Livestock & Feed Trends

CLFMA OF INDIA

VOLUME - 22 • NUMBER - 1 • APRIL - JUNE 2024

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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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From the Chairman's Desk.....

Dear Friends,

Warm greetings!

We are delighted to share that the first quarter of the financial year, from April to June, has been marked by significant progress and engagement for CLFMA OF INDIA. Our efforts to safeguard the interests of the livestock industry have yielded positive outcomes, and we are thrilled to see such encouraging results.

CLFMA is pleased to announce its 57th Annual General Meeting and 65th National Symposium 2024, which will be held at Hotel Novotel Goa Resort and Spa / Novotel Goa, Candolim, on September 20th and 21st, 2024. We have also requested logo support for our symposium from the Government of India.

We extend our sincere gratitude to all CLFMA Members for your unwavering support to CLFMA OF INDIA. Allow me to provide a brief overview of our key activities, outlined under "CLFMA Activity Updates":

International Engagements of CLFMA OF INDIA i.e. CLFMA OF INDIA delegation met with soybean and corn grower farmers from the USA, CLFMA's participated in the Right to Protein Run organized by the Veterinary Association of Nepal and supported by USSEC, in Kathmandu, Nepal. In the first quarter CLFMA had successful meetings with Government of India & the Regional Advisory Council. CLFMA OF INDIA organized three successful seminars, the first seminar in Coimbatore on the Topic “Surging Ahead towards the next level contributing to the Five Trillion Economy” in collaboration with the Broiler Co-ordination Committee (BCC), the second seminar in Ludhiana, Punjab on the topic “Feed Ingredients – Supply, Price and Alternatives” in partnership with GADVASU and third seminar in Pune, which covered the same topic as the Ludhiana Seminar. All the seminars had excellent participation. CLFMA OF INDIA Treasurer, Mr.Nissar F. Mohammed attended the

“ONE INDIA ONE FIP” workshop in Bangalore.

Your feedback and input are invaluable to us as we strive for continuous improvement. Please feel free to share your thoughts at any time. I am eagerly look forward to meeting you in person at CLFMA's 65th National Symposium at Hotel Novotel, Goa. Your active participation will be greatly appreciated in making our Symposium a grand success.

Thank you once again for your ongoing support and dedication to the Livestock industry.

With warm regards,
For **CLFMA OF INDIA,**

Suresh Deora
Chairman

CONTENTS

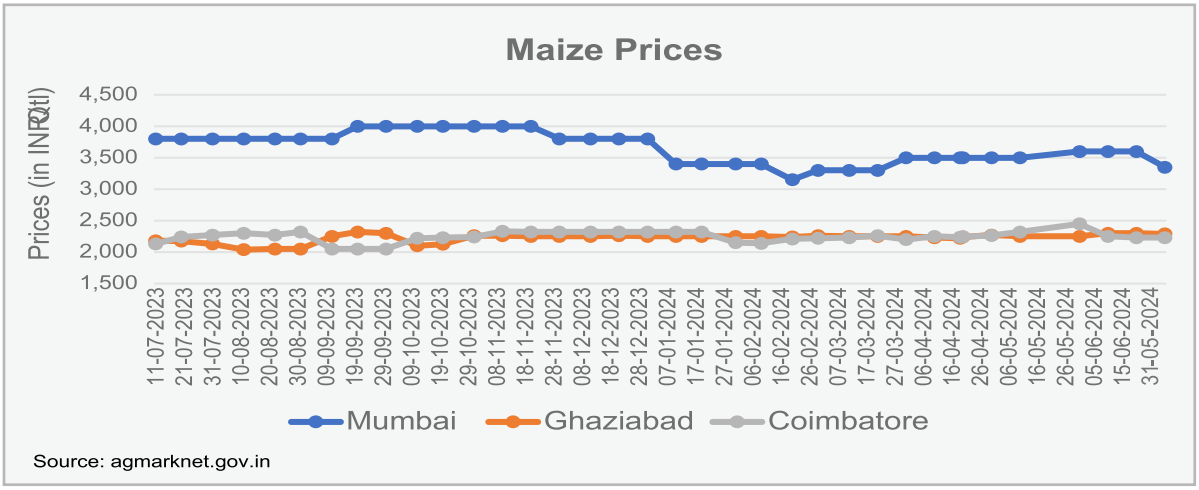
Printed, Published and Edited by Executive Director on behalf of CLFMA OF INDIA, Printed by Sugam Printers, 21/649, West View Chs. Ltd., Shastri Nagar, Goregaon (W), Mumbai 400 104 and Published from 111, Mittal Chambers, 11th Floor, 228, Nariman Point, Mumbai - 400 021. Tel. No. 91-22-2202 6103. Fax No. : 91-22-2288 0128. Editorial View are independent.

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

Commodity Updates

1. Domestic Prices

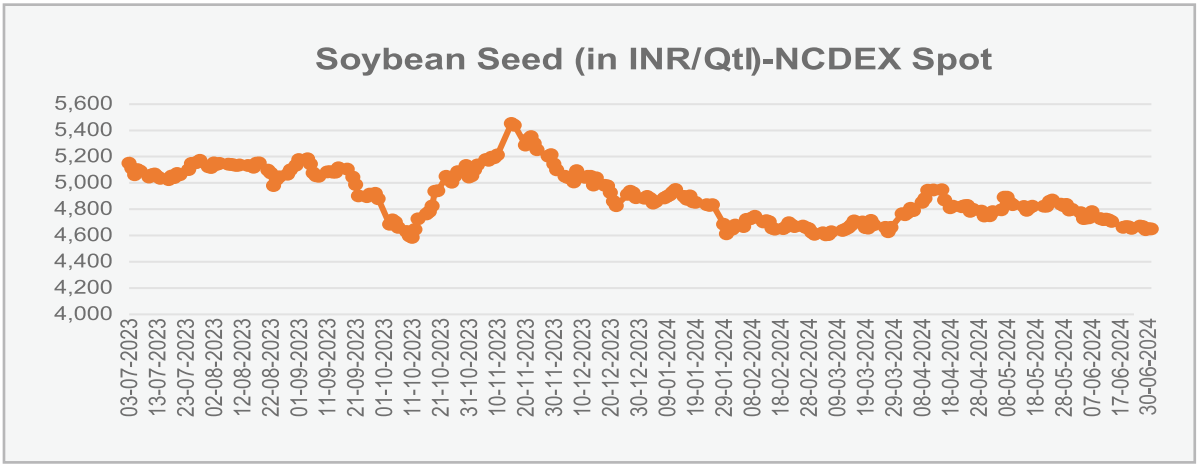
I. Maize



Source: agmarknet.gov.in

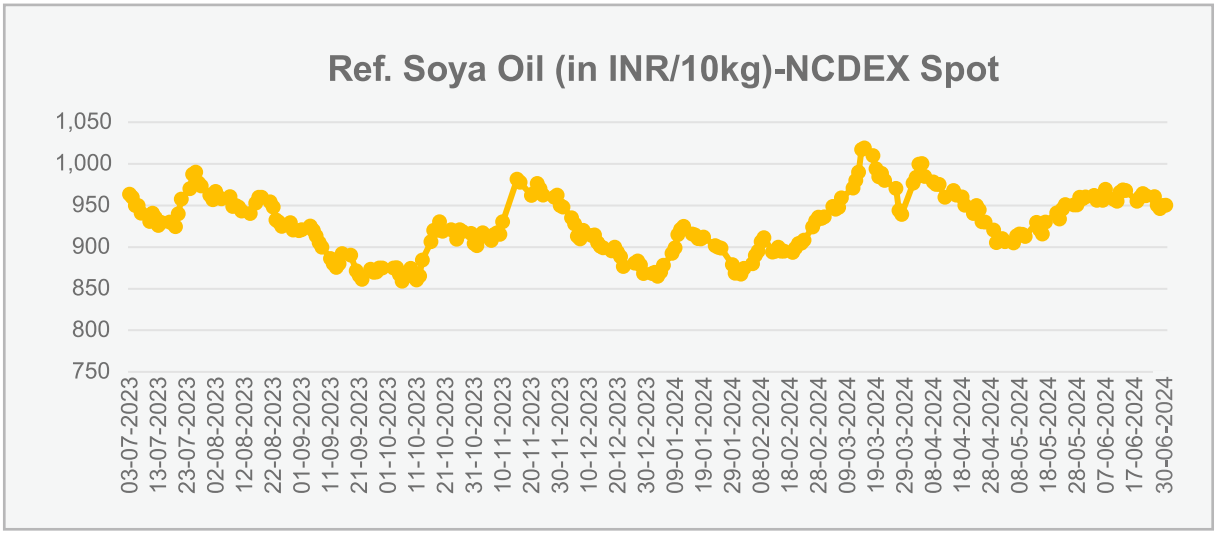
Maize Prices (INR/Quintal)		
City	30/06/2024	31/05/2024
Mumbai	3,350	3,600
Ghaziabad	2,290	2,250
Coimbatore	2,230	2,450

