Livestock & Feed Trends

CLFMA OF INDIA

VOLUME - 23 • NUMBER - 3 • OCTOBER - DECEMBER 2025

"Strengthening Ties, Advancing Agriculture: CLFMA's Collaborative Impact Across Livestock Sector"

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Improvement in BWT in open shed

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Upto 30%

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#1 FCR point represent third/last decimal point of 1000

*Majority of field trials were conducted at same farm with multiple sheds in integrations across various geographical locations and at different time of the year. Some of the integrators were generous in sharing complete production indices while others communicated the summary of the trial results. In the field trials, Improval™ MS was compared with antibiotic/probiotic/antibiotic + probiotic/probiotic + prebiotic control. Detailed reports availble on request.

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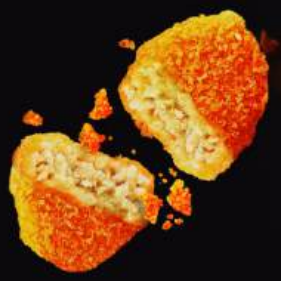

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From the Chairman's Desk.....

Dear Friends,

Warm greetings to you all!

The period from October to December 2025 has been an exceptionally dynamic and rewarding quarter for **CLFMA OF INDIA.** This phase has been marked by strong industry engagement, enhanced global representation, and steady progress across policy advocacy, knowledge dissemination, and stakeholder collaboration-reaffirming our association's leadership role in India's livestock and feed ecosystem.

It gives me immense pleasure to announce the **59th Annual General Meeting (AGM)** and the **67th National Symposium of CLFMA OF INDIA**, scheduled to be held on **11th and 12th September, 2026.** I request all members to kindly block these dates in your diary. The venue will be announced shortly. We look forward to your esteemed presence.

The past quarter witnessed several noteworthy developments, which are detailed comprehensively in the *CLFMA Activity Updates* section of this magazine. I would like to highlight a few key milestones:

I had the privilege of participating in the **National Media Curtain Raiser of Poultry India Expo 2025** in New Delhi and attending the **36th Annual General Meeting of the Poultry Federation of India (PFI)** in Lucknow. CLFMA's active participation in **Poultry India Expo 2025,** along with our engagement on platforms such as **PFI and IPEMA,** reaffirmed our unwavering commitment to the poultry sector-one of the most vital pillars of India's livestock economy. The encouraging response at the CLFMA stall and the enriching technical discussions during the Knowledge Day clearly reflected the growing industry emphasis on scientific feeding practices, sustainability, and innovation.

A truly historic milestone for our association during this quarter has been **CLFMA OF INDIA's first-ever representation on the Board of Directors of the International Feed Industry Federation (IFIF)**. This global responsibility significantly strengthens India's voice in shaping international discourse on feed, livestock development, and animal nutrition, and marks a proud moment for all our members.

In line with our commitment to nutrition awareness and social outreach, CLFMA celebrated **World Egg Day on 10th October 2025,** in collaboration with **Mumbai Veterinary College,** by promoting the nutritional importance of eggs among school students.

To further strengthen technical knowledge and industry preparedness, CLFMA, in association with the **U.S. Grains & Bioproducts Council (USGBC)** and **KPFBA,** successfully organized two informative webinars focusing on **DDGS and Sorghum in Animal Nutrition,** which received encouraging participation from industry stakeholders.

Our international engagement continued with participation in **CRUSHCON 2025 in Dubai,** and ongoing collaboration with global partners such as **USSEC** and **U.S. Grains & Bioproducts Council (USGBC).** These initiatives underline CLFMA's proactive approach to understanding global market dynamics, sustainable sourcing, and the development of resilient feed supply chains. Additionally, CLFMA supported the **2nd Millet–Maize–DDGS–Ethanol International Summit 2025** held in Gurugram, where I had the opportunity to

participate as a Guest Speaker, reinforcing our commitment to feed ingredient diversification and sustainability.

At the national level, CLFMA continues its constructive dialogue with policymakers on the promotion of alternative feed ingredients, including **grain sorghum and DDGS,** aimed at addressing rising input costs and advancing science-based, economically viable solutions for farmers.

As we move forward, CLFMA OF INDIA remains steadfast in its focus on **advocacy, capacity building, global engagement, and collaborative partnerships** to strengthen India's livestock and feed sectors.

I extend my sincere gratitude to all our members for your continued support, active participation, and unwavering trust. Together, we will continue to work toward building a **sustainable, competitive, and nutritionally secure future** for our industry and for our nation.

With warm regards,

For **CLFMA OF INDIA,**

Mr. Divya Kumar Gulati
Chairman

ASSOCIATION OF LIVESTOCK SECTOR

Announcement

CLFMA 59th AGM & 67th NATIONAL SYMPOSIUM 2026

Dear Sir / Madam,

We are pleased to inform you that, the 59th Annual General Meeting (AGM) and 67th National Symposium 2026 will be held on **September 11 & 12, 2026.**

You are requested to kindly block your dates for 59th Annual General Meeting and 67th National Symposium 2026.

With warm regards,

Divya Kumar Gulati
Chairman

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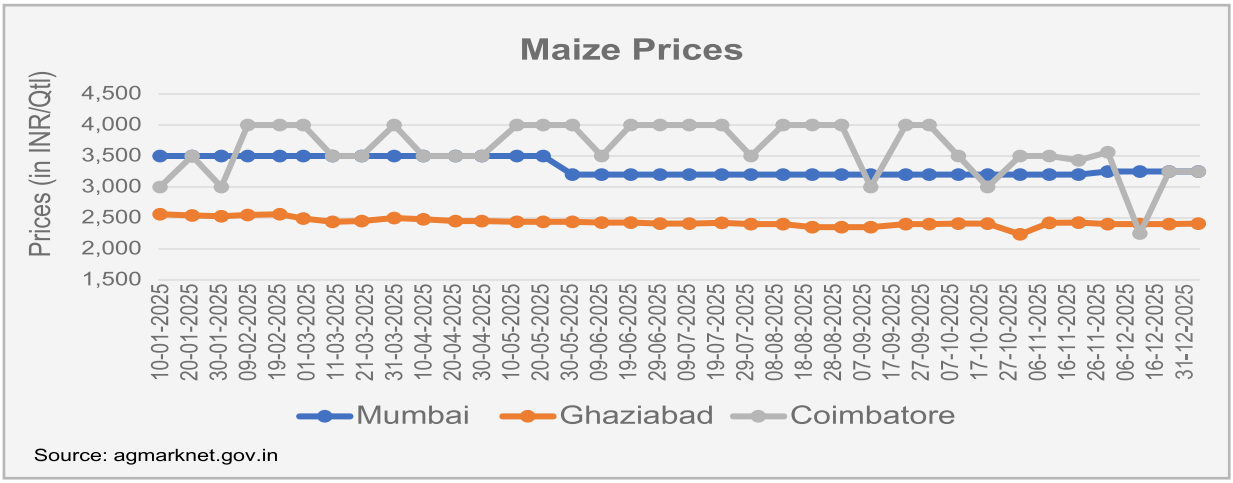
• website : www.clfma.org • E-mail : admin@clfma.org

Commodity Updates

1. Domestic Prices

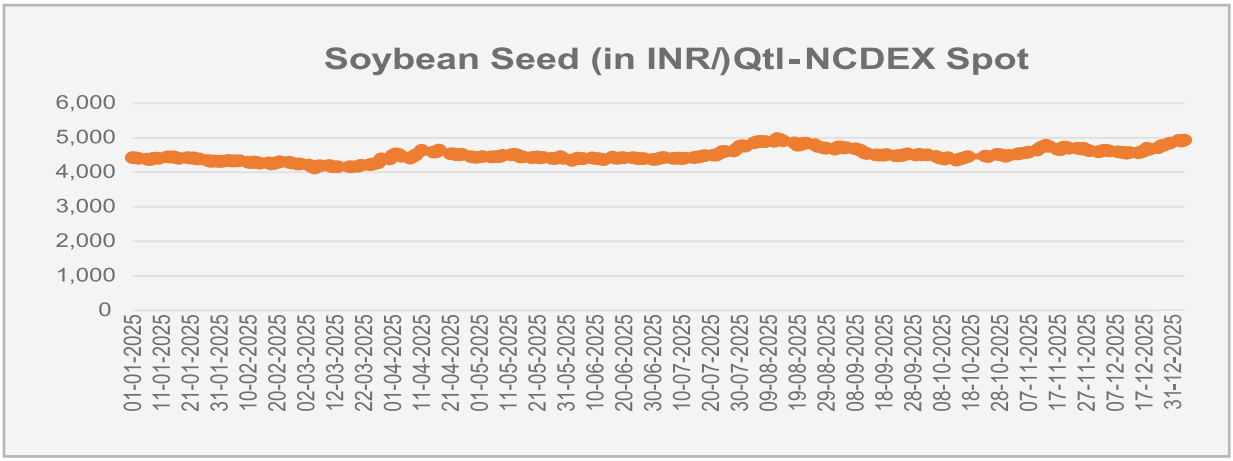
I. Maize



Source: agmarknet.gov.in

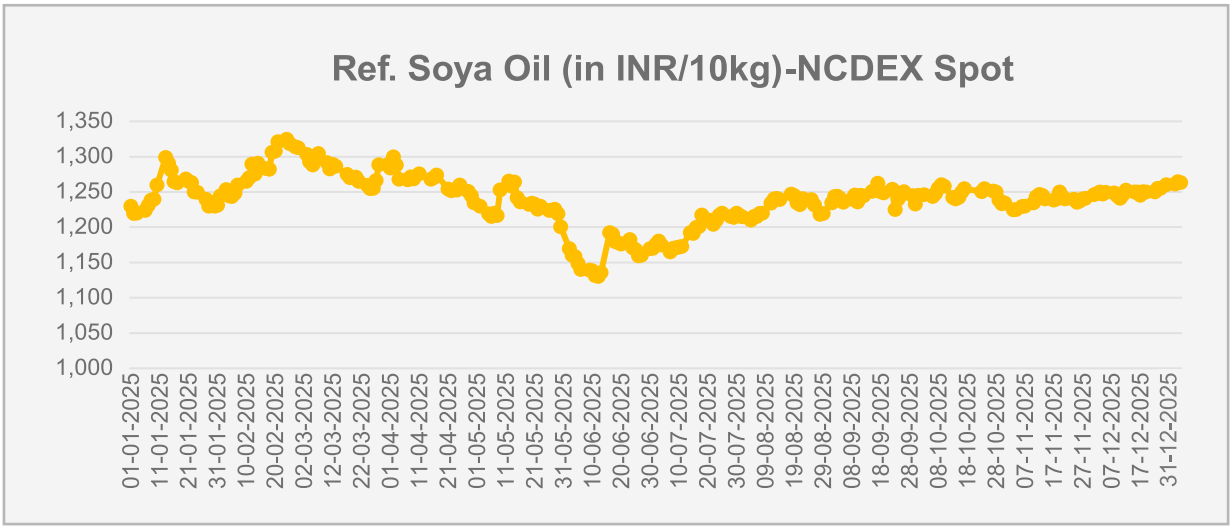
Maize Prices (INR/Quintal)		
City	**31/12/2025**	**30/11/2025**
Mumbai	3,250	3,250
Ghaziabad	2,410	2,400
Coimbatore	3,250	3,560

II. Soybean

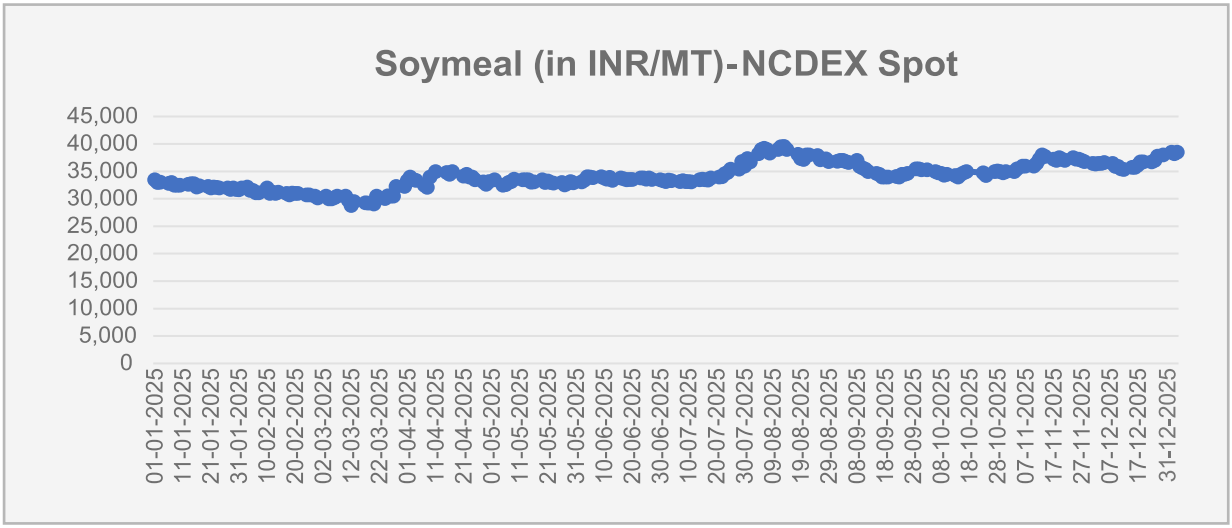


Soybean Complex Prices NCDEX Spot		
Commodity (Unit)	**31/12/2025**	**30/11/2025**
Soybean Seed (in INR/Qtl)	4,930	4,618
Ref. Soya Oil (in INR/10kg)	1,263	1,241
Soymeal (in INR/MT)	38,500	36,800

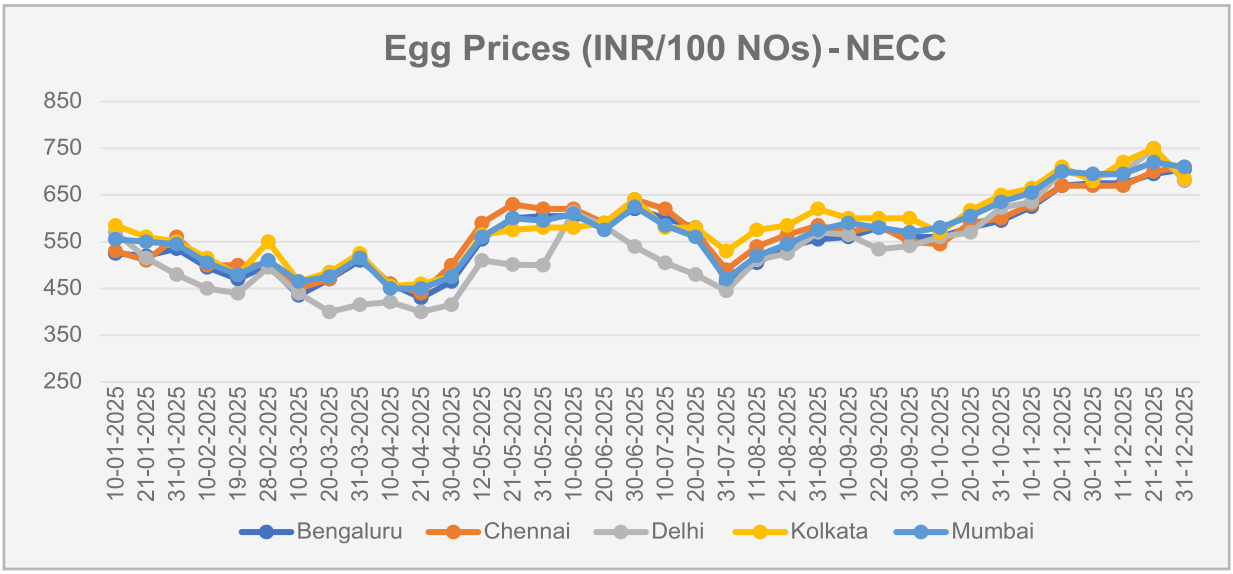
Ref Soya Oil



Soymeal



III. Egg Rates



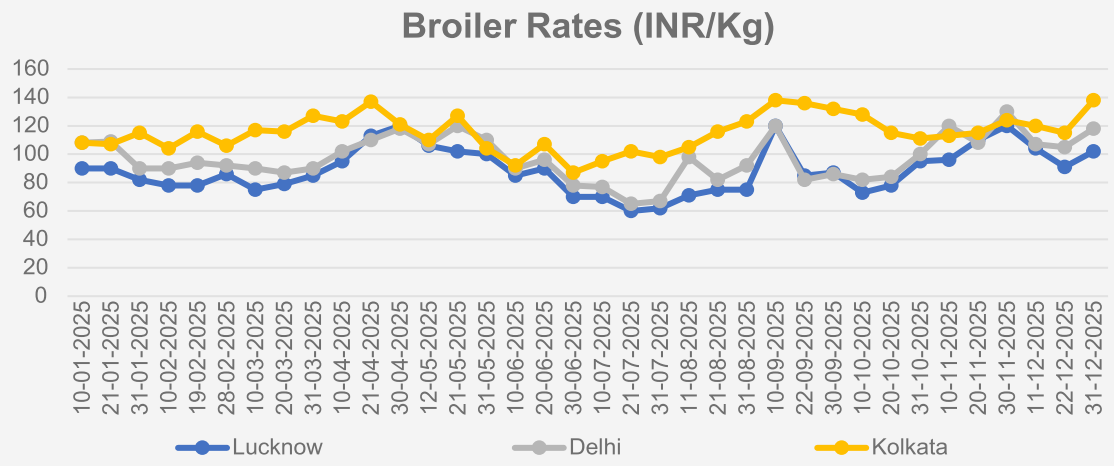
EGG PRICES (INR/100 NOs)		
Name of Zone	**31/12/2025**	**30/11/2025**
NECC Prices		
Ahmedabad	680	710
Ajmer	640	650
Barwala	630	645
Bengaluru (CC)	705	705
Brahmapur (OD)	640	655
Chennai (CC)	710	710
Chittoor	703	703
Delhi (CC)	680	700
E.Godavari	620	665
Hospet	645	645
Hyderabad	630	650
Jabalpur	655	665
Kolkata (WB)	685	685
Ludhiana	640	670
Mumbai (CC)	710	710
Mysuru	706	706
Namakkal	640	640
Pune	705	715
Raipur	640	655
Surat	700	715
Vijayawada	660	680
Vizag	660	660
W.Godavari	620	665
Warangal	632	652

III. Egg Rates

EGG PRICES (INR/100 NOs)		
Name of Zone	**31/12/2025**	**30/11/2025**
Prevailing Prices		
Allahabad (CC)	705	714
Bhopal	660	660
Indore (CC)	660	670
Kanpur (CC)	695	695
Lucknow (CC)	714	714
Muzaffurpur (CC)	700	710
Nagpur	660	665
Patna	700	710
Ranchi (CC)	705	714
Varanasi (CC)	707	717

Source: NECC

IV. Broiler Rates



BROILER RATES (INR/Kg)		
Location	**31/12/2025**	**30/11/2025**
Delhi	118	130
Punjab	109	118
Raipur	110	105
Pune	132	108
Bengaluru	138	101
Hyderabad	147	110
Guwahati	127	116
Kolkata	138	124
Bihar	128	125
Madhya Pradesh	147	109
Lucknow	102	120

