bicarbonate
- Premix (Layer)
- Premix (Broiler)

FEED SUPPLEMENT

- Choline Chloride (CCL)
  Liquid 75% /Powder 60%
- Toxin Binder
- Betain Hcl
- Acidifier
- Phytase
- Multienzyme
- Electrolyte
- Glycerine

PROMOIS ANTIBIOTICS

- Chlortetracycline (CTC)
- Tylosin Phosphate 10%
- Tiamulin10,45,80%
- Enrofloxacin
- Florfenicol
- Azithromycin
- Ciprofloxacin
- Amoxicillin
- Virginiamycin 11%
- Ivermectin
- Anticoccidials

VITAMINS

- Vitamin - A
- Vitamin - E
- Vitamin - C
- Vitamin - B1, B2, B9
- Vitamin - K

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Scientist (Computer Applications) Dr. Savita Kolhe said the app, named 'Soybean Gyan', provides scientific, accurate, and timely guidance on soybean cultivation.

The app's AI-based framework allows farmers to manage diseases and pests effectively. By uploading a photo of their crop, users receive immediate information on any disease or pest affecting the soybean plants, along with recommended solutions. This feature is particularly valuable in rural areas where farmers may lack direct access to expert advice.

Additionally, the app integrates a weather-based forecasting system to predict potential disease and pest outbreaks. Farmers can receive timely warnings based on local weather conditions, enabling them to take preventive measures in advance.

'Soybean Gyan' also includes an AI-enabled chatbot that provides 24/7 assistance, continuously updated soybean market prices, and multiple language options. The app is available for download on Google Play.

India currently imports nearly 60% of its edible oil requirements, highlighting the need to boost domestic oilseed production. Experts believe increasing soybean yields through technology-driven solutions like this AI app is essential for achieving self-sufficiency in edible oil production and enhancing farm incomes.

FSSAI Confirms Eggs in India Are Safe for Consumption

The Food Safety and Standards Authority of India (FSSAI) has clarified that eggs available in the country are safe for human consumption, dismissing recent claims linking eggs to cancer risk as misleading and scientifically unfounded.

Responding to reports and social media posts alleging the presence of carcinogenic substances such as nitrofuran metabolites (AOZ) in eggs, FSSAI emphasized that nitrofurans are strictly prohibited at all stages of poultry and egg production under the Food Safety and Standards (Contaminants, Toxins and Residues) Regulations, 2011.

An Extraneous Maximum Residue Limit (EMRL) of 1.0 µg/kg exists solely as a regulatory benchmark for enforcement, representing the minimum level detectable by advanced laboratory tests. Detection of residues below this limit does not indicate a violation or pose a health risk. FSSAI noted that India's regulations align with international standards, including those of the EU and the US, which also prohibit nitrofuran use and set reference points only for enforcement purposes.

Scientific evidence shows no causal link between normal egg consumption and cancer or other health risks. Isolated reports of residues in specific batches often result from inadvertent contamination or feed-related factors and are not indicative of the national egg supply.

FSSAI urged consumers to rely on verified scientific evidence and official advisories, reaffirming that eggs are a safe, nutritious, and valuable part of a balanced diet when produced and consumed in compliance with food safety regulations.

China Update: NDRC to Boost Grain Production with Focus on Corn and Soybeans

China's National Development and Reform Commission (NDRC) has announced a new initiative to increase grain production capacity by 100 billion jin (50 billion kilograms), prioritizing corn and soybean output while consolidating staple grain production, according to the commission's official account.

The move aims to accelerate agricultural and rural modernization in line with China's broader modernization goals. Key objectives include strengthening agricultural production capacity, improving quality and efficiency, and ensuring stable and secure supplies of grain and other essential agricultural products.

In addition to corn and soybeans, the NDRC plans to expand high-quality forage crops such as silage corn and alfalfa, while advancing large-scale yield improvement programs for major crops, increasing the production of specialty varieties, and aligning production with domestic demand. The initiative also emphasizes arable land protection, balanced land use, and optimization of agricultural land allocation.

Experts note that the focus on corn and soybeans reflects changing consumption patterns. While staple grain consumption is gradually declining, demand for feed grains continues to grow, with soybeans facing a significant domestic supply gap and high import reliance. According to Li Guoxiang, research fellow at the Rural Development Institute of the Chinese Academy of Social Sciences, the expansion aims to enhance domestic supply resilience and strategic autonomy, rather than serve export markets.

China's corn output reached 301.235 million tons in 2025, while soybean production stood at 23.932 million tons, according to the National Bureau of Statistics (NBS) on December 12. Total grain output in 2025 hit 1.43 trillion jin, exceeding 1.4 trillion jin for the second consecutive year, with per capita grain availability surpassing 500 kilograms, well above the internationally recognized food security threshold.

This initiative reflects a strategic shift toward effective capacity expansion, ensuring domestic grain security amid rising global trade uncertainties while stabilizing reliance on imports for key crops like soybeans.

VITAMINS

- SWISS VITAMIN - A
- SWISS VITAMIN - E
- SWISS VITAMIN - C
- SWISS VITAMIN - K
- SWISS VITAMIN - D2
- SWISS VITAMIN - B2
- SWISS VITAMIN - B9
- SWISS VITAMIN - D3
- SWISS VITAMIN - B5
- SWISS VITAMIN - B1

ANIMAL FEED SUPPLEMENT

SWISS CHEMIE

SWISS ANTIBIOTICS

- Chlortetracycline 15% (CTC) (BEST SELLER)
- Tiamulin 10/45/80
- Amoxicillin
- Ciprofloxacin
- Doxycycline
- Albendazole
- Fenbendazole
- Lincomycin Hcl
- Azithromycin
- Oxytetracycline
- Enrofloxacin
- Tetracycline Hcl
- Levofloxacin
- Virginiamycin 11%
- Anticoccidials

AMINO ACIDS

- DL-Methionine
- L-Lysine Hcl
- L-Threonine
- L-Tryptophan
- L-Valine
- L-Isoleucine

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