II. Soybean

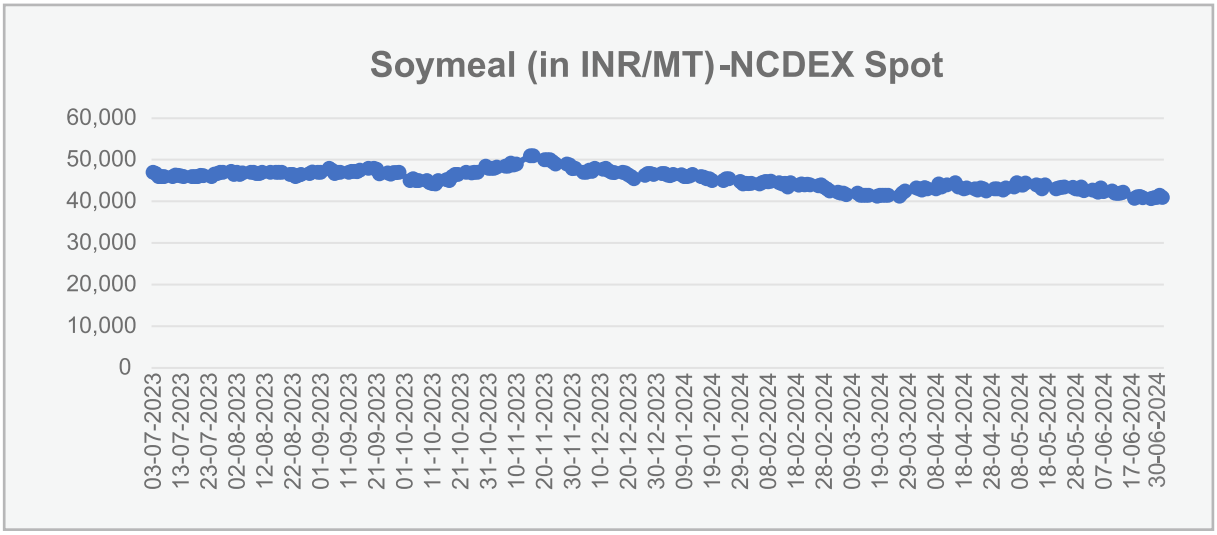


Soybean Complex Prices-NCDEX Spot		
Commodity (Unit)	**30/06/2024**	**31/05/2024**
Soybean Seed (in INR/Qtl)	4,649	4,799
Ref. Soya Oil (in INR/10kg)	950	960
Soymeal (in INR/MT)	41,000	42,575

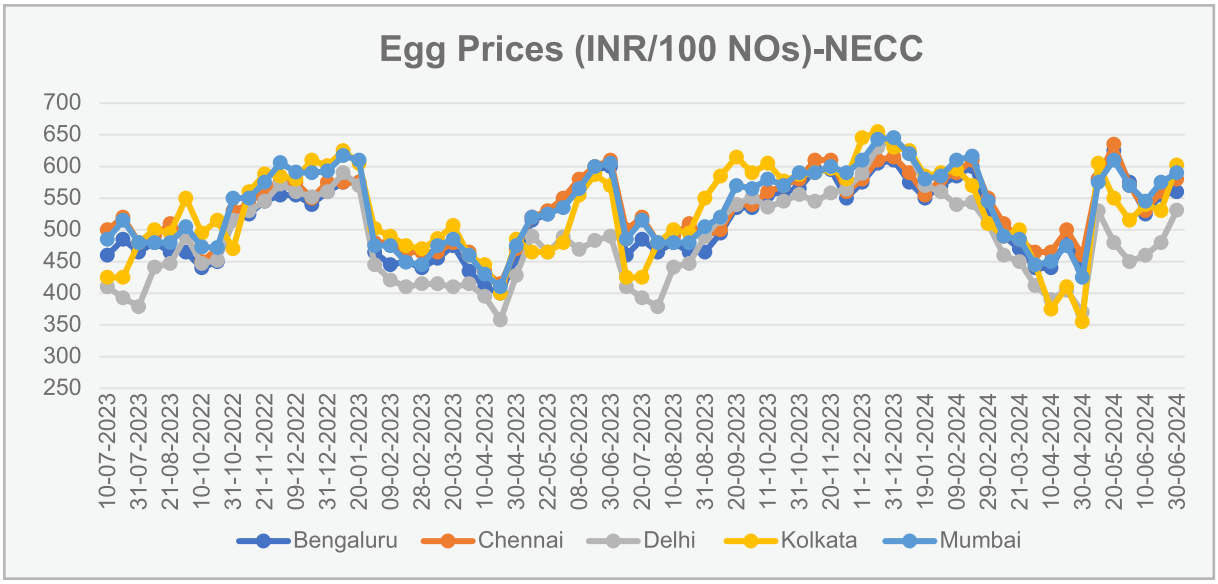
Ref Soya Oil



Soymeal



III. Egg Rates



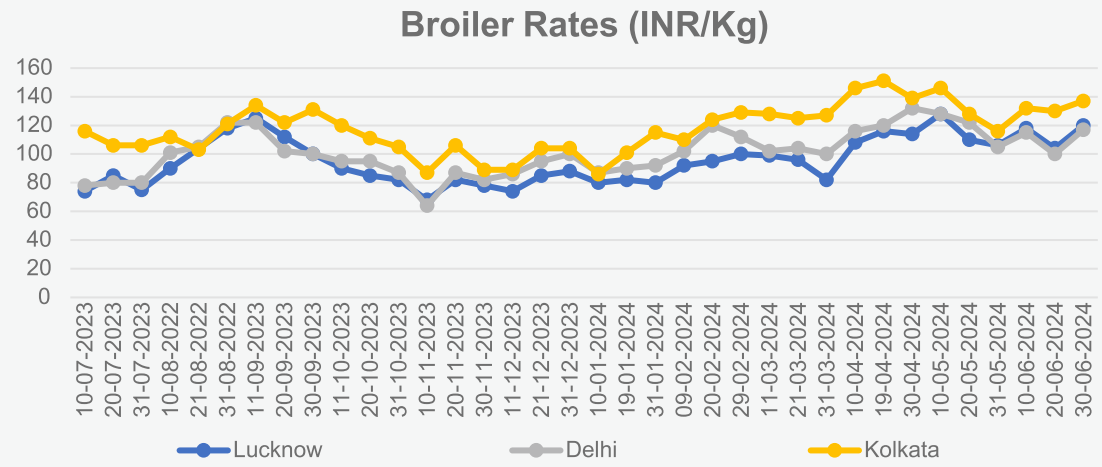
EGG PRICES (INR/100 NOs)		
Name of Zone	**30/06/2024**	**31/05/2024**
NECC Prices		
Ahmedabad	545	520
Ajmer	515	450
Barwala	513	425
Bengaluru (CC)	560	575
Brahmapur (OD)	540	490
Chennai (CC)	580	570
Chittoor	573	563
Delhi (CC)	531	450
E.Godavari	525	485
Hospet	515	530
Hyderabad	520	500
Jabalpur	545	470
Kolkata (WB)	602	515
Ludhiana	510	422
Mumbai (CC)	590	570
Mysuru	565	575
Namakkal	515	530
Pune	590	560
Raipur	550	500
Surat	575	535
Vijayawada	535	490
Vizag	540	500
W.Godavari	525	485
Warangal	522	502

III. Egg Rates

EGG PRICES (INR/100 NOs)		
Name of Zone	**30/06/2024**	**31/05/2024**
Prevailing Prices		
Allahabad (CC)	581	505
Bhopal	540	485
Indore (CC)	550	490
Kanpur (CC)	576	476
Lucknow (CC)	583	500
Muzaffurpur (CC)	580	490
Nagpur	550	505
Patna	580	490
Ranchi (CC)	576	500
Varanasi (CC)	567	490

Source: NECC

IV. Broiler Rates



BROILER RATES (INR/Kg)		
Location	**30/06/2024**	**31/05/2024**
Delhi	117	105
Punjab	117	112
Raipur	100	117
Pune	100	141
Bengaluru	106	141
Hyderabad	112	137
Guwahati	102	134
Kolkata	137	116
Bihar	94	137
Madhya Pradesh	130	141
Lucknow	115	106

Source: SRP (Wholesale Rates)

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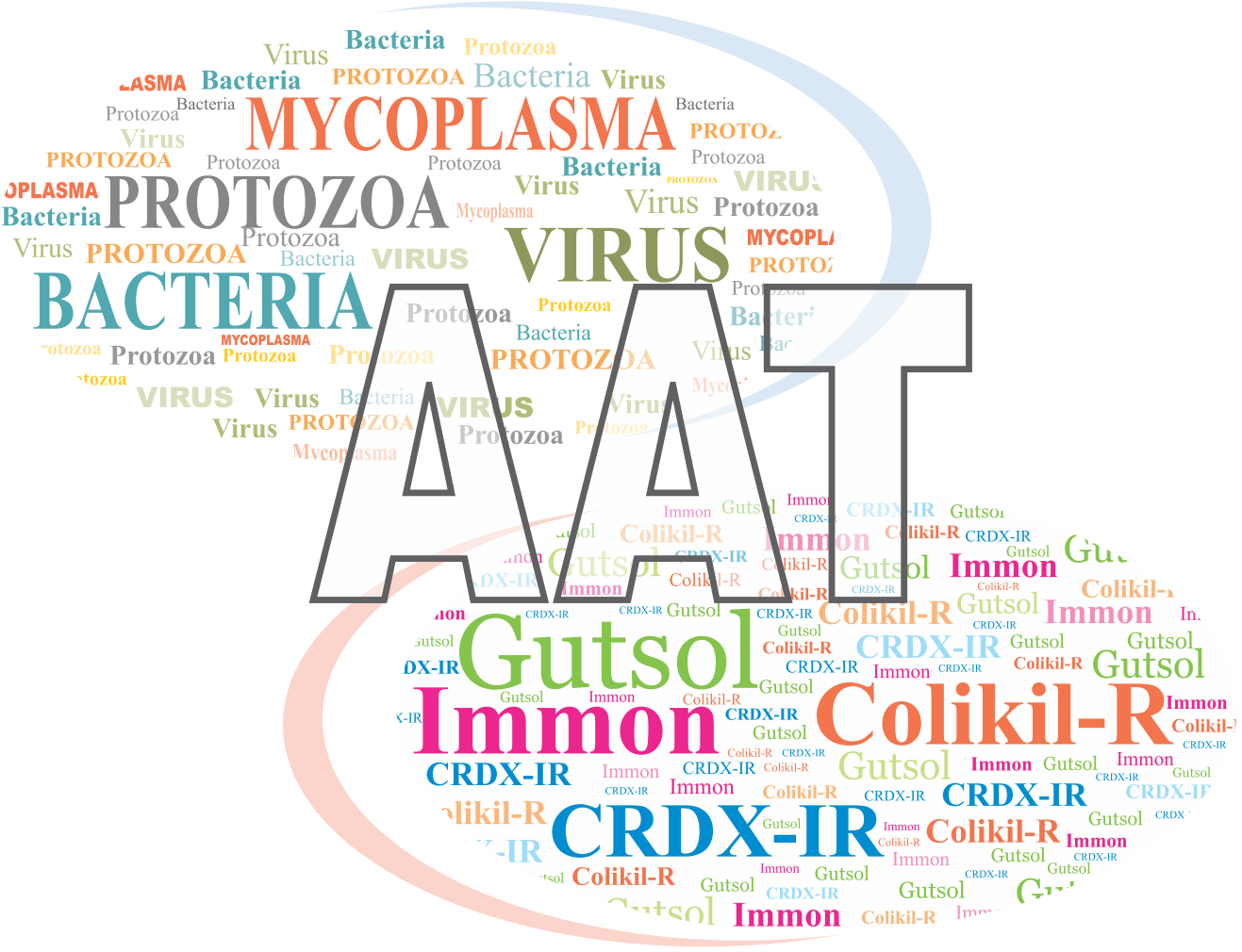