Source: SRP (Wholesale Rates)

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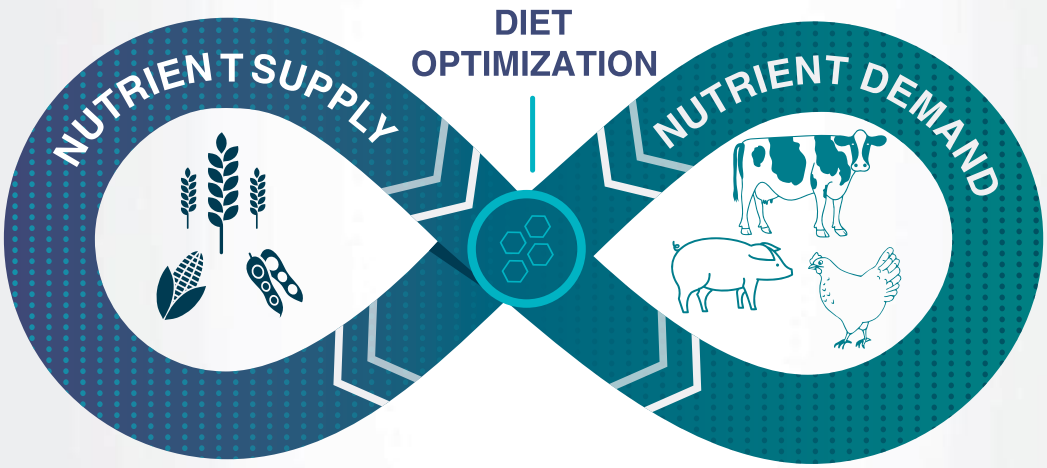

CNS by the Numbers

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3
million samples tested per year

More than
1.5M
wet chemistry tests conducted per year

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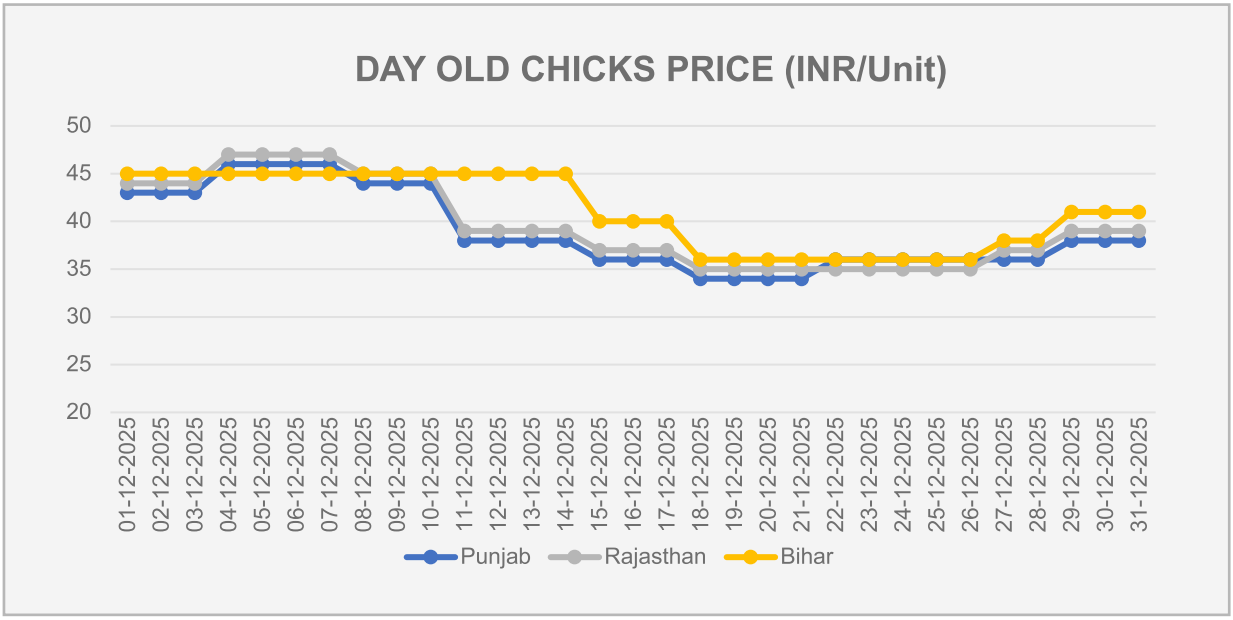
V. Day old Chicks Price

DAY OLD CHICKS PRICE (INR/Unit)		
State	**31/12/2025**	**30/11/2025**
Punjab	38	43
Dehradun	39	44
Haryana	38	43
Himachal Pradesh	39	44
Rajasthan	39	44
Jammu	40	45
Andhra Pradesh	50	47
Uttar Pradesh	40	44
Madhya Pradesh	40	47
Telangana	50	47
Bihar	41	45
Jharkhand	41	45
Gujarat	36	47

Source: Poultry India TV/ SRP



VI. Fish Prices

Fish Prices Average Price (INR/Quintal)		
Fish Type	**31/12/2025**	**30/11/2025**
Bata Putti	9,000	6,500
Black Dom	16,000	13,000
Blue Dom	14,500	12,500
Chilwa	18,000	10,500
Halwa	36,000	27,500
Hilsa	55,000	43,000
Katla (Small)	11,500	9,500
Malli (Big)	22,500	19,500
Malli (Small)	16,000	13,000
Pangass	9,000	8,000
Katla (Big)	17,000	16,000
Singhra (Big)	45,000	25,000
Singhra (Small)	23,500	15,000
Surmali (Small)	40,000	24,000
Surmai (Big)	60,000	34,000
Sol	35,000	40,000
Soli	20,000	19,000
White Dom	17,000	13,000
Rahu (Andhra)	13,000	11,500
Zinga (Zambo-A)	55,000	45,000
Zinga (Zambo-B)	40,000	40,000
Zinga (Zambo-C)	35,000	26,000

Source: agmarknet.gov.in
The Prices are of Delhi (Gazipur Mandi)

2. Global Commodity Prices

Commodity (Unit)	PRICE (31/12/2025)
Milk (USD/CWT)	15.18
Rapeseed (Euro/Ton)	451.75
Soybean Meal (USD/Ton)	294.30
Soybean Oil (USD/lb)	0.49
Live Cattle (USD/Lbs)	2.32
Poultry (USD/Kgs)*	1.55
Eggs US (USD/Dozen)	0.59

Source: tradingeconomics; markets.businessinsider

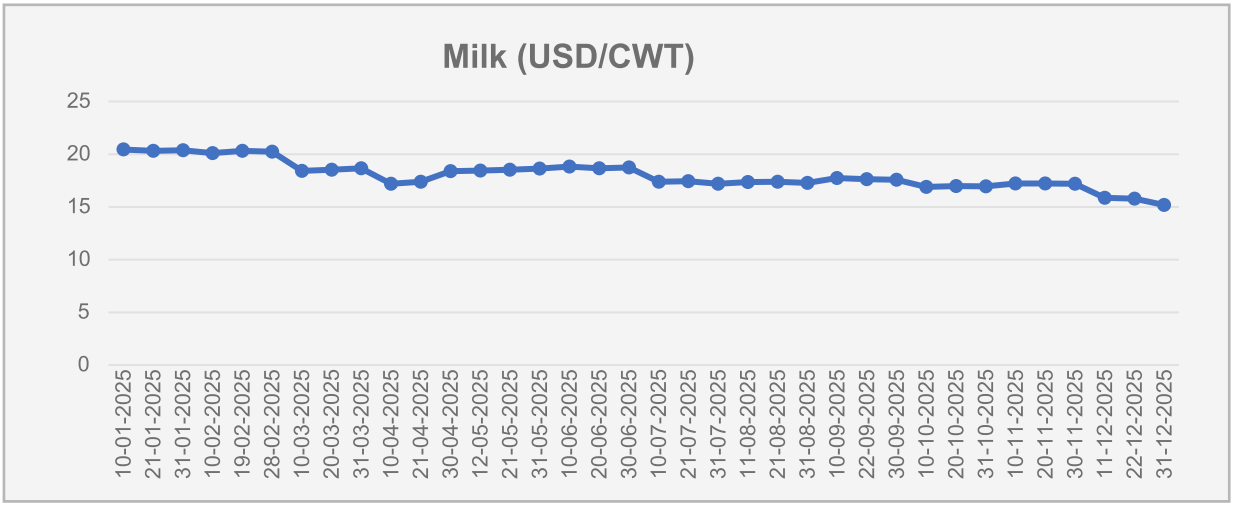
USD: United States Dollar

CWT: Short Hundredweight

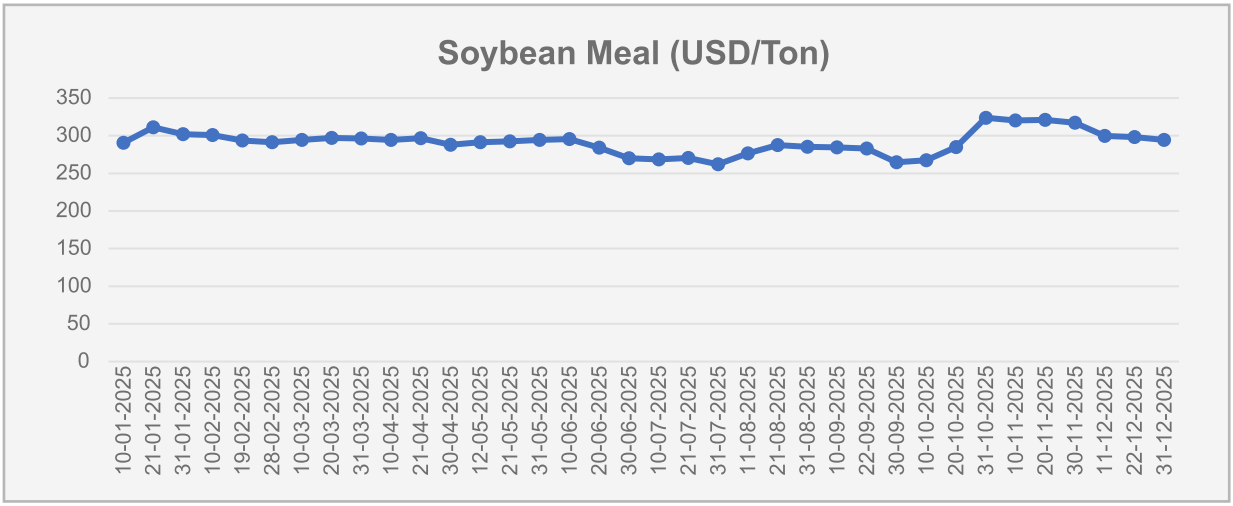
Lbs: Pounds

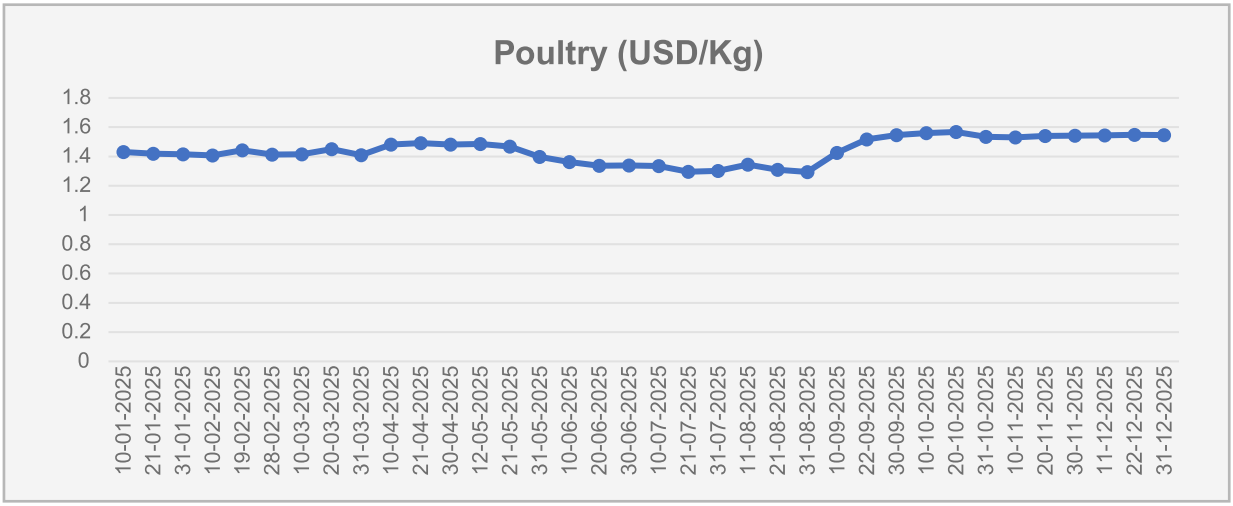
1 BRL (Brazilian Real) = 0.18 USD

*-Poultry price refers to the cost of the chicken in the wholesale market of São Paulo, Brazil. The price is converted from BRL to USD using above conversion rate.



2. Global Commodity Prices





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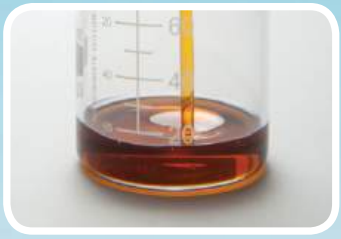
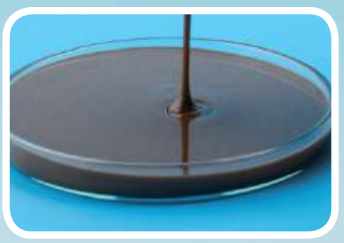

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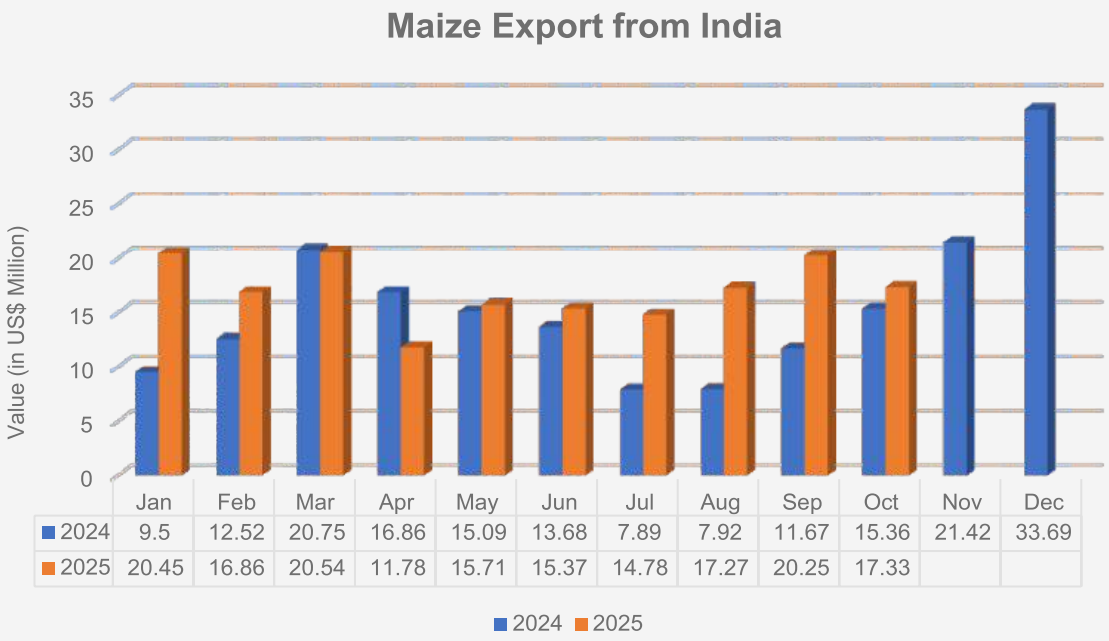
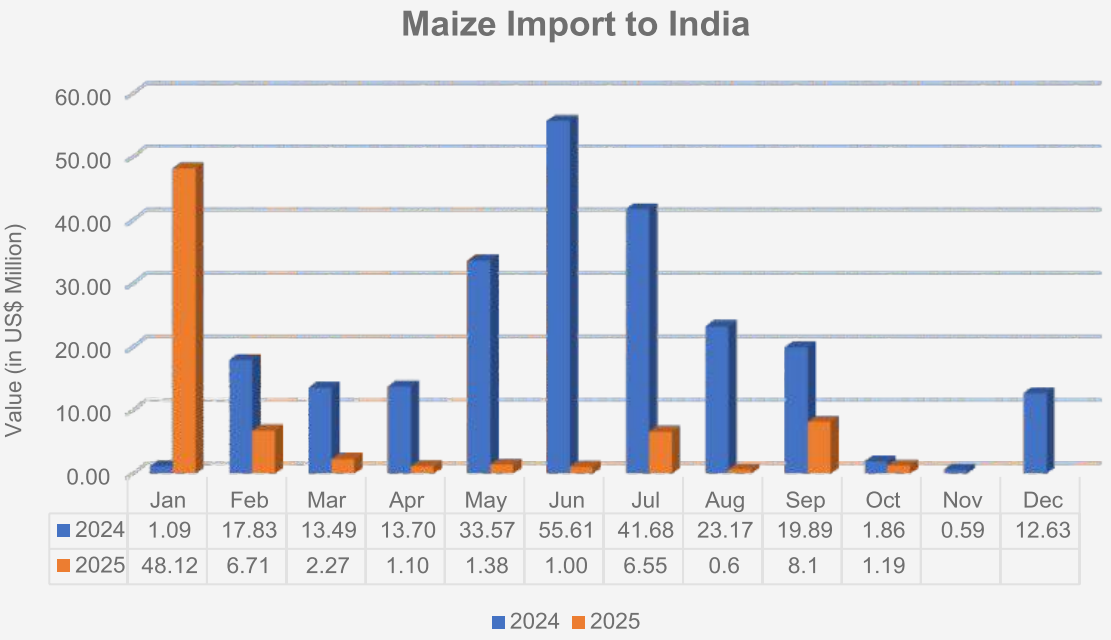
3. Trade Details