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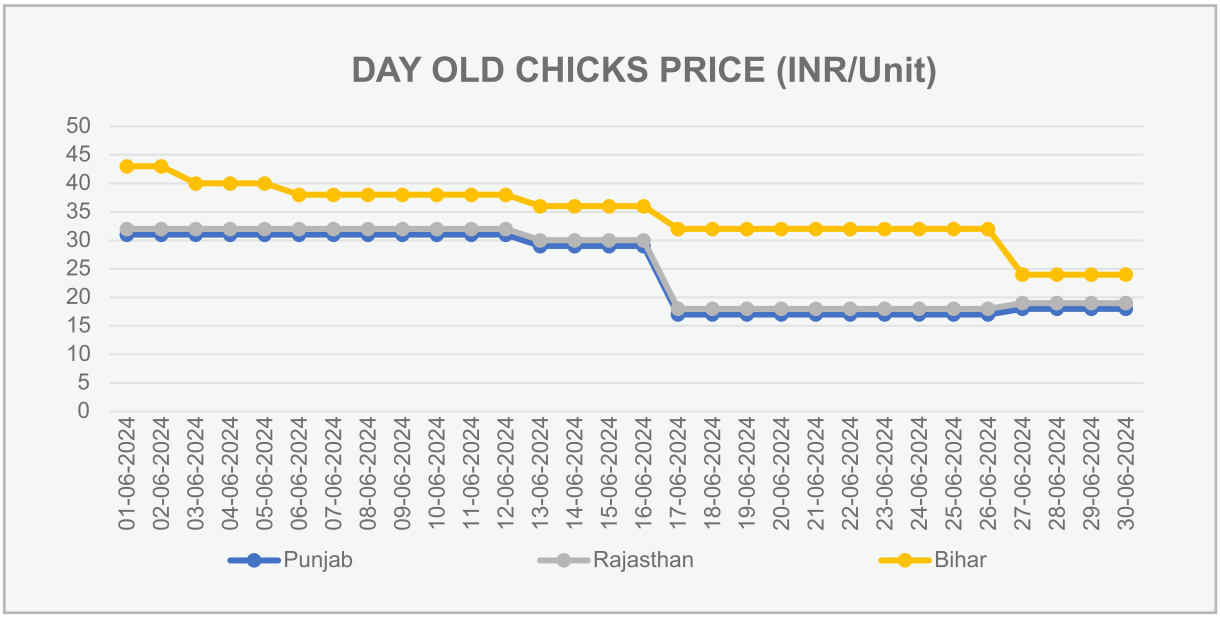
V. Day old Chicks Price

DAY OLD CHICKS PRICE (INR/Unit)		
State	**30/06/2024**	**31/05/2024**
Punjab	18	31
Dehradun	20	33
Haryana	18	31
Himachal Pradesh	19	32
Rajasthan	19	32
Jammu	20	33
Andhra Pradesh	25	53
Uttar Pradesh	22	40
Madhya Pradesh	24	49
Telangana	25	53
Bihar	24	43
Jharkhand	24	43
Gujarat	22	49

Source: Poultry India TV/ SRP



VI. Fish Prices

Fish Prices Average Price (INR/Quintal)		
Fish Type	**30/06/2024**	**31/05/2024**
Bata Putti	8,500	8,500
Black Dom	12,000	12,000
Blue Dom	13,500	13,500
Chilwa	9,000	9,000
Halwa	30,000	30,000
Hilsa	60,000	60,000
Katla (Small)	22,000	20,000
Malli (Big)	33,000	25,000
Malli (Small)	16,000	16,000
Pangass	14,000	18,000
Katla (Big)	30,000	35,000
Singhra (Big)	22,500	22,500
Singhra (Small)	18,000	18,000
Surmali (Small)	32,500	32,500
Surmai (Big)	47,500	47,500
Sol	48,000	55,000
Soli	15,000	15,000
White Dom	13,000	13,000
Rahu (Andhra)	12,500	12,500
Zinga (Zambo-A)	52,500	52,500
Zinga (Zambo-B)	45,000	45,000
Zinga (Zambo-C)	35,000	35,000

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

2. Global Commodity Prices

Commodity (Unit)	PRICE (30/06/2024)
Milk (USD/CWT)	19.89
Rapeseed (Euro/Ton)	486.94
Soybean Meal (USD/Ton)	365.70
Soybean Oil (USD/lb)	0.46
Live Cattle (USD/Lbs)	1.84
Poultry (USD/Kgs)*	1.45
Eggs US (USD/Dozen)	2.44

Source:tradingeconomics; markets.businessinsider

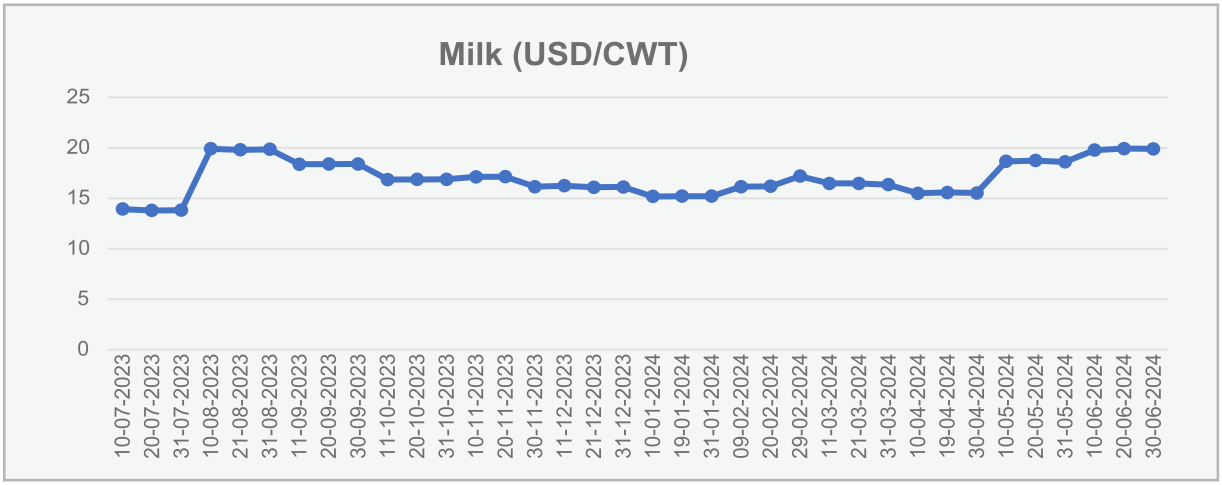
USD: United States Dollar

CWT: Short Hundredweight

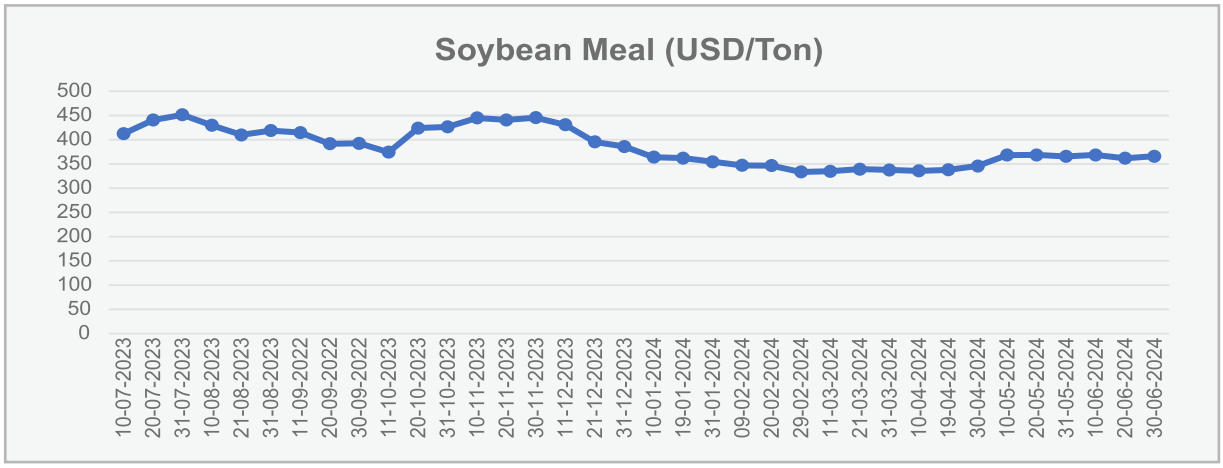
Lbs: Pounds

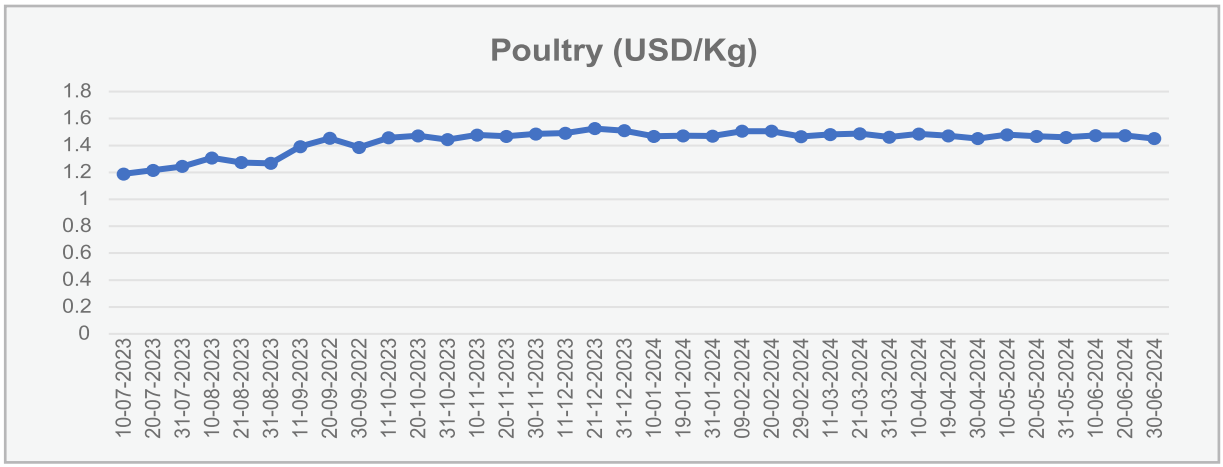
1 BRL (Brazilian Real) = 0.20 USD

*-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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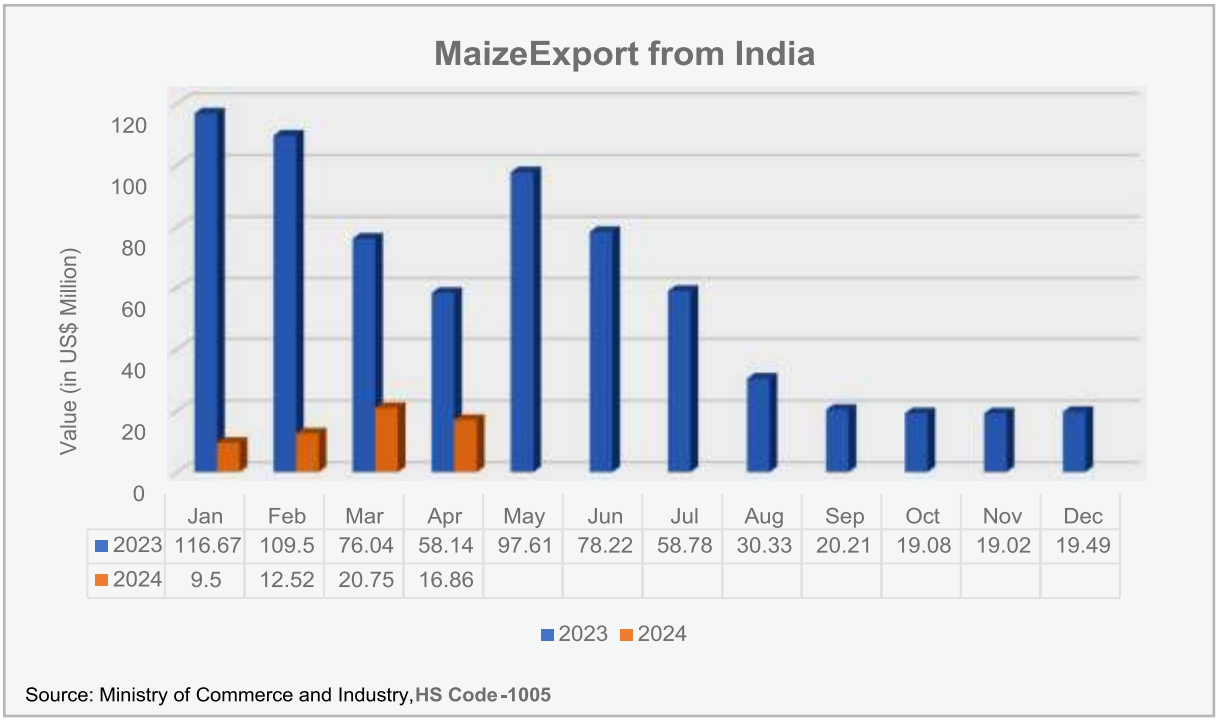
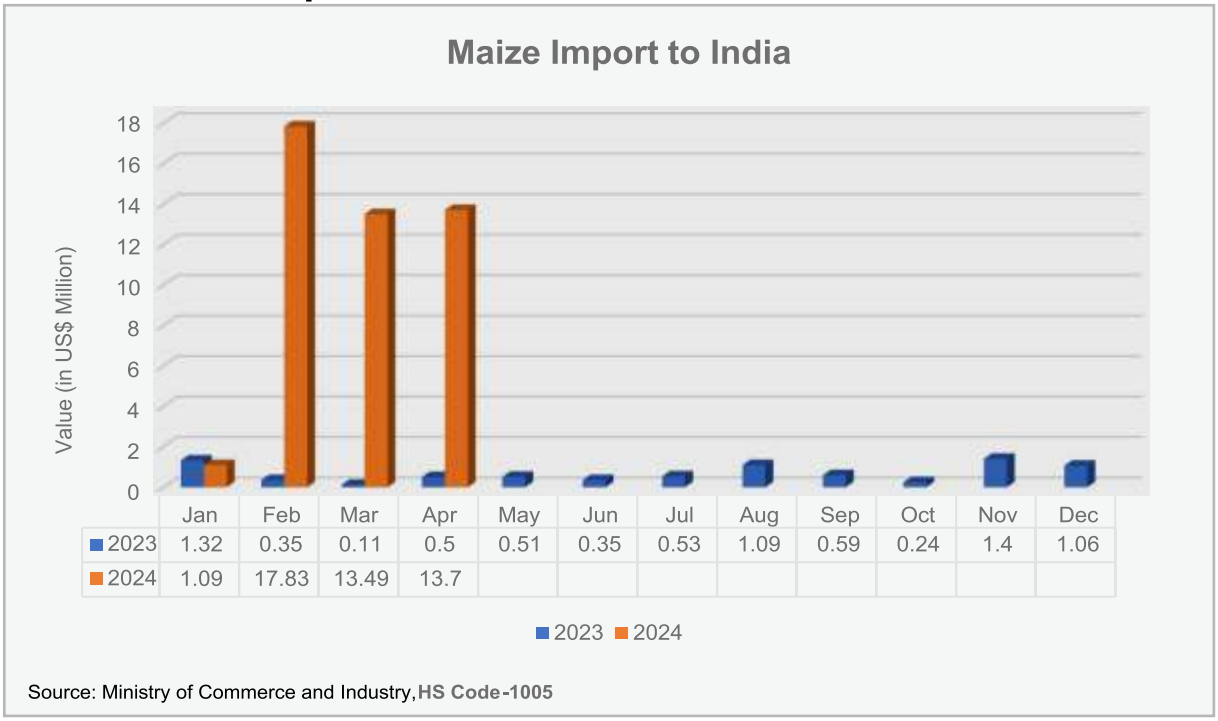
3. Trade Details