India: Maize Export



Source: Ministry of Commerce and Industry, **HS Code-1005**

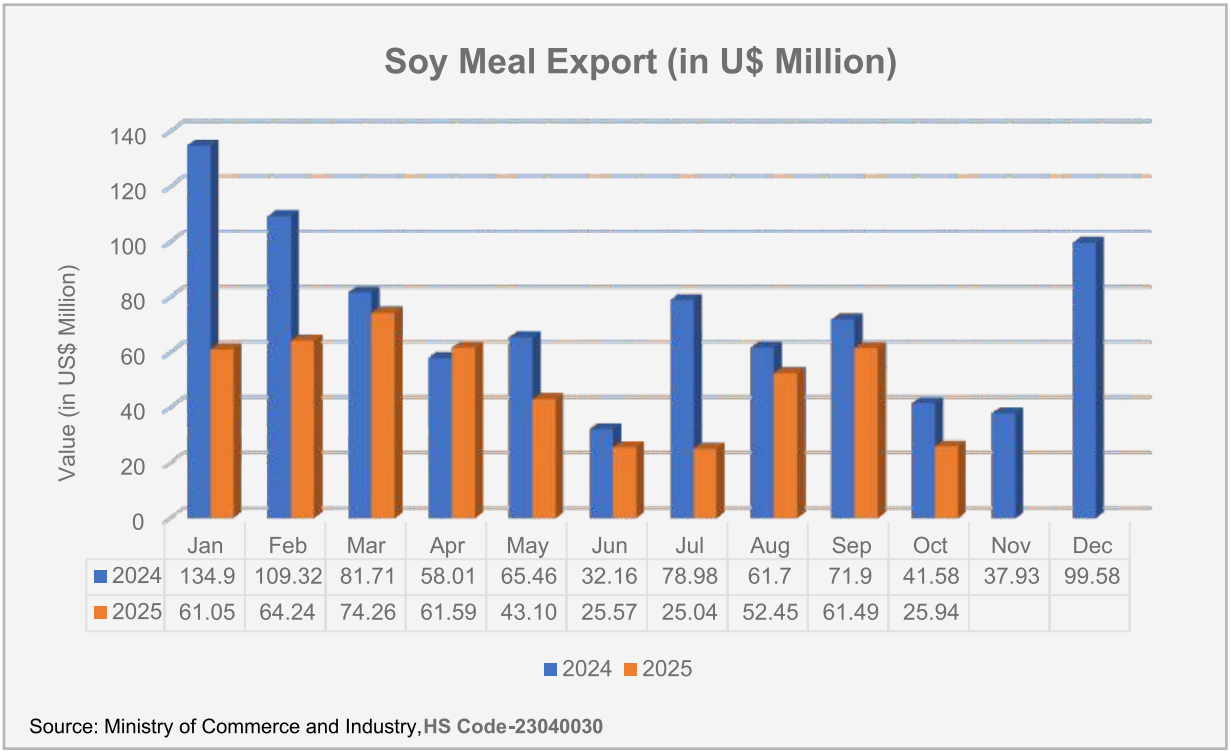
India: Maize Import



Source: Ministry of Commerce and Industry, **HS Code -1005**

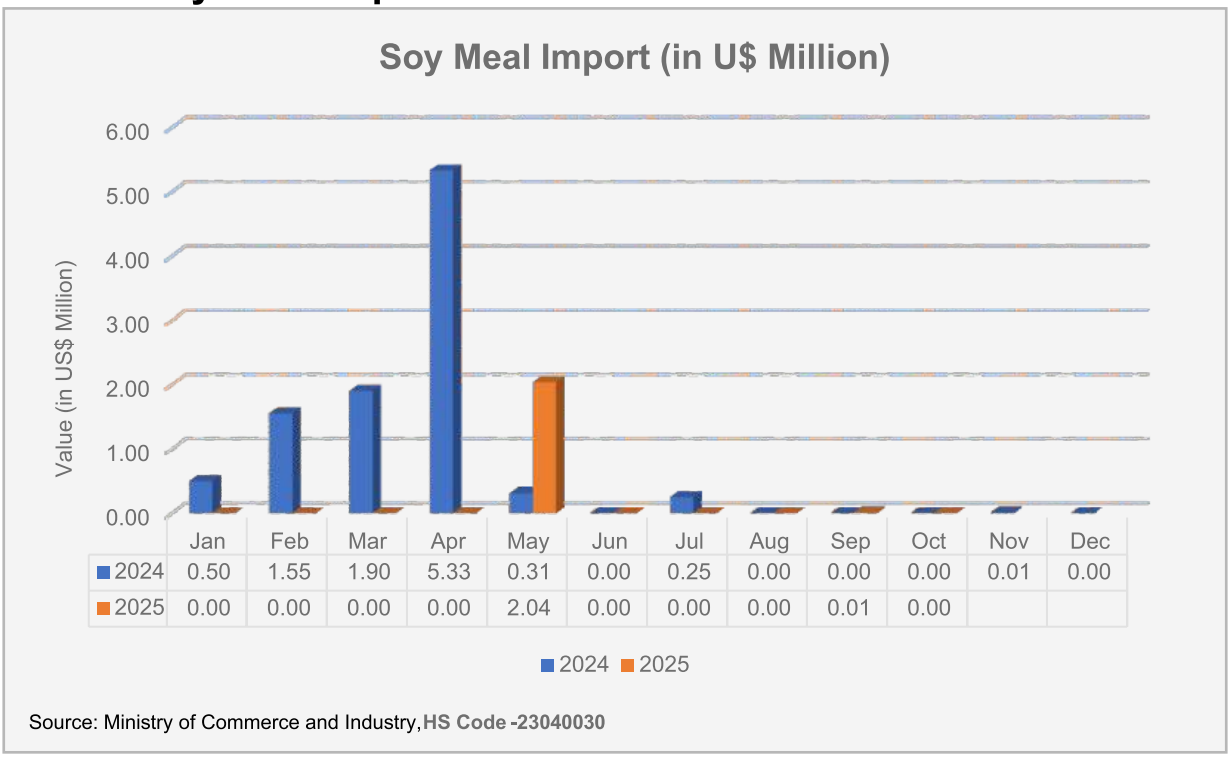
Note: This Data is sourced from the Ministry of Commerce and Industry, which was last updated in October.

India: Soy Meal Export



Source: Ministry of Commerce and Industry, **HS Code-23040030**

India: Soy Meal Import



Source: Ministry of Commerce and Industry, **HS Code -23040030**

Note: This Data is sourced from the Ministry of Commerce and Industry, which was last updated in October.

5. Market Drivers

Maize	
Market Drivers	**Monthly Outlook**
Growing Demand for Poultry and Livestock Feed	Bullish
Rising demand for Ethanol in Auto-fuels	Bullish
Increasing Demand as a Wheat Substitute due to Wheat Export Ban	Bullish
Increasing Food Inflation	Bearish
Commercialization of Genetic Modified Maize Crop	Bullish
Increasing demand for Coarse Cereals	Bullish

Poultry	
Market Drivers	**Monthly Outlook**
Rapid Growth in Consumer Demand for Livestock Products	Bullish
Rising Demand for White Feather Broilers	Bullish
Increasing Broiler Chicken Price Increases Due to Higher Feed Cost	Bearish
Increasing Food and Feed Inflation	Bearish
Enhancement of Backyard Poultry Farming	Bullish
Increasing the Demand of Organic Poultry Farming	Bullish

Regards,
CLFMA OF INDIA
111, Mittal Chamber, 11th Floor,
Nariman Point, Mumbai - 400 021, INDIA
Telephone: +91-22-22026103

Sourced by: IMARC Group

CLFMA ACTIVITY UPDATES

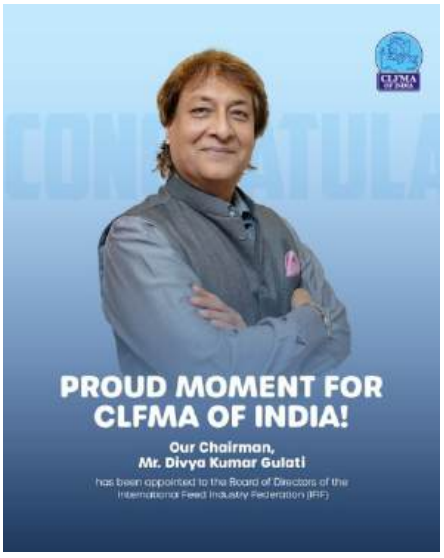
IFIF elects new Chair and Leadership Team for 2026-2027 on 1st October, 2025; A Proud Moment and Historic Milestone for CLFMA of India.

For the first time in CLFMA's illustrious history, we are proud to announce that our **Chairman, Mr. Divya Kumar Gulati, has been appointed to the Board of Directors of the International Feed Industry Federation (IFIF) for the term 2026–2027.**

This prestigious appointment marks a significant milestone, as **CLFMA of India** is honoured to represent the nation on the global stage. Mr. Divya Kumar Gulati's inclusion in the IFIF Board strengthens India's voice in shaping the future of sustainable growth, innovation, and collaboration within the global feed and livestock sector.

We extend our heartfelt gratitude to Ms. Constance Cullman, the newly appointed Chair of IFIF; Mr. Roberto Betancourt, First Vice Chair; Dr. Reinder Sijtsma, Treasurer; and the other esteemed members of the elected Board of Directors. We also sincerely thank Mr. Ruud Tijssens for his exemplary leadership as IFIF Chair (2022–2025), and Ms. Alexandra de Athayde, Executive Director of IFIF, for her continued dedication and guidance.

Together, we look forward to contributing meaningfully to IFIF's mission and advancing the shared goals of the global feed and livestock community.



Chairman CLFMA of India, Mr. Divya Kumar Gulati at Poultry India Expo 2025, Curtain Raiser Highlights CLFMA's Perspective.

The 17th edition of Poultry India Expo 2025 was formally introduced through a National Media Curtain Raiser held on 6th October 2025 in New Delhi. The session, led by IPEMA President Mr. Uday Singh Bayas in the presence of senior leadership and key dignitaries, set the tone for South Asia's largest poultry exhibition.

CLFMA Chairman Mr. Divya Kumar Gulati attended the programme as a distinguished guest, reflecting CLFMA's continued engagement with stakeholders across livestock and allied sectors.

The upcoming Poultry India Expo 2025, scheduled from 25–28 November 2025 at HITEX, Hyderabad, aims to showcase innovation, foster knowledge exchange, and strengthen industry linkages. Knowledge Day will precede the expo on 25th November at Novotel, Hyderabad.

India's Poultry Sector - Strategic Relevance

With India now among the world's leading producers of eggs and broiler meat, poultry contributes significantly to:

- Affordable protein access & nutrition security
- Rural employment & farmer livelihood
- Economic growth through structured value chains
- Sustainable food systems with low resource intensity

CLFMA recognizes poultry as a critical pillar within the livestock ecosystem, complementing dairy, aqua, and other allied sectors in ensuring food, nutrition, and economic resilience for the country.

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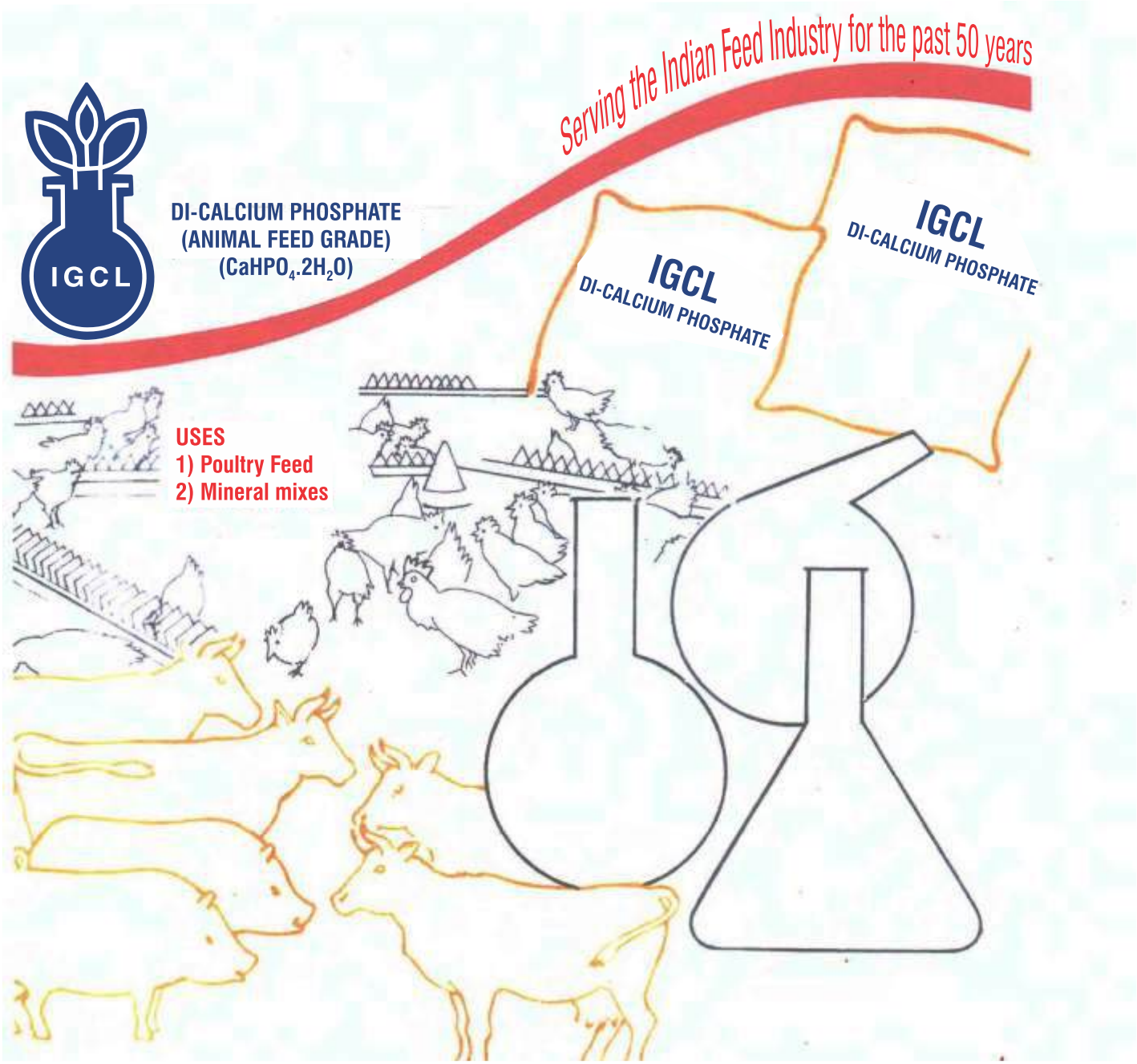

SPECIFICATIONS

(1) Moisture content	7. 0% Max
(2) Phosphorous as "P"(Total)	16.6-18.3 %
(3) P205 (Total)	38-41 %
(4) Calcium as CA	23.0 % Min
(5) Acid insoluble ash	1. 0 % Max.
(6) Flourine as F	0.2 % Max.

N.B.: The contents for item (2) to (6) are on moisture-free basis.

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Chairman CLFMA of India, Mr. Divya Kumar Gulati, attended PFI's 36th Annual General Meeting held on 8–9 October 2025 at Hotel Ramada, Lucknow.

CLFMA OF INDIA celebrated World Egg Day on 10th October, 2025

CLFMA of India and Mumbai Veterinary College celebrated World Egg Day on 10th October, 2025 at Ahilya Vidya Mandir High School, Kalachowki, Parel, Mumbai. From CLFMA OF INDIA Ms. Poonam Mestry, Ms. Shraddha Kadam & Mr. Dinesh Ambavkar celebrated the World Egg Day by distributing eggs to Students.

In response to CLFMA's representation dated 9th June 2025, requesting one-time permission to import 300 MT of Non-GMO, tannin-free Grain Sorghum from the United States for conducting scientific poultry feed trials in India, in view of the rising input costs for livestock

farmers we received an email dated 13th October 2025 from Dr. Astha Pant, Livestock Officer (NLM), addressed to CLFMA Chairman Mr. Divya Kumar Gulati (PMO reference: PMO ID No. 5949532/PMO/2025/AR dated 21.08.2025):

In this regard, it is informed that the Department of Animal Husbandry and Dairying, Ministry of Fisheries, Animal Husbandry and Dairying, Government of India, has written to the Department of Agriculture and Farmers Welfare and to the Department of Commerce, stating that the decision on the import of U.S. Grain Sorghum for animal feed may be taken by the Department of Commerce, in consultation with the Department of Agriculture and Farmers Welfare, subject to fulfillment of the prescribed phytosanitary requirements.

CLFMA of India, in collaboration with the U.S. Grains & Bioproducts Council (USGBC) and the Karnataka Poultry Farmers & Breeders Association (KPFBA), hosted two knowledge enhancing webinars on modern feed ingredients "DDGS Use in Livestock Diets: Optimizing Performance" on 5th November 2025, and "Sorghum Uses in Animal Nutrition" on 13th November 2025, both held from 5:00 pm to 7:00 pm.

In September 2025, the delegation comprised senior CLFMA office bearers including Chairman, Mr. Divya Kumar Gulati, Dy. Chairmen Viz. Mr. Sumeet Surekha, Mr. Naveen Pasuparthy, Mr. Abhay Parnerkar, Mr. Abhay Shah, Hon. Secretary Mr. Nissar F. Mohammed & Treasurer Mr. R. Ramkutty, President East Zone Mr. Sameer Chotai & Immediate Past Chairman Mr. Suresh Deora visited several ethanol plants, as well as Corn and Sorghum fields across the United States. The scale of operations, advanced technologies, robust logistics, and efficient bulk-handling systems showcased during the visit highlighted the emerging global realities in feed ingredients. This experience underscored the importance of exposing and educating the Indian animal feed sector about new U.S.-origin feed products and their nutritional value.

To build on these insights, CLFMA of India, in partnership with U.S. Grains & Bioproducts Council (USGBC) and the Karnataka Poultry Farmers & Breeders Association (KPFBA), organized two focused webinars: "DDGS Use in Livestock Diets: Optimizing Performance" on 5th November 2025, and "Sorghum Uses in Animal Nutrition" on 13th November 2025, from 5:00 PM to 7:00 PM. These sessions were open to farm owners, nutritionists, veterinarians, and feed production managers.

The objective of these webinars was to share scientific knowledge, enhance understanding, and equip participants with practical insights on the composition, applications, and benefits of innovative U.S.-origin feed ingredients in animal nutrition.

The programs featured expert speakers from the U.S., including farmers, DDGS producers, and renowned animal nutritionists. Both webinars received an encouraging response, **with 81 participants attending the first and 54 joining the second.** The active participation of stakeholders from diverse segments of the animal health and nutrition industry reflects the growing interest in globally competitive and nutritionally efficient feed solutions.

CLFMA OF INDIA Applauds the Grand Success of the 17th Poultry India Expo 2025.

The Compound Livestock Feed Manufacturers Association (CLFMA) OF INDIA congratulates the Indian Poultry Equipment Manufacturers' Association (IPEMA) on the resounding success of the 17th Poultry India Expo 2025, held from 25–28 November 2025 at HITEX Exhibition Centre, Hyderabad.

CLFMA OF INDIA was pleased to extend its support to this landmark event, which has firmly established itself as one of the largest and most influential poultry exhibitions globally. The expo served as a powerful platform for innovation, technology exchange, and collaboration across the entire poultry value chain, truly reflecting the spirit of "One Nation, One Expo."

Several CLFMA member companies actively participated and visited the exhibition, engaging with global equipment manufacturers, technology providers, nutrition experts, and solution developers. The interactions facilitated valuable discussions on feed technology, raw material efficiency, farm automation, sustainability, biosecurity, and emerging challenges in poultry production, all of which are directly relevant to India's rapidly evolving feed and livestock ecosystem.

CLFMA appreciates the strong industry–government engagement witnessed during the expo, with the presence of eminent Ministers, Members of Parliament, and senior leaders from Telangana, reinforcing the importance of collaborative efforts in strengthening India's poultry and allied sectors.

The Poultry Knowledge Day 2025 was particularly noteworthy, offering meaningful insights into future-ready feed planning, disease management, sustainability, rural market development, and skill development, areas that resonate closely with CLFMA's ongoing initiatives to promote scientific feeding practices and sustainable livestock growth.

As India continues its journey toward becoming a global poultry powerhouse and aligns with the vision of **Viksit Bharat 2047,** platforms like Poultry India Expo play a critical role in uniting stakeholders, accelerating innovation, and shaping a resilient, sustainable future for the sector.

CLFMA of India participated in Poultry India 2025 with a dedicated stall (JJ37), where the CLFMA Secretariat, along with Office Bearers and Members, actively promoted the livestock sector. The stall received a significant number of visitors. Ms. Sree Roopa, IAS, Commissioner of Animal Husbandry, Government of Karnataka, also visited the CLFMA stall.

CLFMA OF INDIA commends IPEMA and the Poultry India team for their exemplary efforts in organizing this record-breaking edition and looks forward to continued collaboration in advancing India's poultry and feed industries.











CLFMA OF INDIA Participated in CRUSHCON 2025 Hosted by USSEC–MENASA at Dubai on 03-04 Dec 2025.

CLFMA OF INDIA actively participated in CRUSHCON 2025, hosted by the U.S. Soybean Export Council (USSEC) – Middle East, North Africa & South Asia (MENASA) region at W Dubai - The Palm. The conference emerged as one of the region's most influential platforms, bringing together global thought leaders, policymakers, economists, researchers, and agribusiness experts to deliberate on how soy, sustainability, innovation, and trade are reshaping the global feed and food ecosystem.

The event focused on building a sustainable, responsible, and resilient soy value chain, highlighting global market trends, data-driven insights, AI-enabled decision-making, and collaborative opportunities across feed, food, edible oil, and protein sectors. These discussions strongly resonated with CLFMA OF INDIA's mission of strengthening India's livestock, poultry, and aquaculture value chains through reliable feed raw material sourcing and sustainable trade.

The event kicked off with Mr. Kevin Roepke, Executive Director – USSEC MENASA's presentation, highlighting Key Global Trends shaping 2026. Mr. Jeff Zimmerman, Regional Agricultural Counselor, U.S. Consulate, highlighted U.S.–Gulf cooperation in agricultural trade and development. Mr. Jim Sutter, CEO – USSEC, emphasized the evolving role of the global soy industry in strengthening nutrition security, noting that nearly 15% of the world's calories are expected to move across borders, making trade a critical pillar of future food and feed security-particularly for fast-growing regions such as South Asia, the Middle East, and Africa.

Ms. Janna Fritz, Chair – USSEC and U.S.

Soy farmer leader, shared insights on sustainable production and farm-level innovation, while Ms. Susan Watkins, United Soybean Board, and Mr. Rob Shaffer, American Soybean Association, highlighted how U.S. farmers are investing in sustainability, global market development, and long-term supply reliability.

A powerful keynote by Mr. Mark Z., Founder – Tillridge Partners & Bunge Board Member, addressed global agri-investment trends and capital efficiency. Mr. Tanner Ehmke and Ms. Candace Roper of CoBank provided valuable perspectives on macroeconomic forces, inflationary pressures, and commodity market outlooks impacting feed raw materials globally.

Post-lunch sessions reinforced soy's nutritional and sustainability advantages. Ms. Christelle Cordahi, MS, RD – USSEC MENASA, spoke on how sustainability creates shared value across the soy supply chain. Mr. Will McNair and Mr. Tom D'Alfonso, Global Directors – USSEC, highlighted soy's role in differentiated human and animal nutrition. Research-based insights on soymeal's nutritional energy value and its future in poultry diets were shared by Dr. M. Reza Abdollahi, Massey University, New Zealand, and Mr. Matthew Clark, The FeedGuys, Malaysia. Mr. Roberto Rigobon, MIT, introduced data-driven predictive analytics models for soy production and global trade.

A key theme across sessions was the rising demand for protein and vegetable oils as urbanization and incomes grow. While protein consumption eventually plateaus, vegetable oil demand continues to rise, positioning soy uniquely as a dual-purpose crop for both high-quality feed protein and edible oil an insight of strong relevance to India's feed and livestock sectors.

The conference also highlighted emerging challenges such as heat stress, energy efficiency, and feed formulation, particularly in rapidly expanding poultry regions. Discussions emphasized the importance of highly digestible proteins and high-energy, low-mycotoxin soybean meal, where U.S. Soy offers a clear performance and sustainability advantage supporting bird productivity while mitigating metabolic heat stress.

The day concluded with the HungerCon Networking Dinner hosted by Right to Protein, celebrating innovation in food and nutrition. The evening featured curated dishes using U.S. High Oleic Soybean Oil, introduced by Ms. Deeba Giannoulis, USSEC MENASA. Ms. Janna Fritz reaffirmed U.S. Soy's commitment to global nutrition security, while Ms. Julie Borlaug, President, The Borlaug Foundation, delivered a moving keynote on her grandfather's legacy and the ongoing fight against global hunger.

Reflecting the spirit of "Connect, Collaborate, Catalyse," CRUSHCON 2025 reinforced U.S. Soy's role as a trusted partner in building sustainable, resilient, and protein-secure global food systems. The discussions were particularly relevant for CLFMA OF INDIA, as India continues to strengthen its feed, poultry, dairy, and aquaculture sectors amid evolving global trade dynamics and sustainability expectations.

CLFMA OF INDIA was represented by a strong leadership delegation, underscoring its commitment to global engagement and strategic collaboration:

- Mr. Divya Kumar Gulati, Chairman
- Mr. Naveen Pasuparthy, Dy. Chairman
- Mr. Abhay Shah, Dy. Chairman
- Mr. Nissar F. Mohammed, Hon. Secretary
- Mr. R. Ramkutty, Treasurer
- Mr. Suresh Deora, Immediate Past Chairman
- Mr. Sunil Kataria, CEO & MD, Godrej Agrovet Ltd.

CLFMA OF INDIA's participation at CRUSHCON 2025 reaffirmed its proactive role in engaging with global stakeholders, promoting sustainable feed solutions, and supporting policies and partnerships that enhance nutrition security, trade resilience, and the long-term growth of India's livestock and allied sectors.

The 2nd Millet–Maize–DDGS–Ethanol International Summit 2025, themed "Unlocking the Future of Millets, Maize, DDGS and Ethanol," was successfully held on 15th–16th December 2025 at Hotel Leela Ambience, Gurgaon, Delhi. CLFMA of India extended its support to this significant international event.

The summit served as an important platform for deliberations on the evolving role of millets, maize, DDGS, and ethanol in India's Agri, feed, and bioenergy ecosystem.

Chairman CLFMA of India, Mr. Divya Kumar Gulati, was invited as a Guest Speaker at the summit, reflecting the association's active engagement in policy and industry dialogues related to feed ingredients, raw material availability, and sustainability. His participation highlighted CLFMA's commitment to promoting balanced growth across the livestock, feed, and ethanol sectors, while encouraging greater collaboration between stakeholders across the value chain.

The summit witnessed participation from a wide cross-section of stakeholders, including trade and industry experts, business leaders, importers and exporters, millers, leading agencies, government bodies, policymakers, traders, processors, retail investors, corporate groups, commodity exchanges, logistics and warehousing companies, machinery and technology manufacturers, industrial equipment suppliers, government boards, and industry associations related to maize, millets, DDGS, and ethanol from India and

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AMMONIUM DIPROPIONATE LIQUID/POWDER

BUTYRATES

SODIUM BUTYRATE POWDER (98 %)

SODIUM BUTYRATE COATED (30%,60% & 90 %)

CALCIUM BUTYRATE POWDER (98 %)

CALCIUM BUTYRATE COATED (30%,60% & 90%)

FORMATES

POTASSIUM FORMATE POWDER

POTASSIUM DIFORMATE POWDER

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GLYCINE CHELATED TRACE MINERALS

ZINC GLYCINE SULPHATE

COPPER GLYCINE SULPHATE

MANGANESE GLYCINE SULPHATE

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BISGLYCINATES

ZINC BISGLYCINATE

COPPER BISGLYCINATE

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FERROUS BISGLYCINATE

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abroad. The diverse participation enriched discussions and underscored the growing global importance of these sectors.

Dairy Seminar at KVASU - Mannuthy postponed.

CLFMA of India, the U.S. Grains Council, and the Bioproducts Council had planned to organize a Dairy Seminar on 10th December 2025 at Kerala Veterinary and Animal Sciences University, Mannuthy, from 10:00 a.m. to 1:30 p.m. However, the seminar has been postponed due to the upcoming elections in Kerala. The Seminar will be rescheduled during **January–February 2026.**

National Veterinary Commission (NVC) Bill - High Level Committee Meeting.

The Meeting of the High Level Committee constituted to draft the National Veterinary Commission (NVC) Bill, hosted by the Department of Animal Husbandry & Dairying (DAHDj was scheduled on 20th December 2025 at 11:30 AM. CLFMA Chairman, Mr. Divya Kumar Gulati, participated in the meeting virtually.

Government Launches 16 Major Fisheries Projects Worth Over Rs 693 Crore

Prime Minister Narendra Modi on October 11, 2025 launched and laid the foundation for 16 major fisheries projects worth over Rs. 693 crore, aimed at strengthening India's Blue Economy and supporting fishers and farmers across the country. The projects were unveiled during a special Krishi program at the Indian Agricultural Research Institute in New Delhi. Implemented under the Pradhan Mantri Matsya Sampada Yojana (PMMSY) and the Fisheries Infrastructure Development Fund (FIDF), the initiatives include seven new projects with foundation stones laid, valued at Rs. 572 crore, and nine inaugurated projects worth Rs. 121 crore. These efforts are expected to enhance fisheries infrastructure, generate employment, boost exports, and improve livelihoods for both coastal and inland communities. Highlighting the government's focus on additional income sources for farmers, PM Modi emphasized that sectors like animal husbandry, fisheries, and beekeeping are being actively promoted to benefit small and landless farmers. Among the key initiatives is the Rs. 170 crore Trout Fisheries project in Uttarakhand, aimed at increasing trout production and creating employment opportunities in the region. Puducherry will see the development of a Rs. 119.94 crore Smart and Integrated Fishing Harbour in Karaikal, designed to provide safe docking, hygienic fish handling, and improved marketing for domestic and export purposes. Odisha's Rs. 100 crore Integrated Aqua Park in Hirakud will support tilapia and pangasius production, cage farming, hatchery operations, and fish processing, benefiting over 1,700 farmers while providing training to 700 individuals. Another notable project is Rs. 70 crore Nutrition Hub of Sustainable Aquaculture in Amethi, Uttar Pradesh, which will focus on eco-friendly fish feed production and modern aquaculture practices to increase farmer profitability. Across states including Assam, Madhya Pradesh, Haryana, Jharkhand, Andhra Pradesh, Mizoram, and Chhattisgarh, multiple projects such as feed mills, cold storages, ice plants, and biofloc systems were inaugurated or approved to improve fish production, processing, and marketing. The event also witnessed enthusiastic participation from local fishers and progressive farmers representing 100 Aspirational Agricultural Districts.

CMFRI Aims 2.5 Million Tonnes of Mariculture Production by 2047

Addressing the surging seafood demand, the ICAR-Central Marine Fisheries Research Institute (CMFRI) is aiming to achieve 2.5 million tonnes mariculture production in India by 2047 from the present 1.5 lakh tonnes. Highlighting that mariculture is the next big thing in India's marine fisheries sector, CMFRI Director Grinson George said various technologies such as cage culture and Integrated Multi-Trophic Aquaculture (IMTA) could be utilized to increase the marine fish production. He was speaking after inaugurating a training programme for fish farmers at CMFRI marking the nationwide launch of Central Government's Pradhan Mantri Dhan Dhanya Krishi Yojana (PMDDKY). India currently produces an average 3.5 million tonnes from marine capture fisheries annually. Due to climate change and resource depletion, the country needs to explore alternative systems such as mariculture to increase marine fish production, he said. CMFRI has developed several mariculture technologies suited to Indian conditions, which can substantially enhance productivity and fishermen livelihood opportunities. He said that the country has immense potential in seaweed farming, another major component in mariculture. While the global seaweed production stands at 35.5 million tonnes, India's production remains very low. At least 5 million tonnes of domestic seaweed production could be achieved to meet the growing industrial and nutraceutical demand. India has the natural potential and scientific capability to emerge as a global mariculture hub. "If we adopt modern technologies and develop a strong policy framework, mariculture can transform the economic landscape of coastal India," he said. A national mariculture policy and supportive legal framework were required to promote sustainable, large-scale investment and systematic growth in this sector, he added.

India's Poultry Sector Eyes Domestic Consumption Over Exports Amid Cost Pressures

India's poultry industry is prioritising domestic consumption over exports, citing high production costs and a vast untapped local market, senior industry officials said on Oct 06, 2025. Despite ranking second globally in egg production, India ranks 25th or 26th in egg exports, said Tarun Sridhar, former secretary in the Union Ministry of Animal Husbandry, Dairying and Poultry, at a curtain raiser for the 17th Poultry India Expo to be held November 25-28 in Hyderabad. "Export is not an end in itself," the former secretary told reporters. "If my product is giving me more value in the domestic market, then why should I go for exports?," he questioned. India ranks fourth or fifth globally in meat production. Still, it has the world's lowest per capita consumption at 3 kg annually, which is lower than that of Bangladesh and other developing nations. Per capita chicken consumption in India stands at 6-7 kg per person per year, while egg consumption stood at 103 eggs annually, according to Naveen Pasuparthy, President of Karnataka Poultry Farmers & Breeders Association (KPFBA). "The country has protein-deficient citizens," Pasuparthy said, noting that 71 per cent of Indians consume chicken and eggs. "We have 1.43 billion people. Why will I want to export?," he questioned. Indian poultry producers face significant cost disadvantages compared to major exporters. Corn costs ₹23-25 per kg in India, compared to ₹14 per kg in exporting countries, while soybean meal is 30 per cent more expensive domestically, industry officials said. "Our cost of production is ₹90. Their cost of production is ₹25-30 less than ours," said Divya Kumar Gulati, chairman of the Compound Livestock Feed Manufacturers Association (CLFMA), noting that feed accounts for 80-85 per cent of production costs. The cost gap stems partly from India's restrictions on genetically modified crops, which lower feed costs in competing nations. "We will not be able to compete in international markets," Pasuparthy said.

Poultry Sector Revenue to Rise 4–6% This Fiscal, Margins Under Pressure: CRISIL

The poultry sector in India will see revenue increase by 4-6% this fiscal, driven by steady consumptiongrowth, fuelled by rising rural demand, higher per capita meat consumption, and a growing preference for a protein-rich diet, according to CRISIL Ratings. Operating margin, however, will slip 80-100 basis points (bps) because of lower broiler prices in the first half of the fiscal, partly mitigated by a subsequent recovery in broiler prices and favourable feed costs throughout the year. Despite lower profitability, the credit profiles of poultry companies are seen as stable, backed by modest capital expenditure, limited debt addition, and steady accruals, CRISIL said in a release. An analysis of 34 such companies rated by us, with cumulative revenue of around Rs. 10,815 crore last fiscal, indicates as much, it added. The layer/egg segment accounts for 55 per cent of the poultry industry by value, and the broiler segment for the remaining 45 per cent. In the broiler segment, revenue growth is likely to slow to 1-3% this fiscal due to lower realisations. Jayashree Nandakumar, Director, Crisil Ratings, said, “Wholesale broiler prices fell 20 per cent on-year to Rs 110-115 per kg in the first quarter of this fiscal, as a short summer and an early monsoon led to relatively higher bird weights and, hence, a surplus in supply. Subsequently, with the onset of the festive season, broiler prices have begun to recover. Yet, average broiler prices will be lower by 4-6% on-year in the current fiscal.” Sales volume in the broiler segment is expected to grow 6-8 per cent to around 5.86 lakh tonne this fiscal. In the layer/egg segment, sales volume is up 4-6 per cent to around 15,750 crore eggs, even as prices are rising steadily 2-4 per cent amid stable demand. India’s per capita egg consumption, at 102 per annum, is significantly below the global average of 218, indicating substantial growth potential. Hence, the egg segment’s revenue is poised to grow by 7-9% this fiscal, according to CRISIL. The blended revenue growth of the poultry industry is expected to be 4-6% in the current fiscal year. Profitability, however, is under pressure. The first half of this fiscal saw broiler prices crash, leading to substantial inventory losses for industry players and, thereby, a 200 bps decline in operating margins.

Milma Eyes Australia, New Zealand Market, Signs MoU for Shipments

Eyeing overseas markets, the Kerala Cooperative Milk Marketing Federation (KCMMF), popularly known by Milma, has signed a tripartite agreement with RG Foods and Midnightsun Global for shipping products to Australia and New Zealand. The MoU was signed by KCMMF Managing Director, Asif K Yusuf with Vishnu G, Executive Director, RG Foods, and Bindu Ganesh Kumar, Proprietor of Midnightsun Global, in the presence of Milma Chairman K S Mani. As per the MoU, RG Foods will arrange for the pick-up of Milma products from KCMMF premises, handle all logistics including transportation, customs clearance and freight forwarding, besides ensuring compliance of the import laws and regulations of the countries concerned. Midnightsun Global will act as a co-ordinating partner for operational executions, facilitation and co-ordination without having any ownership rights over the products. "This agreement marks a milestone in Milma's successful overseas market outreach for its products, known for their quality and health benefits," said K S Mani, the Chairman of Milma. Milma products are already available in major Gulf countries, where they have found good consumer resonance, especially among the Non-Resident Indian (NRI) community and particularly, the Non-Resident Keralites (NRKs). It is significant to note that both Australia and New Zealand have significant NRK population, Mani said. The biggest beneficiaries of product and market expansion of Milma are the dairy farmers, who are the members of the dairy cooperative. Milma had passed on to farmers 92.5 per cent of its profit to farmers last year, he added. As per the agreement, Milma will be exporting paneer, payasam mix and dairy whitener in the first phase. The company will be exploring the possibilities of exporting its products to more countries with sizeable Malayali diaspora, said KCMMF's MD Asif said. Milma will manufacture and package the products as per the agreed specifications and quality standards. It will also ensure adherence to all international regulations governing the production and sale of the products, as suggested by RG Foods.

HM Amit Shah to Inaugurate Largest Dairy Facility, Projects Worth Rs. 825 Crore in Haryana

New Delhi, Oct 3 (IANS) Union Home and Cooperation Minister Amit Shah will visit Haryana on Oct 03, 2025 to inaugurate India's largest dairy production facility, besides development projects of Rs. 825 crore in Rohtak and Kurukshetra. Divulging details, a state government spokesperson said on Oct 02, 2025 that as part of efforts to promote the cooperative sector, HM Shah will inaugurate the newly constructed Sabar Dairy Plant at IMT Rohtak. Built for Rs. 325 crore, the plant will house state-of-the-art machinery, which will be formally commissioned by the Union Minister. The facility is expected to generate direct and indirect employment for nearly 1,000 people. The Sabar Dairy plant is India's largest production facility for curd, buttermilk, and yoghurt, with a daily capacity of 150 metric tons of curd, 3 lakh litres of buttermilk, 10 lakh litres of yoghurt, and 10 metric tons of sweets. The spokesperson further shared HM Shah will also distribute tool kits to 2,200 artisans during the 'Khadi Karigar Mahotsav' at Maharshi Dayanand University, Rohtak. Organised by the Khadi and Village Industries Commission under the Ministry of MSME, this event is themed "Swadeshi Se Swaavlamban". During the programme, he will also distribute modern machinery and tool kits, along with Rs. 301 crore as margin money under the Prime Minister's Employment Generation Programme (PMEGP). This festival is an important step towards promoting indigenous handicrafts and the Khadi industry, in which the participation of local artisans has been ensured. In addition, he will inaugurate PMEGP units and will address a gathering later. In Kurukshetra, HM Shah will inaugurate a five-day exhibition on India's new criminal laws. The exhibition aims to help lawyers, students, parents, and common citizens understand recent reforms in the criminal justice system. The exhibition will showcase the changes and achievements brought about by the new laws and highlight the roles of seven different departments, divided into 10 thematic sections.