India: Maize Export



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

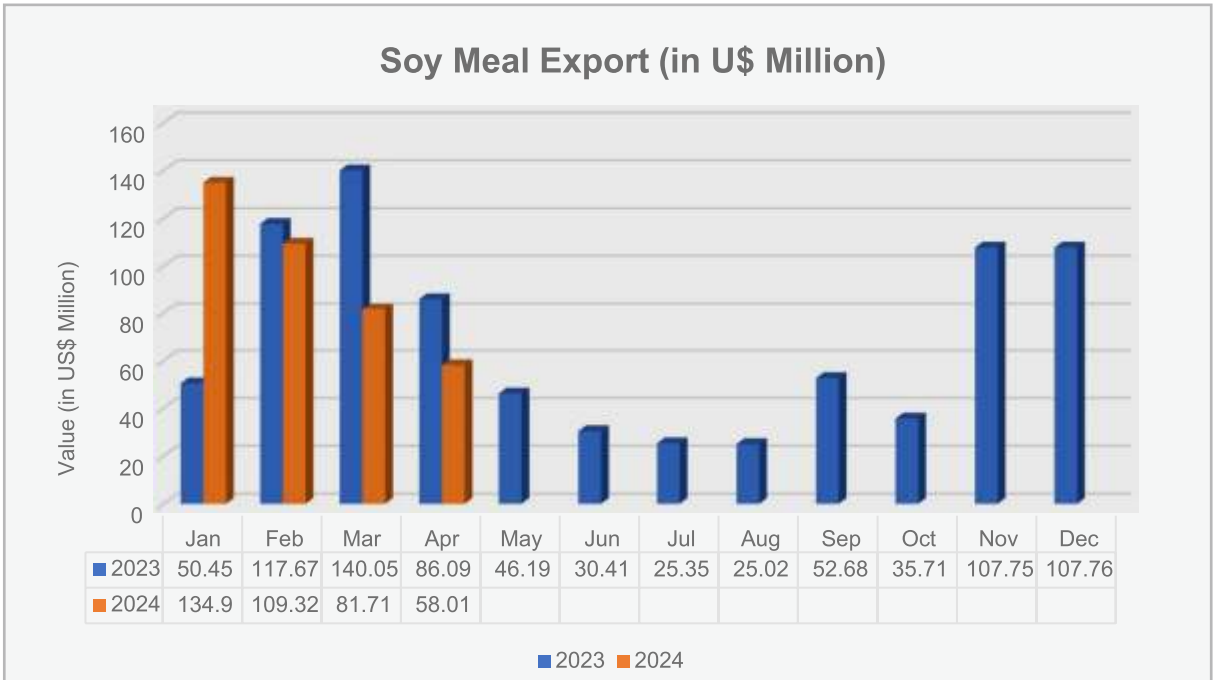
India: Maize Import



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

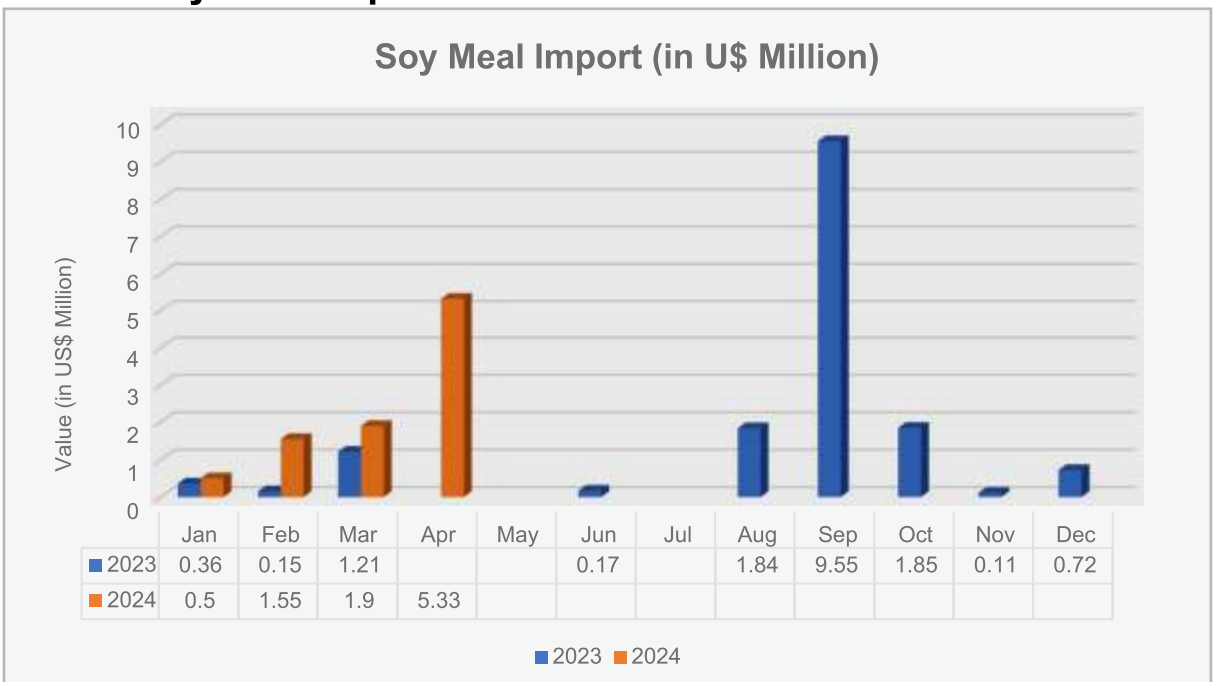
Note: This Data is sourced from the Ministry of Commerce and Industry, which was last updated in April.

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 April.

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
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Sourced by: IMARC Group

CLFMA ACTIVITY UPDATES

CLFMA OF INDIA Delegation met with Soybean and Corn Grower Farmers from USA on 22nd March, 2024 at New Delhi.

CLFMA OF INDIA delegation had a Meeting with Soybean and Corn Grower Farmers from the USA on 22nd March 2024 at New Delhi and the participants were CLFMA OF INDIA's Chairman, Mr. Suresh Deora, Mr. Gary Berg from the United Soybean Board (USB), Mr.Kimberly Atins, Director - Strategic Partnerships, USSEC, Mr. Jerry Slocum, Director, USB, Mr. Courtney B. Kingery, CEO, Indiana Soybean Alliance, Mr.Mike McCranie, US Farmer and Board Director, USSEC, USSEC, Mr.Dennis D.Hupe, Director of Field Services, Kansas Soybean Association, Mr. Tom Griffiths, Director, USB, Mr.Kevin Roepke, USSEC Regional Director, South Asia and Sub-Saharan Africa, Mr. Jaison John, Managing Committee Member, CLFMA OF INDIA & Team Lead - India, USSEC.

Discussion Points:

The US farmers provided updates on the current status of soybean and corn crops in the USA.

CLFMA OF INDIA Chairman Mr. Suresh Deora briefed the delegation on the status of the Indian Poultry Industry and the current and projected consumption of grains and soybean meal in poultry, dairy, and aquaculture sectors.

The US farmers extended an invitation for the CLFMA delegation to visit agricultural farms in the USA that specialize in soybean and corn cultivation.

Future Engagement:

The US farmers expressed their willingness to host the CLFMA delegation whenever they visit the USA, offering to showcase their agricultural practices and innovations in Soybean and Corn farming.

This meeting aimed to foster collaboration and information exchange between the Indian and US agricultural sectors, particularly regarding soybean and corn production and their applications in the poultry industry. Overall, the meeting was deemed successful.

CLFMA Participated in the Right to Protein Run organized by the Veterinary Association of Nepal and supported by USSEC on March 23, 2024 at Kathmandu, Nepal

Also, CLFMA's Chairman Mr. Suresh Deora visited Kathmandu, Nepal on 23rd March, 2024 to witness the Right to Protein Run Organised by the Veterinary Association of Nepal and supported by USSEC. This event likely aimed to raise awareness about the importance of protein in the diet and promote health and nutrition in the community.

CLFMA OF INDIA's participation in Strategy Workshop on Maize to Ethanol in India: Prospects and Strategies" on April 3, 2024 at 9:30 am.

Mr. Suresh Deora, Chairman of CLFMA OF INDIA, actively participated in a Strategy Workshop titled "Maize to Ethanol in India:Prospects and Strategies". The event was organized by the National Academy of Agricultural Sciences, under the Chairmanship of Dr. Himanshu Pathak, President, NAAS and Convenorship of Dr. H.S. Jat, Director, ICAR – IIMR and Dr. T. R. Sharma, DDG (CS), ICAR. It took place on April 3, 2024, commencing at 9:30 am. During the workshop, Mr. Suresh Deora, extensively shared his insights and perspectives on the subject matter.

CLFMA OF INDIA's Treasurer Mr. Nissar F. Mohammed participated in the Interactive Meeting with the Standardization Cell of the Ministry of Fisheries, Government of India, on 18th April 2024.

1st Meeting of the Standardization Cell was convened under the Chairmanship of Shri. Sagar Mehra, Joint Secretary (Inland Fisheries), Department of Fisheries, Ministry of Fisheries, Animal Husbandry and Dairying, GOI on 18th April, 2024 at 12:00pm through Video Conference. Mr. Nissar F. Mohammed, Treasurer of CLFMA OF INDIA, actively participated in this interactive session with key stakeholders including the Standardization Cell of the Ministry of Fisheries, Government of India, the Bureau of Indian Standards, CIFT, NFDB, among others.

CLFMA OF INDIA's Chairman Mr. Suresh Deora attended the 1st Regional Advisory Council Meeting of USSEC on 25th April, 2024

CLFMA OF INDIA received an invitation to join the Regional Advisory Council (RAC) of the Soy Excellence Centre. Mr. Suresh Deora represented CLFMA at the meeting, where he got an opportunity to meet Mr. Lance Rezac, Mr.Jim Sutter, and Mr. Brad Doyle. CLFMA is planning to establish ties

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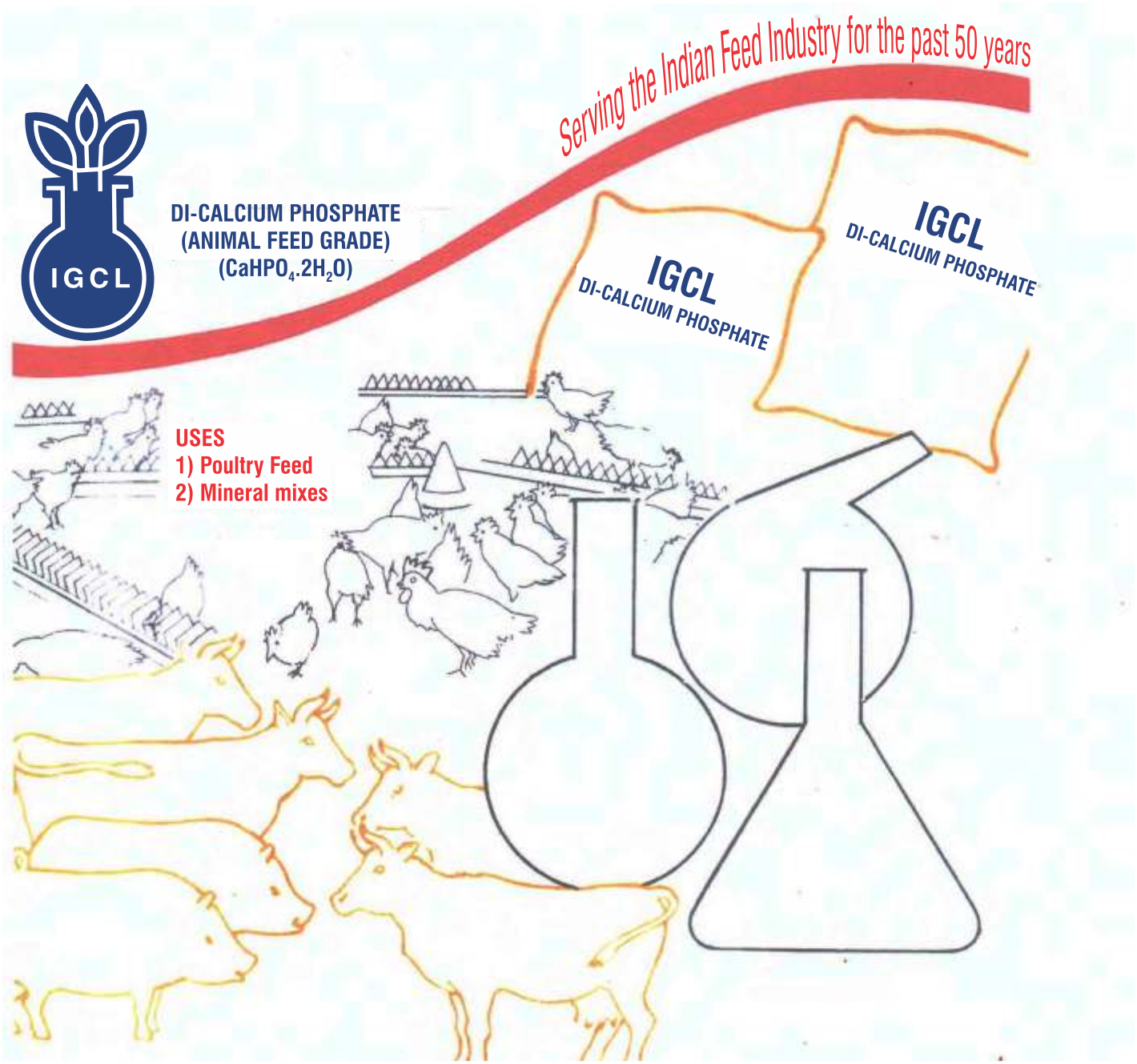

SPECIFICATIONS

(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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between the Regional Advisory Council (RAC) and the Agricultural Skill Development Council (ASDC) as CLFMA is the stakeholder of ASDC. This strategic initiative seeks to harness synergies between the two councils to drive comprehensive development within the Livestock Sector.