Oilmeal Exports flat in H1 2025-26, Despite 40% Increase in September

Overall oilmeals exports from India remained flat during the first six months of 2025-26, despite a 40 per cent increase in September 2025 compared with the same period a year ago. According to the Solvent Extractors' Association of India, overall exports remained flat at 20.93 lt during April-September 2025-26 against 20.82 lt in the corresponding period of the previous fiscal, a marginal increase of 0.50 per cent. India exported 2.99 lakh tonnes (lt) of oilmeals in September 2025 against 2.13 lt in the corresponding period of the previous year, registering a growth of 40 per cent. There was increase in the export of soybean meal, rapeseed meal, groundnut meal, and castorseed meal during September 2025 when compared to September 2024. BV Mehta, Executive Director of SEA, said the export of soybean meal declined to 8.39 lt in first six months of 2025-26 from 9.08 lt during the same period of last year as soybean meal prices came under pressure during the period. Indian soybean meal is facing poor demand in global market and stiff competition from South and North America producers for market share. The increase in supplies of DDGS in the feed market has reduced the domestic demand for soybean meal, he said. Mehta said increase in production of groundnut in the last two years led to high crushing and export of groundnut meal. India exported 15,967 tonnes of groundnut meal during April-September 2025-26 against 5,090 tonnes in during the same period of last fiscal. Citing the SEA Kharif Groundnut Crop Survey in Gujarat, he said the area under groundnut cultivation has expanded from 19.09 lakh hectares (lh) in the previous kharif season to 22.02 lh during the current season, a growth of 3 lh. SEA survey expects the groundnut production at 46.07 lt. All-India total area sown under groundnut is reported at 48.36 lh from 49.96 lh of last year, a decrease of 1.60 lh. South Korea imported 2.32 lt of oilmeals from India during the first half of 2025-26 (3.59 lt in April-September 2024-25). This included 1.30 lt of rapeseed meal, 73,332 tonnes of castorseed meal, and 28,581 tonnes of soybean meal. India exported 4.95 lt of oilmeals to China during April-September 2025-26 (17,806 tonnes). This included 4.88 lt of rapeseed meal and 6,927 tonnes of castorseed meal. Bangladesh imported 2.12 lt of oilmeals from India during the first half of 2025-26 (3.98 lt). This included 1.55 lt of rapeseed meal and 57,060 tonnes of soybean meal. Germany and France imported 1.43 lt and 56,959 tonnes, respectively, of soybean meal from India during April-September of 2025-26.

White revolution-2 on cards to equip milk cooperatives stronger: NDDB Chairman

India is ready for White Revolution-2, which essentially means making the milk cooperatives stronger and adding more farmers to the network, NDDB Chairman Meenesh C Shah has said. The initiative also aims to increase country-wide milk procurement by cooperatives to more than 10 crore litres per day in four or five years. Over eight crore farmers in the dairy sector have contributed significantly in making the country self-sufficient and the largest milk producer, he said. Speaking at a one-day state-level seminar, jointly organised by National Dairy Development Board and Kerala Cooperative Milk Marketing Federation (KCMMF), known by brand Milma, NDDB Chairman urged farmers to be aware of the challenges like adulteration of milk and dairy products, and emphasised the need to increase the share of organised milk market, which stands at around 32-35 per cent.In his presentation on Milma's role in empowering dairy cooperative sector and fostering sustainability in dairy sector, Chairman K S Mani said the total turnover of Milma in 2024-25 stood at ₹4,327.24 crore and by 2030, it targets an annual turnover of ₹10,052 crore with a 15 per cent increase annually. Several projects are lined up to empower milk cooperative societies. But they also try to increase milk production, besides ensuring quality and productivity, Mani suggested. On future plans, he said efforts are on for making Milma's products available on cruise ships, harbours and in airports. Milma's vending machines will be set up at 25 metro stations in Kochi by Ernakulam Regional Co-operative Milk Producers' Union (ERCMPU). Inaugurating the seminar, J.Chinchurani, Minister for Animal Husbandry and Dairy Development said Kerala has the potential to become India's largest milk producer and the State Government has been implementing various initiatives to achieve that goal by increasing milk production. Kerala stands second behind Punjab in milk production and there is an immense scope for the State to move to the top position. The state faces certain hindrances in the dairy sector and feed production due to land scarcity. The new projects are aimed at overcoming such constraints. These include expanding the area for growing feeding grass and making it available to farmers," she said. The Minister said the State aims to attain self-sufficiency through measures like slashing milk production cost and enhancing productivity. "We need to ensure sustainable growth in the sector. Increasing productivity, buttressing marketing networks and leveraging latest technologies are the key to achieve that aim," she added.

Gut Health in Poultry: The Foundation of Sustainable and Profitable Poultry Production

Dr. Vishal Patil, MVSc

The global poultry industry is undergoing a significant transformation, shaped by economic shifts, environmental concerns, and public health imperatives. This sector is experiencing robust expansion, with a projected market size increase from $384.95 billion in 2024 to $410.98 billion in 2025, demonstrating a compound annual growth rate (CAGR) of 6.8%. This growth is primarily fueled by poultry's affordability, the rising global demand for protein-rich diets, rapid urbanization, and its relatively lower environmental impact compared to other meat sources. Emerging markets in Southeast Asia, Latin America, the Middle East, and Africa are leading this expansion, while developed markets, particularly in Europe, are also seeing steady growth driven by increasing sustainability trends and a consumer preference for lower-carbon proteins.

Despite its burgeoning growth, the industry faces considerable challenges. These include the persistent threat of disease outbreaks such as avian influenza, geopolitical tensions that disrupt trade and supply chains, fluctuating feed prices, and heightened regulatory scrutiny regarding sustainability and animal welfare. Nevertheless, the future of the industry looks promising, thanks to technological advancements, significant investments in modernization, and a notable shift towards organic and value-added poultry products.

India plays a crucial role in the Asia-Pacific region, contributing a substantial 25% to 30% of the global precision poultry nutrition market. The Indian poultry sector has expanded rapidly, a phenomenon attributed to its burgeoning population, increasing urbanization, rising disposable incomes, and an evolving dietary preference for protein-rich foods. As one of the world's largest producers of both eggs and broiler meat, India significantly contributes to both its domestic consumption needs and burgeoning export markets. The industry in India is characterized by a unique blend of large integrated operations and numerous small-scale farmers, all consistently striving towards modernization and the adoption of advanced farming practices. However, the Indian poultry industry grapples with challenges like effective disease management, ensuring consistent feed quality, strengthening biosecurity measures, and the pressing need for improved infrastructure and cold chain logistics. In response to these challenges and evolving consumer demands, there is a growing emphasis within the Indian poultry sector on antibiotic-free production, sustainable practices, and the integration of new technologies to enhance productivity.

The intrinsic link between gut health and overall poultry production and performance cannot be overstated. The gut is central to efficient digestion, nutrient absorption, immune function, and disease resistance. A healthy gut directly translates to optimal conversion of feed into nutrients, which profoundly impacts growth rates, feed conversion ratio (FCR), bird welfare, and ultimately, overall productivity. When gut health is compromised, a cascade of negative effects ensues, including a decline in digestion and nutrient uptake, leading to poorer growth, increased susceptibility to diseases, higher mortality rates, and significant economic losses for producers.

The poultry gut harbors a complex and dynamic microbiota, a microbial community that begins to develop at hatch and is continuously influenced by feed, environment, and management practices. This intricate microbial community is instrumental in maintaining intestinal integrity, effectively competing against pathogens, modulating immune responses, and supporting the bird's energy balance. Disruptions in this delicate balance, a condition known as dysbiosis, can result in inflammation, infections such as coccidiosis and necrotic enteritis, and ultimately, reduced performance. Therefore, maintaining gut health is not merely a beneficial practice but a foundational element for profitable and sustainable poultry production, especially given that up to 90% of poultry diseases are linked to gut health. This maintenance involves a holistic approach, encompassing proper nutrition, including balanced diets and the

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strategic use of feed additives like probiotics, prebiotics, and organic acids, coupled with optimal brooding and environmental conditions, strict biosecurity protocols, and effective stress management.

The global poultry industry has undergone a profound shift due to the impact of antibiotic growth promoter (AGP) bans and the escalating consumer demand for antibiotic-free products. This has instigated significant changes in production practices, economic considerations, and public health paradigms within the industry. The withdrawal of AGPs has had measurable economic effects on poultry production. For instance, in the European Union, a pioneer in AGP restrictions, the ban increased the cost of producing a kilogram of live broiler by approximately €0.008 ($0.009) as of 2011. This figure represented roughly 16% of the total cost increase (€0.0479 per kilogram) attributed to all EU regulations impacting poultry production, amounting to approximately a 5% increase in total production costs. Interestingly, the economic impact of the AGP ban was comparable to the cost associated with banning meat and bone meal in broiler feeds (also €0.008 per kg) but less significant than the impact of banning GMO grains (€0.012 per kg).

The economic consequences of AGP restrictions demonstrate significant regional variations. High-income industrialized countries with highly optimized production systems appear to experience relatively limited economic impacts. Conversely, lower-income countries with less developed hygiene and production practices potentially face higher economic consequences from AGP restrictions. This disparity is particularly concerning given that without policy changes, global consumption of antimicrobials in food-producing animals was projected to rise by two-thirds (67%) by 2030, with the majority of this increase occurring in emerging economies where livestock demand, especially for poultry, is experiencing the fastest growth.

To compensate for the performance losses observed following AGP bans, poultry producers worldwide have implemented a diverse array of alternative strategies. These include enhanced farm management practices, such as improved biosecurity measures, robust vaccination programs, and effective drinking water treatments. Furthermore, hatchery enhancements, including the meticulous grading and disinfection of hatching eggs and the adoption of single-stage incubation, have contributed to improved performance. A crucial component of these alternative strategies involves the incorporation of various alternative feed ingredients. These include exogenous enzymes, organic acids, prebiotics, probiotics, and even natural compounds like herbs and essential oils. Despite the widespread adoption of these interventions, European producers have not yet fully offset the performance losses attributed to AGP bans, and production costs have undeniably increased.

The European Union has been at the forefront of regulatory action regarding AGP restrictions. In July 2003, the European Parliament and Council enacted regulations specifically prohibiting antibiotics as growth promoters in animal feed. This ban specifically targeted substances already prohibited in human medicine, including monensin sodium, salinomycin sodium, avilamycin, and flavophospholipol. These pivotal decisions were rooted in recommendations from scientific committees primarily concerned with ensuring food safety and public health. As part of this stringent regulatory framework, the European Food Safety Authority (EFSA) was designated to evaluate the safety of feed additives, with authorizations limited to ten-year periods, necessitating reapplication for continued use.

Beyond regulatory mandates, there has been a noticeable surge in consumer interest in meat and poultry products produced without antibiotics or with restricted antibiotic use. This burgeoning consumer preference has emerged as a significant market driver, transcending mere regulatory requirements and actively compelling producers towards antibiotic-free production, even in regions where AGPs remain legally permissible. This trend also underscores a broader emphasis on sustainable and organic practices within the poultry industry.

In the Indian poultry industry, the shift towards alternative strategies for gut health enhancement is a concerted effort focusing on nutritional, management, and feed additive approaches that foster intestinal integrity, microbiota balance, and immune function without relying on antibiotic growth promoters (AGPs). Several key strategies are being employed:

- **Probiotics and Prebiotics:** The supplementation of poultry diets with beneficial live microorganisms (probiotics) and non-digestible fibers that promote the growth of beneficial bacteria (prebiotics) is crucial. This practice helps to modulate gut microflora, improve digestion, and enhance immunity. Probiotics, in particular, can reduce intestinal pH by producing short-chain fatty acids, thereby limiting pathogen growth and improving feed conversion.
- **Organic Acids:** Organic acids such as lactic, formic, butyric, fumaric,

and propionic acids are widely utilized as acidifiers in either feed or water. Their primary functions include lowering gut pH, inhibiting harmful bacteria, improving nutrient digestibility, and supporting gut barrier function. The use of encapsulated organic acids further enhances their efficacy by providing sustained release and reducing odor issues.

- **Dietary Fibers:** The inclusion of moderate levels (3–5%) of insoluble dietary fibers in poultry diets significantly improves gizzard development, increases chyme retention time, and stimulates endogenous enzyme production. These effects collectively enhance nutrient digestibility and overall gut development.
- **Exogenous Enzymes:** Enzymes such as xylanase, phytase, and protease are incorporated into feed to break down non-starch polysaccharides and phytates. This action reduces gut viscosity and anti-nutritional factors, ultimately improving nutrient absorption and reducing pathogen proliferation.
- **Phytogenics and Essential Oils:** Plant-based additives, including essential oils from oregano, thyme, garlic, cinnamon, and rosemary, possess valuable antimicrobial, antioxidant, and immune-stimulating properties. They also enhance enzyme secretion, stimulate appetite, and contribute to maintaining gut microbial balance.
- **Mycotoxin Binders and Antioxidants:** To counteract feed contaminants that can impair gut barrier function, mycotoxin binders and antioxidants are incorporated into feed. These additives protect intestinal health and prevent secondary infections.
- **Improved Feed Quality and Management:** Utilizing coarser soybean meal particles, controlling feed storage to prevent rancidity and mold, and maintaining robust biosecurity and environmental conditions are essential management practices. These measures collectively reduce gut stress and minimize the risk of disease.

These integrated strategies are increasingly adopted throughout India's poultry sector to meet growing consumer demand for antibiotic-free products while consistently maintaining optimal bird performance.

The anatomy of the poultry gastrointestinal tract (GIT) is a complex and highly specialized system designed for efficient digestion and nutrient absorption. It comprises several distinct parts, each playing a crucial role in the digestive process. The journey of feed begins in the crop, a dilated out-pouching of the esophagus, where feed is temporarily stored and softened by saliva before moving to the proventriculus. The proventriculus, often referred to as the true stomach, is where glandular digestion begins, with the secretion of hydrochloric acid and pepsin. Following this, the feed enters the gizzard, a muscular organ responsible for mechanical grinding of feed particles. The small intestine, consisting of the duodenum, jejunum, and ileum, is the primary site for enzymatic digestion and nutrient absorption. The ceca (plural of cecum) are two blind-ended pouches located at the junction of the small and large intestines, important for microbial fermentation of indigestible materials. Finally, the colon and cloaca complete the digestive tract, responsible for water absorption and excretion of waste.

The microbiota residing within the poultry gastrointestinal tract (GIT) represents a highly diverse and dynamic microbial community. Its composition is not static but varies significantly depending on the specific gut region, the age of the bird, its diet, and various environmental factors. The main phyla consistently present in the poultry gut include Firmicutes, which are dominant, typically comprising around 70% of the microbiota, along with Bacteroidetes, Proteobacteria, Actinobacteria, Tenericutes, and other minor phyla such as Cyanobacteria and Fusobacteria. The distribution of these microbial communities varies across different regions of the gut:

- **Crop & Gizzard:** These sections are predominantly colonized by Lactobacillus species, sometimes making up as much as 99% of the microbiota. The crop, in particular, exhibits the greatest diversity of *Lactobacillus species.*
- **Duodenum & Jejunum:** These upper small intestinal segments are also dominated by *Lactobacillus (notably L. salivarius and L. aviarius)*, although they feature a lower bacterial density due to the presence of bile acids and a low pH. Other genera found here include *Clostridia, Streptococci,* and *Enterobacteria.*
- **Ileum:** The ileum presents a more diverse and less stable microbial community compared to the upper small intestine. Commonly found genera include *Lactobacillus, Candidatus Arthromitus, Enterococcus, Escherichia coli, Shigella,* and *Clostridium XI.*
- **Cecum:** This region is the most densely colonized and microbially diverse part of the poultry GIT. It primarily harbors *Clostridia, Lactobacillus*, and *Ruminococcus.* The cecum is critically important for the fermentation of indigestible

carbohydrates and serves as a significant site for both beneficial and potentially pathogenic bacteria.

The microbial composition within the gut also evolves with the age of the bird. Early colonizers typically include *L. delbrueckii, C. perfringens,* and *Campylobacter coli.* As birds mature, a succession occurs, leading to the increased abundance of *L. acidophilus, Enterococcus, Streptococcus,* and a greater presence of *Clostridium species.*

The functions performed by the poultry gut microbiota are indispensable for the host's health and productivity:

- **Digestion & Nutrient Absorption:** The gut microbiota plays a vital role in fermenting indigestible carbohydrates, a process that yields short-chain fatty acids (SCFAs). These SCFAs serve as crucial energy sources for the host and stimulate the proliferation of gut epithelial cells, thereby enhancing overall nutrient absorption.
- **Immune System Development:** The microbiota is a key modulator of immune responses within the gut. It stimulates mucin secretion and increases epithelial turnover, actions that collectively strengthen the gut barrier and act as a defense against pathogen invasion. Furthermore, the microbiota stimulates IgA secretion, which is essential for regulating microbial populations in the gut.
- **Pathogen Exclusion:** Beneficial microbes within the gut compete with pathogens for essential nutrients and attachment sites on the intestinal lining. They also produce antimicrobial substances and maintain a gut environment (e.g., an acidic pH) that is unfavorable for the proliferation of harmful bacteria, thus actively excluding pathogens.
- **Metabolism of Nitrogenous Compounds:** Cecal bacteria are involved in the conversion of uric acid to ammonia, which can subsequently be utilized by the host for amino acid synthesis. Additionally, some dietary nitrogen is incorporated into bacterial proteins, which can serve as a nutritional resource for the bird.
- **Potential Negative Effects:** While largely beneficial, microbes in the proximal gut can sometimes compete with the host for nutrients. They may also produce toxic metabolites, which in some instances can lead to depressed growth or a decrease in fat digestibility.

The poultry gut microbiota is an integral component of bird health, productivity, and disease resistance. Its key functions encompass digestion, nutrient absorption, immune modulation, and resistance to pathogens. Common gut health issues that can arise from dysbiosis include inflammation and gut leakage.

The importance of gut health in poultry production extends beyond just immediate growth and efficiency; it has profound implications for disease resistance, overall bird welfare, food safety, and environmental sustainability. A healthy gut is directly correlated with enhanced feed conversion efficiency, leading to improved growth rates and overall production output. This efficiency is critical for the economic viability of poultry operations. Furthermore, a robust gut microbiome is a cornerstone of a strong immune system, bolstering the bird's natural resistance to diseases and contributing significantly to overall bird welfare. From a food safety perspective, maintaining gut health helps to reduce the prevalence of foodborne pathogens in poultry, thereby safeguarding consumer health. Environmentally, improved feed efficiency through optimal gut health means less waste and a smaller carbon footprint for poultry production, contributing to greater sustainability. The connection between gut health and systemic health in poultry is undeniable, as a compromised gut can lead to systemic inflammation and reduced nutrient utilization throughout the bird's body.