CLFMA OF INDIA's Treasurer Mr. Nissar F. Mohammed joined the Seafood Task Force Introduction – April 29th, 2024, at The Leela Mumbai – Resort – Business Hotel, Ballrooms 1-3, from 09:00am to 14:00pm.

On April 29th, 2024, Mr. Nissar F. Mohammed, Treasurer of CLFMA of India, attended the session of the Seafood Task Force (STF) at The Leela Mumbai. The STF, a Global Trade Association, convened to address forced labour and illegal fishing within Shrimp and Tuna Supply Chains. CLFMA of India received an invitation to this inaugural Indian Stakeholders and Members Meeting. During the session, STF outlined its objectives and work details. Mr. Nissar F. Mohammed, representing CLFMA, actively engaged in the discussions.

CLFMA OF INDIA along with Broiler Co-ordination Committee (BCC) hosted a successful Seminar "Surging Ahead" on 3rd May, 2024 at The Residency Towers in Coimbatore, Tamil Nadu. The event, themed "Surging Ahead Towards the Next Level: Contributing to the Five Trillion Economy" was attended by nearly 75 participants.

Mr. R. Ramkutty, Zonal President – South of CLFMA, welcomed attendees and discussed poultry industry challenges. Mr. Suresh Deora, Chairman of CLFMA, introduced the seminar's theme and extended a warm welcome to all participants, and Mr. R. Lakshmanan, Chairman of BCC, delivered the presidential address and moderated the discussions.

Key presentations included Mr. Reece H. Cannady from the US Grains Council on "Emerging Trends and Challenges in Grains.", Mr. Amit Sachdev, Regional Consultant at the US Grains Council, on "India Corn Outlook.", Mr. Jaison John, India Team Lead at USSEC, on "Protein Meals: Present, Future Trends, and Challenges.", Dr. T. Bina from the Happy Valley Business School on "Professionalism in Family Business."

The seminar concluded with an interactive Q&A session and a vote of thanks from Mr. Divya Kumar Gulati, Deputy Chairman of CLFMA. The event ended with a dinner, facilitating further networking among attendees.

CLFMA OF INDIA, in collaboration with the Department of Animal Nutrition at GADVASU, organized a seminar titled "Feed Ingredients: Supply, Price and Alternatives" on May 11, 2024, at the Silver Jubilee Block Auditorium, GADVASU, Ludhiana, Punjab.

The event was supported by the Progressive Dairy Farmers Association (PDFA), the All Feed Millers Association of Punjab (AFMA), and the Animal Nutrition Society of India (ANSI).

Mr. Suresh Deora, Chairman of CLFMA OF INDIA, welcomed the participants. Key discussions included "Opportunities for dairy farmers of Punjab" by Mr.Daljeet Singh Gill (PDFA President), "Challenges for feed millers of Punjab" by Mr. Ashok Kumar (AFMA President), and ANSI's support for the industry & farmers by Dr. A.P.S. Sethi (ANSI Secretary).

Guest of Honour Dr. Rameshwar Singh, Vice Chancellor of Bihar Animal Sciences University, invited Punjab's dairy farmers for training in Bihar and discussed maize production. Chief Guest Dr.Inderjeet Singh, Vice Chancellor of GADVASU, spoke on the potential of GM crops, promising full support from the university.

Presentations covered "Recent trends in the biofuel industry" by CLFMA OF INDIA's Past Chairman, Mr.S.V.Bhave, "Availability of DDGS in India" by Mr.Sanjit Padhi, Advisor to the All India Distillers' Association. "The importance of millets in animal feeds" by Dr. Ruchika Bhardwaj, A millet breeder from PAU and "The use of DDGS in animal feeds" by Dr. Amit Sharma, Assistant Professor at GADVASU. The seminar concluded with a vote of thanks from Mr.Divya Kumar Gulati, Deputy Chairman of CLFMA OF INDIA.

Approximately 150 participants attended the seminar, which highlighted the importance of DDGS as a protein source in animal feeds, emphasizing optimal usage conditions. Dr. Udeybir Singh Chahal, Head and Professor, Department of Animal Nutrition and President ANSI played a crucial role in organizing the event, with Dr. Dinesh Bhosale, CLFMA OF INDIA's past chairman as the Master of Ceremony.

On May 17, 2024, CLFMA OF INDIA hosted a seminar titled "Feed Ingredients – Supply, Price and Alternatives" at Hotel Ramee Grand, Pune.

The event, starting at 10:30 am, was led by Dr. Dinesh Bhosale as the Master of Ceremony. Key figures included Mr. Suresh Deora, Chairman of CLFMA, Dr.Niteen V. Patil, Vice

Chancellor of MAFSU, and Mr. Divya Kumar Gulati, Deputy Chairman of CLFMA.

The seminar began with a Welcome Address by Mr. Deora, followed by a Keynote Address from Dr. Patil emphasizing the collaboration between the livestock industry and the university. Presentations covered various topics: Mr. Sanjit Padhi discussed DDGS availability, Mr. Nagaraj Meda addressed raw material forecasting, Dr. N. V. Kurkure explored DDGS in animal feed, and Mr.Reece H. Cannady provided a global grains market overview.

The seminar concluded with a Q&A session and a Vote of Thanks by Mr. Divya Kumar Gulati. With nearly 108 attendees, the event was considered a resounding success.

IFIF:

Dr. Emmanuelle Soubeyran of France was elected as the new Director-General of the World Organisation for Animal Health (WOAH) on 28 May 2024. The election took place during the IFIF's 91st General Session and WOAH's 100th anniversary. Dr. Soubeyran will be WOAH's 8th Director-General elected for the next 5-year mandate (2024-2029) and will succeed Dr.Monique Eloit's 8-year tenure at the Organisation.

IFIF & CLFMA congratulated Dr. Soubeyran on her election and the email has been circulated to all CLFMA Members for their information.

ILDEX Vietnam 2024:

CLFMA OF INDIA's Chairman, Mr. Suresh Deora, and Deputy Chairman, Mr.Divya Kumar Gulati, attended ILDEX Vietnam 2024, the 9th International Dairy, Meat Processing, and Aquaculture Exposition, from 29-31 May 2024, along with industry colleagues. On 31st May 2024, they met with Dr. Madan Mohan Sethi, the Consulate General of India in Vietnam.

Looking ahead, we have an exciting lineup of Seminars planned for the coming months:

1. Aqua Seminar for the Fishery Sector in Vijayawada, Andhra Pradesh, scheduled for the end of June 2024, led by Mr.Nissar Mohammed.
2. Poultry Seminar in Kolkata in the second week of July 2024, led by Mr.Sumit Sureka.

Also, CLFMA OF INDIA is planning for a "Run for Protein" event in New Delhi between October 15th, 2024, and November 15th, 2024. The event will feature runs of 2.5 km, 5 km, and 10 km for participants of all ages, including children, adults, and geriatric.

CLFMA OF INDIA celebrated World Milk Day on 1st June 2024 & National Egg Day on 3rd June, 2024.

CLFMA OF INDIA celebrated 57th Foundation Day on 8th June, 2024.

CLFMA OF INDIA's Chairman, Mr. Suresh Deora has sent Congratulatory letter to Hon'ble Prime Minister, Shri. Narendra Modi and all other Hon'ble Ministers associated with the Livestock Industry by mid-June'2024.

Mr. Nissar F. Mohammed, Treasurer of CLFMA OF INDIA, attended the "ONE INDIA ONE FIP" Workshop in Bangalore on June 23, 2024, which focused on advancing MarinTrust Certification for sustainable practices in the Fisheries Industry. During the workshop, Mr.Mohammed highlighted the positive impact that IMIA's efforts will have on the sector and expressed strong support for the initiative to promote sustainability within India's Fishery Sector. Dr. Nicola Clark from MarinTrust UK, one of the speakers, requested CLFMA's assistance in supporting FIP Certification. Additionally, IMIA is seeking the support of CLFMA OF INDIA for this important initiative.

On June 27, 2024, Mr. Nissar F. Mohammed, Treasurer of CLFMA OF INDIA, met with Agri Minister Shri. Krishna Byre Gowda and Speaker Mr. U. T. Khader of the Karnataka Government.

Nissar F. Mohammed, Treasurer, CLFMA OF INDIA was the Speaker in the Shrimp Summit held on 29th June 2024 at the ITC Chola, Chennai, organised by The Center for Responsible Seafood (TCRS), U.S.A.

He emphasized the need for an early Fishery Improvement Programme (FIP) with the help of the Government & the guidance from the Marin Trust, U.K.

CLFMA OF INDIA

ASSOCIATION OF LIVESTOCK INDUSTRY

Announcement

CLFMA 57th AGM & 65th NATIONAL SYMPOSIUM 2024

Dear Sir / Madam,

We are pleased to inform you that, the 57th Annual General Meeting (AGM) and 65th National Symposium 2024 will be held on **September 20 & 21, 2024 in Goa** at Hotel Novotel Goa Resort and Spa / Novotel Goa Candolim, Bardez, Pin 403515 Goa - India.

The theme of the symposium is "Sustainable Livestock Sector: Threats, Challenges and Opportunities."

You are requested to kindly block your dates for 57th Annual General Meeting and 65th National Symposium 2024.

With warm regards,

Suresh Deora
Chairman

CLFMA OF INDIA along with Broiler Co-ordination Committee organized a Seminar "Surging Ahead" on 3rd May, 2024 at Legend Hall, The Residency Towers, Avinashi Road, P. N. Palayam, Coimbatore, Tamil Nadu.

CLFMA of India organized a successful seminar along with BCC at The Residency Tower, Legend Hall, Avinashi Road, Coimbatore, on Friday, May 3rd, 2024 from 06:30 pm onwards. The theme of the seminar was **"Surging Ahead Towards the Next Level: Contributing to the Five Trillion Economy."**

Mr. R. Ramkutty, Zonal President – South of CLFMA, extended a warm welcome to all participants at the seminar. He provided insights into the challenges confronting the poultry industry.

Following this, Mr. Suresh Deora, Chairman of CLFMA of India, introduced the theme "Surging Ahead" and extended a gracious welcome to all attendees.

The Presidential address and moderation of the deliberations were carried out by Mr. R. Lakshmanan, Chairman of BCC and Managing Committee Member of CLFMA of India.

CLFMA Dy. Chairman Mr. Divya Kumar Gulati introduced Mr. Reece H. Cannady, Director of the US Grains Council. He delivered an insightful presentation titled "Emerging Trends and Challenges in Grains." Overall, the presentation provided a comprehensive overview of the current trends and challenges in the grains market, with a focus on corn, ethanol, DDGS, and freight logistics.

CLFMA Hon. Secretary, Mr. Abhay Shah introduced Mr. Amit Sachdev, Regional Consultant at the US Grains Council. He presented an in-depth analysis titled "India Corn Outlook." Overall, Mr. Amit Sachdev's presentation provided valuable insights into the current dynamics and future prospects of the corn market in India, addressing key factors such as demand drivers, supply challenges, and potential areas for development.

CLFMA Treasurer Mr. Nissar F. Mohammed introduced Mr. Jaison John, India Team Lead at USSEC & Managing Committee Member of CLFMA OF INDIA. Mr. Jaison John emphasized that rising raw material prices will lead to higher food prices and potentially lower food quality. He suggested that importing genetically modified (GM) raw materials could be one viable solution. He delivered a comprehensive presentation titled "Protein Meals: Present, Future Trends, and Challenges." In his presentation, he highlighted India's progression towards maturity in food demand and outlined strategies to address protein challenges, particularly through initiatives like the Soy Excellence Centre program. He also discussed the expansion of US soybean crush capacity and the expected impact on soybean meal production. Additionally, he touched upon the National Oil Mission and rapeseed production scenarios, providing comprehensive insights into the future of protein meals in India.

Mr. R. Ramkutty, CLFMA South Zone President introduced Dr. T. Bina, Director of the Happy Valley Business School. She delivered a compelling presentation titled "Professionalism in Family Business." Throughout her presentation, she delved into the intricate life cycle of family businesses, exploring various stages and challenges. Dr. T. Bina supplemented her insights with enlightening case studies that exemplified real-world scenarios and lessons learned within family-owned enterprises.

The Question-and-Answer session concluded on a high note, characterized by its interactivity and engagement. Following this enriching exchange, Mr. Divya Kumar Gulati, Deputy Chairman of CLFMA of India, delivered a gracious Vote of Thanks, expressing gratitude to all participants for their active involvement and contributions. Subsequently, the seminar transitioned seamlessly into a dinner session, fostering continued networking among the attendees. Overall, the seminar was a resounding success, with nearly 75 members and delegates in attendance, reflecting the enthusiasm and interest surrounding the event.

CLFMA OF INDIA in collaboration with the Department of Animal Nutrition, GADVASU organized a Seminar on "Feed Ingredients: Supply, Price and Alternatives" on 11th May, 2024 at Auditorium, Silver Jubilee Block, GADVASU, Ludhiana, Punjab:

CLFMA OF INDIA hosted a seminar on "Feed Ingredients – Supply Price and Alternatives" on May 11, 2024, in collaboration with the Department of Animal Nutrition, GADVASU, in Ludhiana. The event was supported by the Progressive Dairy Farmers Association, the All Feed Millers Association of Punjab, and the Animal Nutrition Society of India.

Mr. Suresh Deora, Chairman of CLFMA OF INDIA, delivered the Welcome Address and introduced the association to all participants. Mr. Daljeet Singh Gill, President of PDFA, discussed "Opportunities for Dairy Farmers of Punjab." Mr. Ashok Kumar, President of AFMA, addressed the "Challenges for Feed Millers in Punjab." Dr. A.P.S. Sethi, Secretary of ANSI, explained how ANSI can support both the industry and farmers.

Dr. Rameshwar Singh, Hon'ble Vice Chancellor of Bihar Animal Sciences University, graced the seminar as the Guest of Honour. He extended an invitation to the dairy farmers of Punjab to train their counterparts in Bihar and discussed maize production in the state. Dr. Inderjeet Singh, Hon'ble Vice Chancellor of GADVASU, attended as the Chief Guest and spoke about the potential of GM crops, promising full support from the university.

Mr. S. V. Bhave, Past Chairman of CLFMA OF INDIA, discussed "Recent Trends in the Biofuel Industry." Mr. Sanjit Padhi, Advisor to the All India Distillers Association, addressed the availability of DDGS in India. Dr. Ruchika Bhardwaj, a millets breeder from PAU, highlighted the importance of millets in animal feeds. Dr. Amit Sharma, Assistant Professor at GADVASU, provided detailed insights on the use of DDGS in animal feeds. The seminar concluded with Mr. Divya Kumar Gulati, Deputy Chairman of CLFMA OF INDIA, delivered the vote of thanks.

Dried Distillers Grains with Solubles (DDGS) is a valuable protein source produced by ethanol manufacturers using rice or maize. Rice DDGS contains 43-45% protein, while maize DDGS contains 26-28% protein. It can be used in animal feeds at levels of 1-5%. For optimal use, DDGS should have a moisture content of no more than 11%, be free from aflatoxins, and not be over-processed.

Dr. Udeybir Singh Chahal, Head and Professor, Department of Animal Nutrition and President, ANSI played an important role in organizing the event. Dr. Dinesh Bhosale was the Master of the Ceremony. Approximately 150 participants from various sectors attended the event.

CLFMA Organized a Seminar "Feed Ingredients: Supply, Price and Alternatives" on 17th May, 2024 at Hotel Ramee Grand Pune, Regal Hall, Pune.

On May 17, 2024, CLFMA OF INDIA hosted a seminar titled "Feed Ingredients – Supply Price and Alternatives," commencing at 10:30 am. Dr. Dinesh Bhosale, Past Chairman of CLFMA OF INDIA, served as the Master of Ceremony. He began by introducing Mr. Suresh Deora, Chairman of CLFMA OF INDIA, the Chief Guest, Dr. Niteen V. Patil, Hon'ble Vice Chancellor of Maharashtra Animal & Fishery Sciences University (MAFSU), Nagpur, and Mr. Divya Kumar Gulati, Deputy Chairman of CLFMA OF INDIA.

The Seminar opened with a Welcome Address by Mr. Suresh Deora. He introduced the event's theme and warmly welcomed the Chief Guest and all attendees.

The Keynote Address was delivered by Dr. Niteen V. Patil, who highlighted the essential collaboration between the Livestock Industry and the University.

Mr. S. V. Bhave, Past Chairman of CLFMA OF INDIA, delivered the Opening Remarks. Subsequently, Speaker Mr. Sanjit Padhi, Advisor to the All India Distillers Association, presented on the availability of DDGS in India, explaining its details comprehensively. Mr. Nagaraj Meda, Managing Director of Transgraph, Hyderabad, discussed raw material availability and price forecasting. Dr. N. V. Kurkure, Director of Research at MAFSU, Nagpur, explored the potential of DDGS in animal feed. Mr. Reece H. Cannady, Director of the U.S. Grains Council, delivered an insightful presentation titled "Global Grains Outlook Including Maize, Sorghum, and Millets," providing a thorough overview of the global grains market.

The presentations were well-received and appreciated by all participants. The seminar concluded with an interactive and engaging Question-and-Answer session.

Mr. Divya Kumar Gulati, Deputy Chairman of CLFMA OF INDIA, delivered a gracious Vote of Thanks, expressing gratitude to all participants including CLFMA Staff for their active involvement and contributions. The seminar was deemed a resounding success, with nearly 108 members and delegates in attendance, reflecting the high level of enthusiasm and interest in the event.