Strategies to improve gut health in poultry have evolved significantly, especially with the move away from AGPs. Nutritional interventions play a pivotal role. The inclusion of dietary fibers, both insoluble and soluble, is crucial for promoting healthy gut development and function. Organic acids are widely used to modulate gut pH and favorably influence the microbiota, creating an environment less conducive to harmful bacteria. Probiotics and prebiotics are essential for enhancing beneficial microbiota, which in turn supports digestion, nutrient absorption, and immune function. The use of various enzyme types and commercial products is common in the Indian poultry industry to enhance gut health and nutrient utilization. For instance, Carbohydrases such as Xylanase, Cellulase, and Beta-glucanase are included in feed to break down non-starch polysaccharides in grains, thereby improving nutrient absorption and feed efficiency. Phytases, like ORSI PHYTASE-5000 and Phytase Enzyme Granules, are crucial for releasing phosphorus from phytate, which not only improves phosphorus availability but also helps reduce feed costs. Proteases, such as Alkaline Protease Powder and Proteinase K, enhance protein digestibility and utilization in feed. Furthermore, many commercial

products utilize Multi-enzyme Blends, which combine carbohydrases, phytases, proteases, and sometimes lipases, for comprehensive nutrient breakdown and overall gut health. Examples include Gromixes Animal Powder and various other proprietary blends.

Beyond nutritional interventions, management practices are equally vital. Proper housing, adequate ventilation, and effective water management are fundamental to creating a healthy environment for the birds. Strict biosecurity measures are essential to prevent the introduction and spread of pathogens. Stress reduction during critical stages of a bird's life, such as hatching, brooding, and vaccination, can significantly impact gut health. Innovative technologies are continuously being developed to further enhance gut health. The use of functional feed ingredients, which provide specific benefits beyond basic nutrition, is gaining traction. Vaccination and robust disease control strategies remain cornerstones of preventing gut-related diseases.

Phytogenic feed additives (PFAs) have gained significant prominence as natural alternatives to AGPs in poultry production. These plant-derived bioactive compounds are increasingly important as the industry shifts away from antibiotics due to concerns about antimicrobial resistance and evolving consumer preferences. Phytogenics encompass a diverse group of plant-derived compounds, including essential oils from herbs like thyme, oregano, cinnamon, rosemary, and garlic. They also include various herbs and spices (e.g., marjoram, yarrow, green tea, black cumin, coriander) and other plant metabolites such as saponins, flavonoids, mucilages, and tannins. These additives can be incorporated into feed in various forms, including dried, solid, and ground forms, crude extracts, and concentrated and purified extracts.

Phytogenics exert their beneficial effects through multiple mechanisms of action:

- **Antimicrobial effects:** They actively combat potential pathogens like Escherichia coli and Clostridium perfringens, thereby reducing the risk of diseases such as colibacillosis and necrotic enteritis.
- **Digestive enhancement:** Phytogenics can regulate the secretion of digestive juices and influence intestinal nutrient transporters, potentially leading to improved nutrient absorption and feed efficiency.
- **Antioxidant properties:** Many phytogenic compounds possess antioxidant effects, which help protect cells from oxidative damage.
- **Anti-inflammatory effects:** They can reduce inflammation in the gut, thereby supporting overall intestinal health.
- **Gut microbiota modulation:** Phytogenics help maintain the symbiotic relationship between gut microbiota and the host, preventing dysbiosis.
- **Immune system support:** These compounds can decrease the microbial burden on the animal's immune system.
- **Intestinal mucus production:** Some phytogenic compounds promote the production of intestinal mucus, which strengthens the gut barrier.

Research has consistently demonstrated several benefits of phytogenics in poultry production. They typically improve feed efficiency by 2-5%, with the most significant responses observed in animals experiencing high bacterial loads in their gut. Phytogenics also enhance gut health by reducing bacterial colony counts and decreasing fermentation products like ammonia and biogenic amines. Studies have shown their ability to alleviate coccidiosis symptoms, including reducing lesion severity and oocyst shedding. Furthermore, phytogenics can improve prececal nutrient digestion and overall nutrient utilization. When combined with other feed additives like organic acids, phytogenics can offer synergistic benefits.

As of 2025, phytogenics have become an established component of poultry nutrition strategies. They are increasingly utilized as part of comprehensive approaches to replace antibiotics in poultry production. Ongoing research focuses on identifying optimal combinations of different phytogenic compounds to maximize their benefits. The industry has developed more sophisticated analytical techniques, such as high-performance liquid chromatography and gas chromatography-mass spectrometry, to accurately identify and quantify specific compounds in phytogenic extracts. Systematic studies have indicated that combinations of different phytogenic compounds (e.g., essential oils with saponins) can yield greater benefits than using these compounds separately.

Despite their promise, several challenges and limitations remain in the widespread use of phytogenics. Research has sometimes shown contradictory outcomes regarding their effectiveness, highlighting the need for more standardized approaches. While many studies demonstrate antioxidative and antimicrobial efficacy in vitro, corresponding in vivo evidence

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remains limited. Determining appropriate inclusion levels for different phytogenic compounds also remains a challenge. Furthermore, the complete mechanisms of action for many phytogenic compounds are still not fully understood. Finally, the cost-effectiveness of phytogenic supplementation depends on product economics, farm status, and baseline feed efficiency.

A wide array of commercial products is available in the poultry industry to enhance gut health, falling into several key categories:

- **Probiotics:** These are live microorganisms, such as Bacillus subtilis, *Bifidobacterium spp., and Lactobacillus spp.*, that are incorporated into feed to enhance gut microbiota balance, improve digestion, stimulate immunity, and prevent the proliferation of pathogens.
- **Prebiotics:** These include non-digestible fibers like Mannan-oligosaccharides (MOS) and Fructooligosaccharides (FOS), which promote the growth of beneficial gut bacteria and improve immune response.
- **Symbiotics:** These products combine both probiotics and prebiotics to enhance the survival and persistence of beneficial microbes in the gut, leading to improved health outcomes.
- **Organic Acid Blends:** Commercial products such as ACTIVATE® Nutritional Feed Acids (Novus International) and various protected/encapsulated organic acids (e.g., lactic, formic, butyric acids) act as acidifiers. They lower intestinal pH, inhibit harmful bacteria, improve nutrient digestibility, and reduce pathogens.
- **Enzyme Additives:** An example is Xylamax Enzyme Feed Additive (Novus International), which enhances digestion by breaking down fibers and improving nutrient absorption.
- **Essential Oils / Phytogenics:** Products containing compounds like thymol, carvacrol, and eugenol (derived from oregano, thyme, etc.) are plant extracts that stimulate appetite, enzyme secretion, and immune function, possessing both antimicrobial and antioxidant effects.
- **Butyrate-based Products:** ProPhorce™ SR (Perstorp) is a butyrin solution that supports gut integrity and provides protection against pathogens, particularly crucial in young chicks.
- **Trace Mineral Supplements:** MINTREX Trace Minerals (Novus International) contributes to overall gut health and bird performance by providing bioavailable minerals.
- **Gut Health Feed Solutions:** PROVENIA® Feed Solution (Novus International) is a proprietary blend designed to support gut bacteria balance and overall bird health.

The role of regulatory bodies in product approval and quality assurance is paramount to ensure the safety, efficacy, and consistent quality of these commercial products in the market.

The Compound Livestock Feed Manufacturers Association (CLFMA) of India plays a pivotal role in advancing gut health management in poultry and actively supporting the industry's transition away from antibiotic growth promoters (AGPs). CLFMA's contributions are multifaceted and crucial for the sustainable growth of the Indian poultry sector:

- **Promoting Science-Based Nutrition:** CLFMA advocates for the adoption of advanced, science-based nutritional strategies among its member feed manufacturers. This includes the crucial incorporation of feed additives such as probiotics, prebiotics, phytogenics, organic acids, and enzyme blends, which have been proven as effective alternatives to AGPs for enhancing gut health and optimizing production performance.
- **Facilitating Industry Education and Training:** Through a robust program of seminars, workshops, and technical publications, CLFMA diligently disseminates knowledge on critical topics like gut health management, the inherent risks of antibiotic resistance, and the demonstrated efficacy of non-antibiotic alternatives. This commitment to continuous education ensures that feed producers and poultry farmers remain updated on best practices and evolving regulatory changes.
- **Encouraging Research and Innovation:** CLFMA actively supports research collaborations with both academic institutions and industry partners. The objective of these collaborations is to develop and rigorously validate new feed additives and innovative nutritional approaches. This includes evaluating the effectiveness of phytogenic compounds, organic acids, and various blended feed additives in improving gut barrier function, enhancing microbiota stability, and contributing to overall bird health.
- **Advocacy and Policy Support:** The association actively engages with regulatory authorities to shape policies that encourage responsible antibiotic use and facilitate the

streamlined approval and adoption of safe and effective alternatives. CLFMA's advocacy efforts are instrumental in aligning industry practices with national and international food safety and public health standards.

- **Supporting Antibiotic-Free Production:** By providing comprehensive technical guidance and vigorously promoting the use of gut health-promoting feed solutions, CLFMA directly assists producers in achieving antibiotic-free (ABF) poultry production. This initiative is increasingly vital in response to burgeoning consumer demand and global trends advocating for reduced antibiotic usage in animal agriculture.

CLFMA's initiatives have undeniably contributed to a steady reduction in AGP reliance by equipping the industry with essential knowledge, facilitating access to innovative products, and providing unwavering support for integrated gut health management. The association's sustained efforts ensure that poultry producers can maintain robust productivity and profitability while simultaneously meeting crucial food safety and public health objectives. In conclusion, CLFMA's leadership in promoting gut health solutions and advocating for responsible feed manufacturing practices is instrumental in guiding India's shift toward sustainable, antibiotic-free poultry production. By consistently fostering innovation, promoting education, and facilitating strong industry collaboration, CLFMA empowers the sector to effectively manage gut health and significantly reduce its dependence on AGPs, thereby aligning with both national priorities and global best practices. Their contribution to promoting best practices in poultry health management, their initiatives for research, education, and dissemination of gut health strategies, and their support for organic and antibiotic-free poultry production collectively underscore their crucial role.

In summary, maintaining optimal gut health is paramount for the sustainable growth and profitability of the global poultry industry. This requires a multi-faceted and integrated approach that seamlessly combines advanced nutritional strategies, meticulous management practices, and the continuous adoption of innovative technologies. The future prospects for poultry production are bright, contingent upon the industry's ability to adapt to evolving consumer demands and regulatory landscapes. Key regulatory bodies and industry associations like CLFMA are instrumental in driving this progress, acting as catalysts for research, education, and the widespread implementation of best practices in gut health management. Their continued commitment will ensure that the poultry industry remains productive, profitable, and increasingly sustainable, meeting the demands of a growing global population while upholding the highest standards of animal welfare and food safety.

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Strategies to Increase Dry Matter Intake (DMI) in Lactating Cows Long with Relevant Data

Dr.Vennela Banoth, M.V.Sc scholar

Dry matter intake (DMI) defined as the crucial factor in dairy cow management which directly impacts the overall animal health and milk production. Further, it refers as the quantity of feed consumed by a cow during its lactation, besides the water content. DMI is prerequisite for the formulation of diets to prevent overfeeding or underfeeding of nutrients and to ensure productive nutrient use to animals.

Dry matter intake plays a crucial role in guaranteeing a smooth recovery for recently parturiated dam's and supporting dam's lactation. DMI is one of the factor which affects the energy requirement for milk production, maintenance, change in the body and its also effects the diet and psychological state of animal. Hence, DMI understanding is necessary for the dairy ration formulation.

Similarly, during the periparturient period in lactating cows is characterized by profound metabolic and endocrine changes to meet out the milk production during early lactation. Maintaining optimal blood glucose levels i.e 45.81 and 70.77 mg/dL is crucial for the transition to lactation period and due to impaired glucose homeostasis resulted in negative energy balance (NEFA) which leads to further decreases blood glucose levels and the mobilization of body reserves to provide additional energy, leading to elevated blood concentrations of NEFA and β-hydroxybutyric acid (BHBA). When lower blood glucose 41.4 mg/dL results in ketosis, which further reduces appetite and DMI in the days following calving.

In dairy cattle, the period between 3 weeks before and 3 weeks after parturition is called as transition period, which is one of the most critical physiological stages since most of the metabolic disorders like ketosis and hypocalcaemia anticipated due to energy deficits resulted from weakened immune system, reduced dry matter intake and increased production demands due to increase in foetal growth in late gestation, colostrogenesis followed by lactogenesis, mainly this physiological transition from late gestation to lactation develops a cow in state of negative energy balance. Furthermore, these cows with energy deficits also underwent weakened immune system and therefore more susceptible to infections inturn deteriorated future fertility and general wellbeing of animal.

Further, past researches consistently shows that cows with higher prepartum blood glucose levels have better DMI and recovery after calving. Studies as that dam with refined energy status before parturition tend to consume improved feed after calving, thus bypass the risks associated with decreased metabolic stress and feed intake. Ensuring that the cows have access to a balanced diet that includes adequate energy in the dry period, particularly from fiber and fat, can help maintain blood glucose and set the stage for better intake after calving. Hence, cows with increased pre-partum blood glucose levels have shown improved DMI and recovery after parturition.

Many investigations suggested that the Indian dry matter intake in buffaloes 2.57kg dry matter per 100kg body weight than in Indian cattle as 3.09kg dry matter per 100kg body weight in India. In lactating cow, energy expenditure for milk production usually peaks 4 to 8 weeks postpartum, and peak DMI (energy intake) lags until about 10 weeks postpartum, the average DMI for a cow of 400kg body weight was about 2kg. Some researchers observed that the concentrate DMI increased more in the individual dam with 0.26 kg/kg milk than in the group of animals with 0.06 kg/kg milk.

Metabolic Changes During Transition Period: Challanges And Consequences

The period after parturition in dairy cows is represented by profound metabolic and endocrine changes to meet out increased milk production during early lactation after parturition. During transition period impaired glucose homeostasis resulted in negative energy balance which leads to lower blood glucose levels and the mobilization of body reserves to provide additional energy, leading to elevated blood concentrations of NEFA

and BHBA.

This increased blood BHBA and NEFA has been associated with below mentioned unwanted after parturition complications:

- Decreased dry matter intake (DMI)
- Immunosuppression
- Increased peripartum complications and future infertility problems
- Decreased milk yield and increased future infertility problems

Hence, the following nutritional strategies has been proposed to support metabolic adaptations during the transition period which increases dry matter intake

A. Strategies to Meet Glucose Demands and Decrease NEFA Supply During the Transition Period

1. **Carbohydrate formulation of the prepartum diet:** A substantial amount of research has been conducted to examine the carbohydrate nutrition of dairy cows during the dry period, specifically relating to the Non fibrous carbohydrate (NFC) content of the diet. The diets with richer in NFC content than normal typical dry cow rations should be fed before calving to stimulate the development of ruminal papillae for ensuring effective absorption of volatile fatty acids (VFAs) which are produced during ruminal fermentation.

   Cows need to be provided with the high quality palatable forages such as Alfalfa hay or green grass which provides them with fibre and supports and stimulate appetite.

   The main positive effects on performance and metabolism have been observed when Neutral detergent fiber (NDF) which is a key indicator of fiber content in feeds also a measure of the structural components in plant mainly hemicellulose, cellulose and lignin etc from forage was replaced by NDF from non-forage fiber sources in diets fed during the prepartum period.

2. **Direct supplementation with glucogenic precursors:** Propylene glycol which is a well-established glucogenic precursor that has long been used as an oral drench for many years in the treatment of ketosis. Available numerous studies consistently demonstrate that its administration as an oral drench decreases concentrations of NEFA in plasma and often reduces the concentrations of BHBA levels in plasma. Additionally, supplements consisting of propionate complexed to trace minerals or calcium potentially may serves as effective substrates for hepatic gluconeogenesis. Further, calcium propionate has not been affecting postpartum milk yield or plasma NEFA concentrations. Moreover, Monensin a feed addictive which improve feed efficiency provided in controlled-release capsule (CRC)form during the transition period and early lactation has been shown to reduce the incidence of subclinical ketosis in dairy cows by 50% alongside with lowering postpartum concentrations of serum BHBA by increased circulating concentrations of glucose.

3. **Added fat in transition diets:** It has been proposed that dietary fat may help to decrease concentrations of NEFA and help to prevent the occurrence of ketosis. Dietary long-chain fatty acids are absorbed into the lymphatic system and do not pass first through the liver. This fatty acids will provide energy for mammary gland and peripheral tissues which further increases energy availability would in turn it decrease mobilization of body fat and decrease NEFA concentrations as concluded by many investigations. As per study i.e administration of 454 grams/day of a commercially available fat supplement (82% fatty acids by weight) for the first 3 days of lactation by oral drench, further this administration of fat did not affect concentrations of NEFA and BHBA in plasma and triglycerides in liver during the period after calving, and tended to decrease DMI and milk yield during the first 21 days of lactation.

4. **Effects of specific fatty acids:** Feeding trans-10, cis-12 conjugated linoleic acid (CLA), a fatty acid known to decrease milk fat percentage and yield in cows in established lactation decreases energy output during early lactation and in turn, decreases the extent and duration of negative energy balance during early lactation. Feeding trans-octadecenoic acid during the transition period and early lactation decreased liver triglyceride concentration.

B. Restricted Feed During the Dry Period for Dam

Increasing DMI during the prepartum period is a harbinger of increased DMI during the postpartum period and overall transition cow success. The cows fed balanced diets restricted to below-calculated energy requirements (usually about 80%

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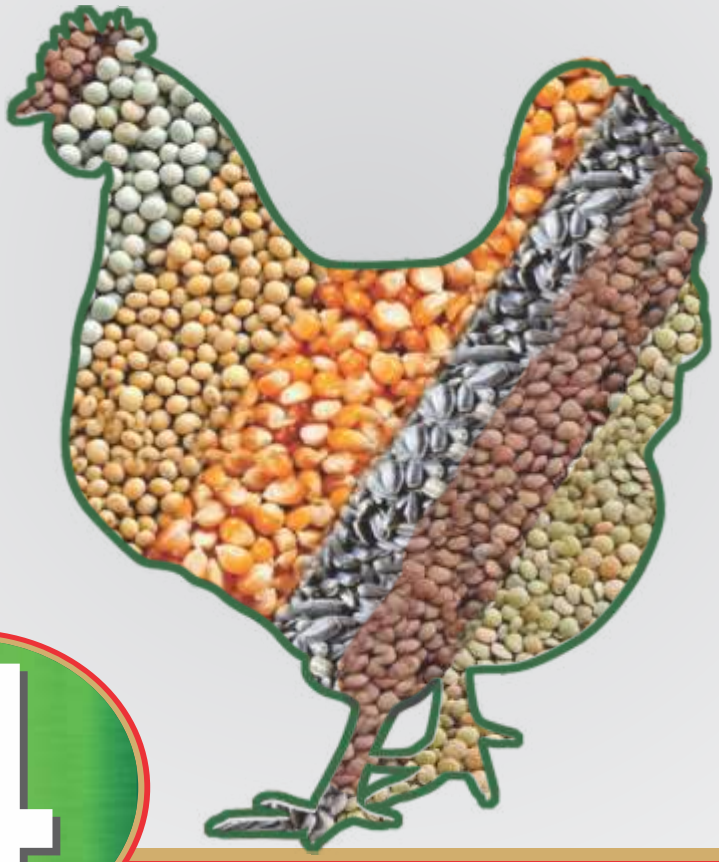

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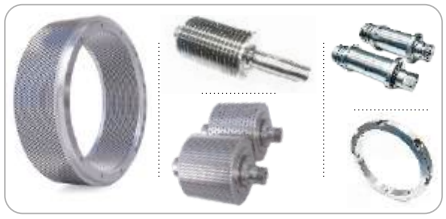

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of predicted requirements) did not decrease their voluntary DMI during the days preceding parturition and increased postpartum DMI and milk yield at faster rates than cows consuming the same diets for ad libitum intake.

Furthermore, feed-restricted cows typically had blunted NEFA concentration compared with those fed for ad libitum intake and cows fed for ad libitum intake prepartum had decreased insulin sensitivity compared with those that were restricted-fed.

C. Strategies for Prevention of Hypocalcemia

One of the more interesting relationships in the peripartum metabolism of dairy cow is the lack of association of Ca content of the diet-fed prepartum with the occurrence of milk fever. However, the approach of adjusting cation-anion difference [[Na+K] – [Cl +S]] to prevent metabolic alkalosis and perhaps induce compensated metabolic acidosis. Prepartal diets with a negative dietary cation-anion difference (DCAD) have repeatedly been shown to reduce subclinical and clinical hypocalcemia in cows predisposed to milk fever. The use of prepartum diets having a lower DCAD has repeatedly been shown to be effective in preventing milk fever in cows predisposed to milk fever.

Sodium aluminum silicate (Zeolite A), potentially binds Calcium (Ca) in the digestive tract thereby making it unavailable for intestinal absorption by the dam and, in theory, dramatically it restricts Ca entry rate to prompt negative Ca balance in the cow before the initiation of lactogenesis. Many studies concluded prepartum feeding of Zeolite A prevented milk fever and subclinical hypocalcemia.

MANAGEMENTAL STRATEGIES TO INCREASE THE DRY MATTER INTAKE

A. Providing stress free environment

Overcrowding and combining first calf heifers with old cows at the same time leads to several challenges like reduction in the amount of space available for the cows which causes them to experience stress along with limited feed and water which leads to decreased DMI. So providing with adequate space and first calf heifers should be separated from older cows.

Stress in the postpartum dam can be minimised by providing the clean and open spaces or adequate spaces. However, overcrowding of dams leads to stress in them and reduces the appetite of the cow, eventually leading to reduced DMI and milk yield.

B. Monitoring peripartum dams

Peripartum dams needed to be regularly monitored mainly for illness, reduction in appetite and abnormal behaviour. Early detection of any of the symptoms and management further prevents reduction of DMI.

C. Ensure access to clean and freshwater

Cows should always have access to clean and freshwater as it maintains hydration. If adequate fresh and clean water are not available this may lead to dehydration which can significantly reduce feed intake and lowers DMI.

D. Use of dam approved flavours in feed

The feed of dairy cows can be mixed with the flavours which can improve palatability and increase DMI. By adding flavours cows tend to have more food during stressful periods like the transition to lactation which helps reduce metabolic disorder and supports faster recovery.

CONCLUSION

Significant progress in understanding the metabolic adaptations that dairy cows make as they transition from a nonlactating to a lactating state has enabled the continual development of specific nutritional strategies to support these metabolic adaptations. Moreover, periparturient nutritional physiology continues to evolve, however, the substantial variation in response to nutritional manipulation that occurs on commercial dairy farms is a reminder that transition cow management is a multifaceted issue. Future research in transition cow biology and management will be most fruitful if conducted as an investigation of integrative biology rather than classical nutrition.

Department Veterinary Gynaecology and Obstetrics
Tamil Nadu Veterinary and Animal Science University
Veterinary College and Research Institute,
TANUVAS, Tirunelveli – 627358

"Shrimp Feed Management For Improving FCR by Comparing Manual Feeding Vs Auto Feeder"

Dr. Patekar Prakash Goraksha, B.F.Sc, M.F.Sc, Ph.D. Scholar

Shrimp aquaculture has emerged as a keystone of India's blue economy, contributing ₹45,000 crore ($5.5 billion) to annual export revenues and sustaining over 4 million livelihoods in coastal states. Next to China, India is the second-largest producer of farmed shrimp in the world, accounting for about 15% of global production, with Andhra Pradesh dominating 70% of domestic output. The sector's global importance is highlighted by its position as the top exporter of frozen shrimp, supplying 40% of the U.S. market and 25% of the EU's demand. However, India faces stiff competition from Ecuador, which surpassed India in terms its export volume in 2022, shifting India to third place globally by quantity. While there is a boom in India's shrimp export, the industry remains profoundly reliant on imported feed ingredients such as soybean meal and fish oil, which constitute 60–70% of operational costs and expose farmers to volatile global prices. Despite this, the sector embraces enormous growth potential: the government's Pradhan Mantri Matsya Sampada Yojana (PMMSY) aims to double aquaculture exports to $10 billion by 2025, leveraging India's vast brackish water area and expanding hatchery capacity. Innovations in disease-resistant strains (e.g., Specific Pathogen-Free Litopenaeus vannamei) and a shift toward value-added products (20% of exports) further enhance the prospects of foreign exchange earnings. In addition to this, of late, there is a great demand for domestic consumption.

Despite significant progress, there are several challenges that remain to be addressed in India's shrimp farming industry. Unpredictable climate conditions, ever-increasing cost of feed and feed resources, recurring outbreaks of White Spot Syndrome Virus (WSSV), and competition from Ecuador, where production costs are lower (₹1.50/kg compared to India's ₹2.20/kg), pose serious threats to the country's market share. A key factor in overcoming these challenges is improving the Feed Conversion Ratio (FCR), a crucial measure of how efficiently shrimp convert feed into growth. To examine the effectiveness, economic feasibility, and sustainability of manual vs. automated feeding systems in India, the improvement of FCR is a major nutritional index in shrimp farming.

Shrimp farming, a vital part of global aquaculture, is under increasing pressure to find a balance between high production and environmental responsibility. A key factor in maintaining this balance is the FCR. Simply, FCR measures how efficiently shrimp convert feed into growth. It's calculated by dividing the total amount of feed consumed (in Kg; dry weight basis) by the increase in shrimp biomass (Kg, in wet weight). A lower FCR is better, meaning the shrimp are using the feed more effectively, which is good for both the farmer's wallet and up keeping the environmental. Beyond the financial benefits, optimizing FCR is crucial for protecting delicate brackish water ecosystems, especially in India. Unconsumed feed decomposes, releasing harmful substances like free ammonia and nitrite nitrogen, which deplete oxygen in the water, leading to algal blooms and eutrophication, harming aquatic life. Furthermore, high FCR exacerbates carbon footprints, as decomposing feed emits methane (CH_4) and carbon dioxide (CO_2), emphasizing the urgency of sustainable practices. Recognizing its importance, the FAO considers FCR as a key indicator of sustainable aquaculture, aligning it with global goals, viz., Sustainable Developmental Goals (SDGs) for eliminating hunger (SDG-2) and protecting life below water (SDG-14).

So, how can we improve FCR in shrimp culture? Several strategies can be implemented. Using quality aqua feed with high nutrient digestibility for efficient nutrient absorption and reducing excess nutrient and organic loads. Focusing on the "**Ideal Protein Concept**," which balances amino acids based on the shrimp's specific needs, rather than just crude protein levels, also minimizes nitrogen waste. Adding palatability enhancers, like betaine or krill meal, can stimulate the shrimp's appetite and prevent them from ignoring their food. Growth promoters and metabolic modifiers,

such as probiotics or enzymes, can further accelerate growth and improve nutrient use. Adhering to Best Management Practices (BMPs) and Good Aquaculture Practices (GAP) is also essential. Maintaining the optimal water quality (pH, dissolved oxygen, total alkalinity, total hardness, free ammonia and nitrite-N) and soil conditions (nutrients and micro-nutrients) ensures healthy shrimp that can utilize feed efficiently. Optimizing feeding practices is another key area. Automated feeding devices, carefully adjusted feeding rates, feeding frequencies, feeding time, and strategies tailored to specific zones within the farm can all help minimize overfeeding. Maintaining the right balance of protein and energy (P: E) in the feed is also crucial. A proper P: E ratio ensures that the shrimp uses nutrients for growth, not just basic maintenance. Supporting healthy molting by providing adequate minerals like phospholipids and cholesterol helps the shrimp grow faster. Boosting the shrimp's immunity with immunostimulants like β -glucans and vitamins C and E from reliable sources can help prevent disease, reduce mortality, and maintain healthy biomass gains.

Shrimp are fed on high-protein diets derived from a blend of animal and plant protein sources, making it essential to choose ingredients that align with their natural feeding habits. A well-balanced feed should include marine proteins like fishmeal and squid meal, along with plant-based options such as soybean meal, ensuring the right amino acid requirement profile. Adding attractants like krill oil can enhance palatability while avoiding low-quality fillers helps improve digestion and nutrient absorption. Beyond ingredients, the physical and chemical properties of the feed play a crucial role. Shrimp feed should consist of properly sized sinking pellets (1.2 – 1.8 mm) that remain stable in water at least for an hour so as to prevent the nutrient leaching. A balanced diet should contain 30 – 35% protein, 6 – 8% lipids, and essential fatty acids like DHA and EPA. Incorporating enzymes and probiotics can further enhance digestion and support gut health. In India, mostly the shrimp is cultured in a fertilized earthen pond. Therefore, periodic/phase fertilization, both organic and inorganic, maintains the required plankton levels, providing a natural food source of high nutrient quality, which reduces reliance on complete artificial feed. Monitoring plankton density and using probiotics help maintain an optimum culture environment, creating a healthier and more sustainable habitat for shrimp.

Traditional manual feeding methods, where labourers distribute feed based on visual cues, are often inefficient and can lead to over- and under-feeding. While under-feeding leads to poor growth, over-feeding results in economic loss and deterioration of the water and soil environment. By embracing science-based feeding strategies, shrimp farmers can not only improve the FCR and profitability but also contribute to a more sustainable and environmentally responsible aquaculture practice.

Regional Case Studies

- **Andhra Pradesh:** In Nellore, small-scale farmers (1–2 ha) report average FCRs of **1.6–1.8** due to overfeeding tendencies (CIBA, 2022). Excess feed accounts for **25–30% of total input,** exacerbating water quality degradation.
- **West Bengal:** In the Sundarbans, tidal fluctuations disrupt feeding schedules, leading to FCRs as high as **2.0** during monsoons (WorldFish, 2021).

Limitations

- **Human Error:** Overfeeding, driven by precautionary measures to avoid undernourishment, elevates FCR and waste.
- **Labor Dependency:** Seasonal shortages during paddy cultivation periods delay feeding, causing growth disparities.
- **Lack of Precision:** Manual systems cannot adapt to diurnal feeding patterns or shrimp molting phases.

Automated Feeding Systems: Precision and Technological Advancements

Types of Automated Feeders

1. **Timer-Based Feeders:** Dispense pre-programmed rations at fixed intervals.
2. **Demand Feeders:** Use underwater sensors to detect shrimp feeding activity.
3. **AI-Integrated Systems:** Deploy machine learning algorithms to optimize feed timing and quantity.

Case Studies

- **Andhra Pradesh:** Solar-powered feeders tested in Bhimavaram reduced FCR from 1.65 to 1.3 within three cycles (MPEDA, 2021).
- **Tamil Nadu:** IoT-enabled systems in Nagapattinam improved dissolved oxygen stability to 5–6 mg/L, reducing disease incidence by 40% (NFDB, 2022).

Technical Advantages

- **Precision Feeding:** Adjusts rations based on real-time data (e.g., temperature, dissolved oxygen).
- **Labor Savings:** Automates **70–80%** of feeding tasks, freeing

workers for pond maintenance.

- **Data Analytics:** Platforms like **Aquaconnect's FarmMOJO** track FCR trends, growth rates, and feed utilization.

Comparative Analysis: Manual vs. Automated Systems

A 2023 study by the Central Institute of Brackishwater Aquaculture (CIBA) compared 50 farms across Andhra Pradesh, Gujarat, Tamil Nadu, and Odisha:

Parameter	Manual Feeding	Automated Feeding
Average FCR	1.65	1.25
Feed Cost/Hectare	₹8.2 lakhs	₹6.8 lakhs
Labor Cost/Cycle	₹1.5 lakhs	₹0.9 lakhs
Water Exchange Rate	30%	15%
Nitrogen Waste	45 kg/ha	27 kg/ha

Economic Analysis

- **Break-Even Period:** The ₹2–5 lakhs upfront cost for automation is offset within **2–3 cycles** through feed and labour savings.
- **ROI:** Farms >5 ha achieves **22–25% higher profitability** post-automation (NABARD, 2023).

Environmental Impact

Automation reduces nitrogen discharge by **40%**, aligning with National Green Tribunal (NGT) standards for brackishwater aquaculture.

Case Studies: Scaling Adoption Through Innovation

Tamil Nadu's Cooperative Model

In 2021, 42 smallholders in Nagapattinam formed a cooperative to lease solar feeders under a **shared-economy model.** Key outcomes:

- **FCR Improvement:** 1.7 → 1.3 (22% gain).
- **Labor Cost Reduction:** ₹1.5 lakh → ₹0.9 lakh per cycle.
- **Water Quality:** Stabilized dissolved oxygen (5.2–5.8 mg/L) and pH (7.5–8.2).

Andhra Pradesh's Aqua Mission

The state government's **Aqua Mission 2023** subsidized automated feeders for 5,000 small farmers. Results included:

- **FCR Reduction:** 1.75 → 1.4.
- **Export Quality Compliance:** 85% of harvests met EU antibiotic-residue standards.

Although the adoption of automation in shrimp farming is the need of the hour, it faces several pertinent challenges, primarily financial, infrastructural, and socio-cultural. Financial constraints pose a significant barrier, as the high initial investment required for automated feeders (₹2–5 lakhs) is considerably higher than the cost of manual feeding tools used at present, like uniform broadcasting of feed by employing the boats, manual labour, and tray feeding, etc. (₹20,000-25,000). Additionally, access to credit remains limited, with only 12% of small-scale farmers qualifying for formal loans, restricting their ability to invest in modern technology (NABARD, 2023). Infrastructure deficiencies for taking up the automation further hinder its adoption since most of the Indian farmers culture the shrimp in earthen ponds, which are many times not suitable for fitting/fixing the automated feeding devices. In rural areas of Odisha and West Bengal, frequent power outages lasting 6–8 hours disrupt the operation of electric feeders. Moreover, inadequate internet connectivity, with less than 30% 4G coverage in coastal regions, limits the functionality of IoT-based agricultural systems, reducing their effectiveness. Beyond financial and infrastructural challenges, socio-cultural resistance also impedes adoption. Many farmers exhibit a reluctance to embrace new technologies, with 68% preferring traditional, proven methods over unverified innovations due to risk aversion (WorldFish, 2022). Additionally, limited technical literacy prevents farmers from effectively operating and maintaining advanced automation systems, further slowing the transition to modernized agricultural practices.

Policy interventions and hybrid solutions can significantly enhance aquaculture efficiency and sustainability. Government initiatives such as the **Pradhan Mantri Matsya Sampada Yojana (PMMSY)** aim to expand subsidies, covering 60–70% of feeder costs for farms under 5 ha. Similarly, the **Kisan Credit Card (KCC)** offers low-interest loans (4–7%) to facilitate the adoption of automation, reducing financial barriers for small and medium-scale farmers. Hybrid feeding models, including phase-based automation, utilize demand feeders during critical growth stages (PL15–PL30) while switching to manual feeding post-molting. Additionally, community feeder systems provide centralized automated feeding for clusters of small farms, optimizing resource use and cost efficiency.

Advancing research and local innovation is crucial for developing cost-effective and sustainable feeding technologies. Collaborations between CIBA and IIT focus on designing affordable (<₹1 lakh), solar-powered feeders with vernacular interfaces, ensuring accessibility for diverse user groups. Additionally, fostering a startup ecosystem supports ventures like Eruvaka Technologies, which specializes in localized automated feeder designs tailored to regional farming needs. These integrated approaches, combining policy support, technological innovation, and hybrid

feeding models, can drive long-term sustainability and productivity in the aquaculture sector. Automation is not a replacement for traditional knowledge but a force multiplier. For instance, Tamil Nadu farmers combine sensor data with indigenous water-quality indicators (e.g., presence of Chaetoceros diatoms) to refine feeding schedules. Similarly, Andhra Pradesh's "Smart Ponds" initiative integrates automated feeders with traditional polyculture (shrimp + milkfish) to enhance resilience.

The transition from manual to automated feeding systems is pivotal for India to achieve its $10 billion aquaculture export target by 2025. While manual feeding remains viable for small, subsistence-level farms, automation offers a scalable pathway to FCR optimization, cost reduction, and ecological sustainability. Policymakers must prioritize financial inclusivity, infrastructure upgrades, and farmer education to democratize access. By blending tradition with technology, India can secure its position as a global aquaculture leader while safeguarding the livelihoods of millions.

Fish Nutrition, Biochemistry &
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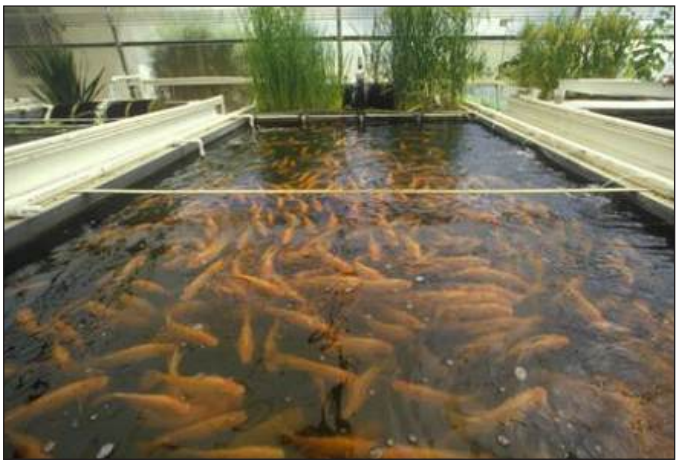

Effect of Anti-Stress Nutritional Practices in Swine Production with Relevant Data

Dr. Kanishk Kamble, M.V.Sc.

If we start with the definition of stress, Father of the stress research Hans Selye, defined it in his classic and still widely respected work, The Stress of Life, first published in 1946, gave us this definition: A non-specific response of the body to a demand. It is still recognized today as the simplest and best physiological definition. He connoted, "Stress is the Spice of Life; the absence of stress is death." Further, he elaborated that there are two types of stress, eustress (pleasant stress) and distress (unpleasant stress). When we discuss stress today, we are usually referring to distress, but we can all relate to pleasant situations or occurrences which have caused us stress: weddings, births, promotions, receiving awards, reuniting with old friends, and countless others while on the other end of the scale accidents, loss of job, anger from spouse, not meeting a deadline are considered as unpleasant stress. But these are terms that are made by considering humans and their lives. What about animals? G.H. stott defined it as symptoms that animals show when introduced to hostile environments. As we defined the stress, let us come to the topic of the essay that is effect of anti-stress nutritional practices in swine production. Before dealing with antistress nutritional practices, we must understand the stress in the swine.

Understanding Stress in Swine and its dynamic

Swines are frequently subjected to a variety of stressors in contemporary swine production methods, which negatively impacts their immune system, growth, and general health. Disease and vaccinations are among the biggest stressors; although they are essential for maintaining health, they can also cause severe inflammatory and immunological reactions. For instance, the immune system's reaction to infections and vaccination against pathogens increases inflammatory cytokines and stress hormones, which leads to metabolic disruptions and oxidative damage (Martinez-Miro *et al.*, 2016). Weaning, a crucial and sudden transition stage in a piglet's life, is another significant stressor. Now, before analyzing that, we must know that the intestinal barrier in swine plays a key function in preserving general health, especially under stressful circumstances. It acts as a first line of defense against dangerous viruses, toxins, and antigens in addition to being a location for the digestion and absorption of nutrients. The physical barrier, chemical barrier, and immunological barrier are the three interconnected parts that make up this barrier. The physical barrier consists of a protective mucus layer released by goblet cells and a single layer of intestinal epithelial cells that are firmly connected by proteins such occludin and claudins. This structure is weakened under stressors including weaning, heat exposure, or transportation. Stress weakens the intestinal's physical integrity and increases its permeability by lowering the expression of tight junction proteins and causing morphological changes such as deeper crypts and shortened villi (Cao *et al.*, 2022).

In addition, the chemical barrier—which consists of antimicrobial peptides, digestive enzymes, and mucus—becomes less efficient while under stress. This reduces the gut's capacity to eliminate dangerous chemicals and microorganisms. Additionally impacted is the immunological barrier, which is made up of immune cells such as intraepithelial lymphocytes and gut-associated lymphoid tissue. Under stress, endotoxins and bacteria can enter the bloodstream through increased intestinal permeability, activating immunological receptors including toll-like receptors (TLRs). Tumor necrosis factor-alpha (TNF-α), interleukin-1β (IL-1β), and interferon-gamma (IFN-γ) are among the inflammatory cytokines that are overproduced as a result, further rupturing the barrier and encouraging systemic inflammation (Lee et al., 2017; Tang et al., 2022).

Furthermore, oxidative damage brought on by stress is a major factor in barrier failure. Increased reactive

oxygen species (ROS) levels exacerbate permeability and tissue damage by directly damaging tight junctions and epithelial cells (Wang *et al.*, 2017). Stress also impairs intestinal ion transport-related enzymes like Na^+/K^+-ATPase and Ca^{2+}/Mg^{2+}-ATPase, which further impacts cellular function and nutrient absorption (Wang *et al.*, 2019). Diarrhea, poor nutrition efficiency, and stunted growth are common signs of intestinal barrier collapse, especially in susceptible piglets. Therefore, maintaining intestinal integrity is a significant aim of nutritional therapy.

Weaning causes development retardation, diarrhea, microbial imbalance, intestinal barrier damage, and separation from the sow as well as changes in nutrition and social settings (Pluske *et al.*, 1997). Another prevalent and serious issue is transportation stress. Pigs transported across long distances are subjected to a variety of environmental stresses, such as noise, vibration, hunger, dehydration, crowding, and temperature changes. These elements play a role in post-slaughter meat quality degradation, muscle glycogen depletion, and oxidative stress (Tarrant, 1989; Peeters *et al.*, 2004). Furthermore, heat stress is becoming a bigger issue, particularly in tropical and subtropical areas or in homes with inadequate ventilation. Pigs' small sweat glands make them especially vulnerable to high temperatures.Heat stress impairs feed intake, induces respiratory alkalosis (hyperpnea), disrupts gut integrity, and leads to reduced fertility and litter size in sows (Lucy *et al.*, 2017; Gonzalez-Rivas *et al.*, 2020). Significant metabolic and oxidative stress is also brought on by physiological conditions like pregnancy and parturition. Hormonal fluctuations and increased energy needs during late pregnancy and childbirth raise oxidative markers and inflammation, which can harm both the mother's and the foetus's development (Jain, 2016; Hao *et al.*, 2021). Aggressive handling treatment and inferior living conditions are examples of additional stressors. Pigs experience physical and psychological distress due to a variety of factors, including overcrowding, rough manual handling, uncomfortable flooring, poor ventilation, and a lack of enrichment. These factors frequently result in immune suppression, elevated cortisol levels, and abnormal behavior (Ramirez *et al.,* 2022; Health *et al.*, 2022). These shifts disrupt homeostasis, compromise the immune system, and trigger inflammatory and oxidative responses (Yang *et al.*,2021).

Together, these seven stress-inducing conditions-disease and vaccination, weaning, transportation, heat stress, pregnancy and parturition, poor housing/handling, and temperature fluctuations-represent critical points where interventions are needed to maintain animal welfare, optimize productivity, and reduce the need for therapeutic antibiotics in swine farming.

Following these stimuli, pigs exhibit elevated biomarkers including reactive oxygen species (ROS) (Wang *et al.*, 2017), malondialdehyde (MDA) (Rio *et al.*, 2005), cortisol and immunoglobulins (Martinez Miro *et al.*, 2016). Such shifts compromise immune function and intestinal permeability (Modesto *et al.*, 2009), often leading to diarrhea or growth retardation (Gaggia *et al.*, 2010; Upadhaya *et al.*, 2021). Transportation stress accelerates muscle glycogenolysis and reduces water holding capacity, adversely affecting meat quality (Briskey, 1964; Peeters *et al.*, 2006; Gonzalez Rivas *et al.*, 2020), while gestating sows under heat stress experience hyperpnea, constipation, severe metabolic burden and reduced litter size (Lucy *et al.*, 2017)

Nutritional Strategies to Mitigate Stress in Swine

As we discussed, the various stresses the Swine often experience-such as weaning, transportation, disease, or environmental changes, that can compromise growth, immunity, and gut health. Now we must discuss the key nutritional interventions used to reduce stress and promote swine welfare and productivity, along with some supporting data.

1.Functional Amino Acids

Beyond simply being the building blocks of proteins, functional amino acids also control immunity, metabolism, and stress signaling pathways. Nitric oxide generation, which enhances blood flow and antioxidant defenses, is mostly dependent on arginine. 0.4% arginine supplementation increased feed efficiency and average daily growth in heat-stressed pigs (Yun *et al.*, 2020). 1.5% arginine increased birth weight and fetal survival in gestating sows (Hong *et al.*, 2020). Glutamate is the next and most advantageous amino acid we can offer pigs. Glutamate acts as a precursor to glutathione and maintains the integrity of the intestinal barrier. Malondialdehyde (MDA) levels were lowered and mucosal immunity was enhanced by a 2% dietary dosage (Guo *et al.*, 2022). Whereas amino acid leucine enhances protein synthesis through mTOR signaling and was shown to reduce serum cortisol and improve growth in intrauterine growth-restricted piglets at 0.35%

supplementation (Zhang *et al.*, 2022).

2. Low Protein Diets

Low-protein diets minimize the generation of harmful gut metabolites like as ammonia, putrescine, and biogenic amines by reducing the fermentation of undigested proteins.

E. coli abundance and diarrhea incidence were reduced in weaned pigs by reducing crude protein (CP) from 24.3% to 17.3% (Heo *et al.*, 2008).

In heat-stressed pigs, adding amino acids (such as lysine, methionine, and threonine) to reduced-CP diets improved intestinal morphology and nutritional absorption (Morales *et al.*, 2020).

3. Natural Products / Plant Extracts

Polyphenols, flavonoids, and essential oils are examples of plant extracts that have antibacterial, immunomodulatory, and antioxidant properties.

In weaned pigs, grape seed proanthocyanidins (250 mg/kg) enhanced intestinal villus structure and reduced diarrhea (Han *et al.*, 2016).

By lowering ROS and MDA and inhibiting NF-κB and MAPK signaling, oregano essential oil (25 mg/kg) and quercetin (25 mg/kg) reduced oxidative stress during transportation (Zhang *et al.*, 2015; Zou *et al.*, 2016).

In IUGR piglets, curcumin (400 mg/kg) from turmeric (haldi) increased Nrf2 and HO-1 expression and improved antioxidant status (Niu *et al.*, 2019).

4. Organic Acids

Organic acids lower harmful microorganisms, maintain gut pH, and enhance digestion. Alpha-ketoglutarate, medium-chain fatty acids (MCFAs), and short-chain fatty acids (SCFAs) are typical examples.

In weaned piglets, sodium butyrate at 1,000 mg/kg enhanced SOD activity and reduced pro-inflammatory cytokines (TNF-α, IL-6) (Huang *et al.*, 2015).

MCFA supplementation (7.75 g/kg) decreased diarrhea in piglets and raised IgA, IgG, and IgM levels in sow colostrum (Chen *et al.*, 2019a).

Alpha-ketoglutarate (1%) reduced the histomorphological defects in the liver and increased GPx activity in the liver. (Wang *et al.*, 2015).

5. Prebiotics

Prebiotics are indigestible fibers that enhance the function of the gut barrier and promote the good gut microbiota.

In weaned piglets, 1% fructooligosaccharides (FOS) decreased diarrhea and raised Nrf2 expression (Zhang *et al.*, 2022).

Mannan-oligosaccharides (MOS) altered the gut microbiota and boosted immunological function; treatment in sows raised piglets' SIgA levels. (Duan and others, 2019a).

Between 100 and 200 mg/kg of chito-oligosaccharides (COS) improved gut morphology and decreased stress-induced diarrhea by promoting Lactobacillus development and decreasing intestinal E. coli (Liu *et al.*, 2008).

6. Probiotics

Lactobacillus, Bacillus, and Saccharomyces species are probiotics that improve oxidative resilience, gut microbiota balance, and immunological response.

According to Wang *et al.* (2017), *Lactobacillus fermentum* and *Bacillus amyloliquefaciens* boosted the levels of antioxidant enzymes (CAT, GPx) and altered Nrf2, NF-κB, and MAPK signaling.

Weaned piglets' liver oxidative balance improved when Pediococcus pentosaceus SMM914, which was isolated from sow milk, stimulated the Nrf2-Keap1 pathway (Wang *et al.*, 2022).

The Importance of Environmental Management

To mitigate stress in swine production, environmental control is just as important as good nutrition. Pig welfare and stress levels can be greatly impacted by climate, social dynamics, and housing circumstances. Pigs can live in a more comfortable environment if there is enough room, good ventilation, and comfortable bedding (Mason *et al.*, 2020). Additionally, pigs' general wellbeing and the probability of stress-related problems can be enhanced by reducing handling stress through gentle and low-stress handling approaches (Harris *et al.*, 2023).

Social dynamics within a group of pigs can also influence stress levels. Pigs are social animals, and disruptions in their social hierarchy can lead to increased aggression and stress. Implementing strategies to minimize aggression, such as providing adequate space and resources, can help maintain a stable social environment (Lee et al., 2022). Additionally, introducing new pigs gradually and allowing for acclimatization can reduce stress during group changes.

Minerals and Vitamins

Minerals and vitamins are essential micronutrients that play critical roles

in the growth, immune response, antioxidant defense, and overall stress resistance of pigs. Their significance becomes even more evident under stress conditions such as heat exposure, oxidative imbalance, or weaning. Stress in pigs not only compromises physiological functions but also leads to increased susceptibility to diseases, impaired growth, and reduced productivity. Adequate supplementation of trace elements and vitamins has been shown to modulate stress-induced damage by enhancing antioxidant enzyme activity, regulating immune responses, and maintaining metabolic stability.

For example, chromium (Cr) at 200 µg/kg improved neutrophil function in finishing pigs under heat stress. Iron (Fe) at 60 mg/kg in neonatal piglets facing oxidative stress induced the expression of multiple immune markers. Selenium (Se) at 1 mg/kg in boars under oxidative stress led to reduced serum ALT and AST, decreased liver malondialdehyde (MDA), and lowered the ratio of apoptotic liver cells. In gilts, the same dose of Se under heat stress enhanced erythrocyte GPx activity, while in sows and piglets, lower doses improved rectal temperature regulation and plasma antioxidant enzyme levels. Additionally, in lactating sows, Se supplementation increased antioxidant capacity in colostrum and milk while decreasing MDA levels.

Under weaning stress, serum retinol, IgA, and GPx levels were elevated in weaned pigs given vitamin A at 13,500 IU/kg. It enhanced immunological markers such as IL-10, IFN-α, IFN-γ, and B cells that produce IgA in nursing piglets. In weaned piglets, vitamin C at 150 mg/kg enhanced liver enzyme levels and hepatic gene expression linked to antioxidant defense. When given to developing pigs at different doses, vitamin E enhanced glutathione metabolism and intestine antioxidant gene expression. 200 IU/kg of vitamin E improved blood antioxidant enzymes and decreased oxidative damage in multiparous sows. Together, our results highlight how important strategic micronutrient supplementation is for improving swine resistance to physiological and environmental stresses (Wang *et al.*, 2023).

Future Directions in Research

As the understanding of the relationship between nutrition and stress in swine continues to evolve, future research should focus on identifying specific dietary components that can further enhance stress resilience. Furthermore, exploring the interactions between nutrition, genetics, and management practices can help develop more comprehensive strategies for improving swine welfare and production efficiency.

Additionally, research should aim to establish standardized protocols for assessing stress in pigs, allowing for more accurate evaluations of the effectiveness of antistress nutritional practices. Developing reliable biomarkers for stress can facilitate the identification of at-risk animals and enable targeted interventions to improve their welfare. By advancing the scientific understanding of stress in swine, producers can implement more effective management strategies that enhance both animal welfare and production outcomes.

Conclusion

In conclusion, antistress nutritional practices play a vital role in enhancing swine production by mitigating stress and improving overall health and welfare. The incorporation of specific nutrients, such as amino acids, vitamins, minerals, and dietary fiber, can significantly influence stress responses in pigs. Additionally, effective environmental management and handling practices are essential for creating a conducive environment that supports pig welfare. As research continues to advance, the integration of nutritional strategies with management practices will be crucial for optimizing swine production and ensuring the well-being of pigs in commercial settings. By prioritizing antistress nutritional practices, producers can enhance productivity, improve meat quality, and contribute to a more sustainable and ethical swine industry.

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22-24 VIV SELECT INDIA 2026

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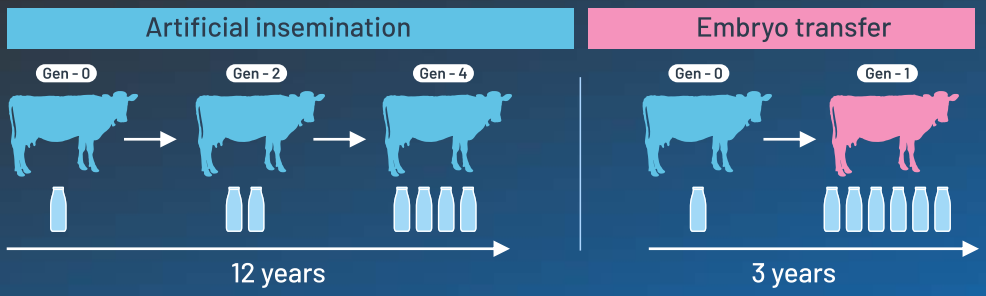

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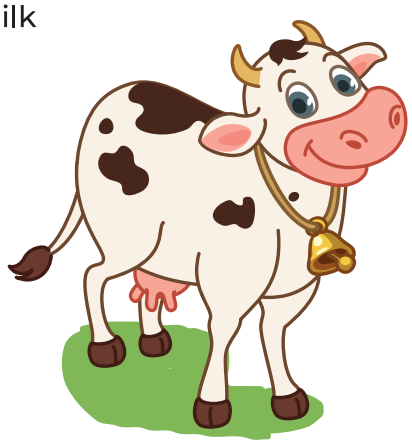

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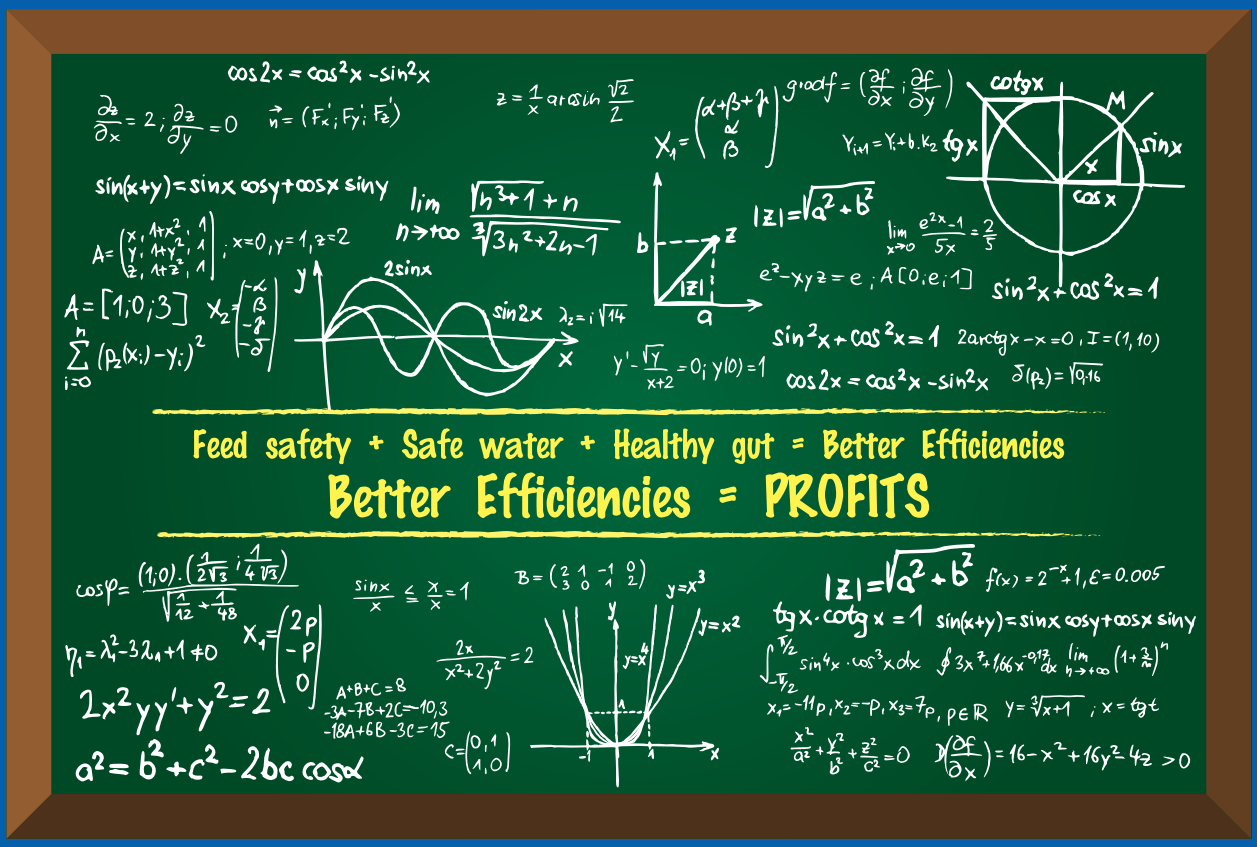

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