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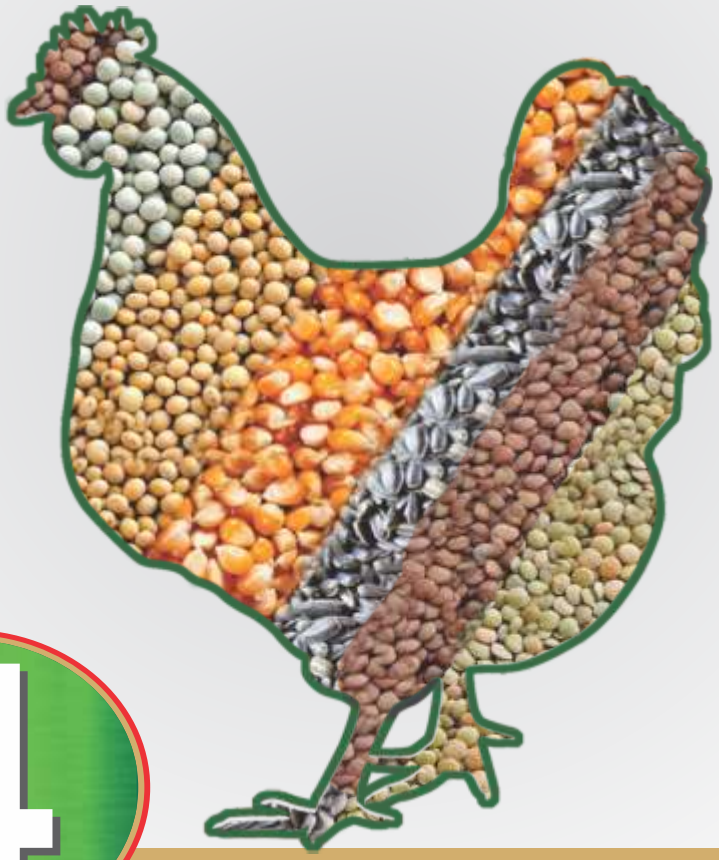

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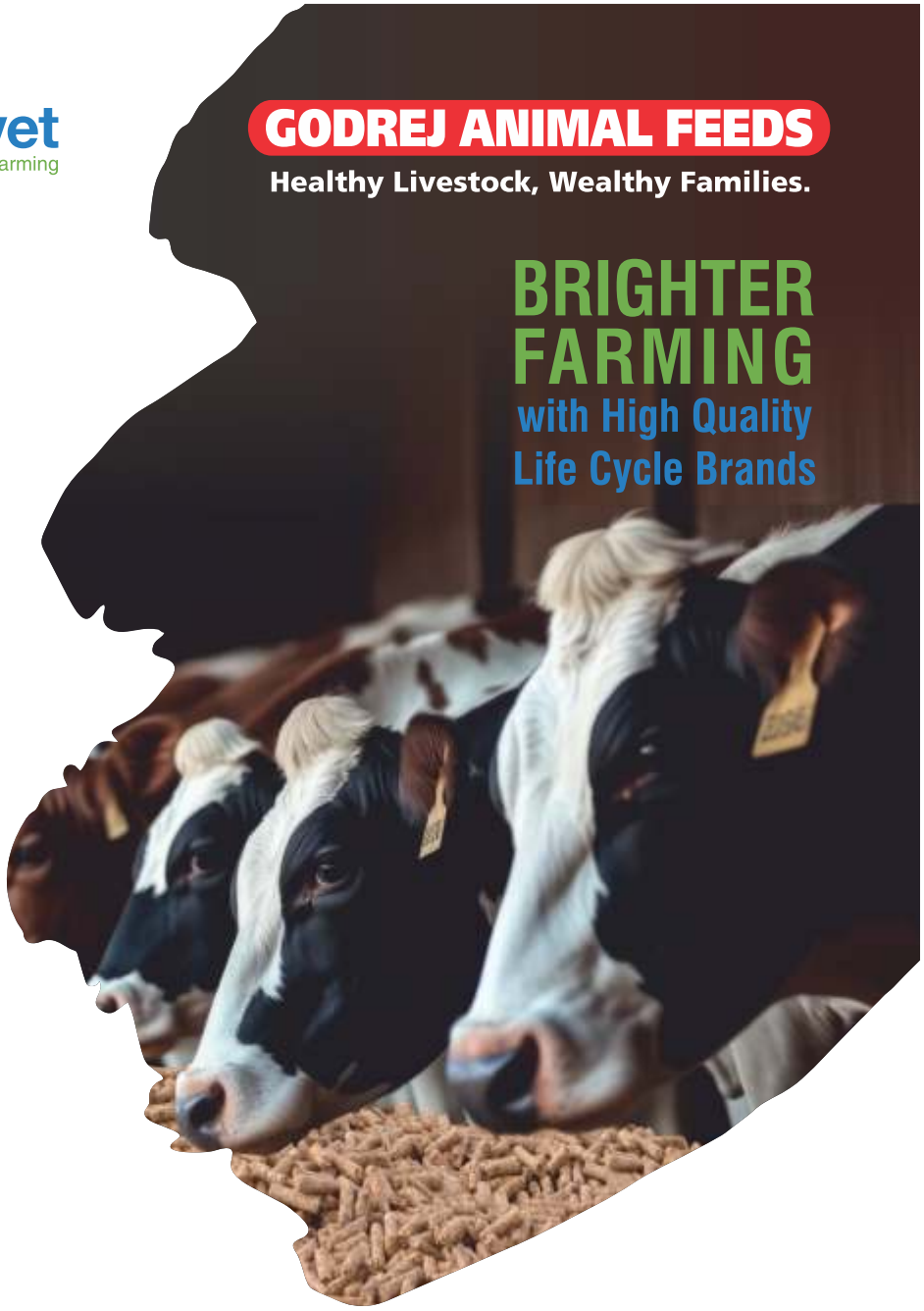

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Seminar on

India Aims to Expand Seafood Exports to $12 Billion in Two Years, Sources say

NEW DELHI (Reuters) – India is aiming to expand its seafood exports to around $12 billion in the next two years from $8 billion currently, mainly by focusing on high-end markets including the United States and Europe, two government officials said on April 03. India has emerged as the biggest supplier of seafood, particularly frozen shrimps, to the United States, with exports doubling over eight years to $2.6 billion in 2022/23, one of the officials at the Commerce Ministry told a small group of reporters. Total frozen shrimp exports topped $5.6 billion in 2022/23, according to commerce ministry estimates. "The government intends to focus on value addition and supply to high-end markets while creating awareness about good labour and environment practices among exporters," the officials said. Shrimp farming has emerged as a big opportunity for nearly 200,000 workers, mainly women in the Southern states of Andhra Pradesh, the second official said, noting, however, that global demand could remain weak this fiscal year. Both officials declined to be named as they were not authorised to speak to the media ahead of a general election which begins this month. China, the European Union, South East Asia, Japan and Middle Eastern countries have also emerged as major markets for India's frozen shrimp, produced in village ponds. Other seafood like frozen fish, octopus and cuttlefish is also finding international buyers. Responding to a report on exploitative labour practices of some shrimp exporters, released by the Chicago-based Corporate Accountability lab, a human rights legal group, officials said the allegations were "baseless" and possibly driven by trade rivalry with other countries and the U.S. industry. Commerce ministry officials will meet seafood exporters and take up the issue with the state government to ensure all export houses meet the expectations of buyers and overseas consumers, the first official said. To rule out any buyer concerns, the government could consider an independent study of the working conditions, he said. Separately, the Federation of Indian Export Organisation, the top exporter body, has said shrimp exporters were complying with food safety and quality norms to meet the requirements of importing nations including the U.S..

Andhra Pradesh Rides the Wave, Leads India's Fishing and Aquaculture Sector with 41% Share

Andhra Pradesh has emerged as the leader in India's fishing and aquaculture sector, accounting for 40.9% of the total share. This is followed by West Bengal, Odisha, and Bihar. A recent report by the statistics office on the value of output from agriculture and allied sectors revealed that West Bengal's share in national output has decreased from 24.6% in 2011-12 to 14.4% in 2022-23, while Odisha and Bihar have increased their shares. The fishing and aquaculture sub-sector has seen significant growth, with output increasing from about Rs. 80,000 crore in 2011-12 to approximately Rs 1,95,000 crore in 2022-23. This includes the entire output of marine fishing and prawn production. The livestock sub-sector has also grown steadily over this period, with increases in the production of milk, meat, and eggs. In 2022-23, the share of milk in livestock output was 66.5%, meat was 23.6%, and eggs were 3.7%, compared to 67.2%, 19.7%, and 3.4% respectively in 2011-12. Uttar Pradesh and Rajasthan together accounted for about a quarter of the livestock sub-sector's output, with Tamil Nadu showing rapid growth during this period. Uttar Pradesh had nearly 41% of the output of the sugar group in 2011-12, which increased to more than half of the total Indian output of sugar crops in 2022-23. Maharashtra was a distant second with 19%, followed by Karnataka (8.9%), Tamil Nadu (3.9%), and Bihar (3.3%). Other states accounted for the remaining 11.4%. In the fruit sector, bananas overtook mangoes in terms of value of output in 2022-23, with bananas holding a 10.9% share and mangoes at 10%. Together, they accounted for more than one-fifth of the total fruit output. Among vegetables, potatoes and onions contributed the highest production, accounting for about 15% of the total output in the group. Floriculture contributed about 7%.

CRISIL sees Revenues of Indian Shrimp Exporters Rising 8% this Fiscal on Improved Demand

Indian shrimp exporters will see their revenues grow by 8-10 per cent this fiscal year as demand from key importing nations recovers and realisations improve, CRISIL Ratings said in a statement. The revenue growth will be despite the higher duties for Indian exporters in the United

States and locational advantages enjoyed by key competing nations, it said. Higher revenues and lower procurement costs will help Indian shrimp exporters sustain an operating margin of around 7 per cent this fiscal, despite supply chain disruptions and higher logistics costs because of geopolitical uncertainties. Credit profiles will remain healthy as debt remains in check because of improved cash accrual, prudent working capital management, and limited capital expenditure (capex) due to surplus capacities. An analysis of 69 shrimp exporters rated by CRISIL Ratings, accounting for almost two-thirds of the industry's revenues, indicates as much, it said. Himank Sharma, Director, CRISIL Ratings, said "Indian shrimp exporters stand to benefit as demand improves for two reasons. First, lower channel inventories at importers' end, who had reduced purchases in the past few months, will need to be replenished. Second, higher spending on discretionary and food items, as the economic outlook improves for Western economies (the key consumers), will drive up volume and realisations for exporters. Volume and realisations of Indian shrimp exporters will go up in tandem by 4-5 per cent each, driving the revenue growth." India, Ecuador, and Vietnam account for around two-thirds of global shrimp exports, while the US, China, and Japan consume more than half of the global produce. In the past two fiscals, Ecuador surpassed India to become the largest shrimp exporter, backed by higher acreage, a favourable climate, and significant investments to improve the genetic quality of brood stock. Ecuador also benefited from its proximity to the US and the European Union as Asian exporters grappled with higher logistics costs amid container shortages. CRISIL said the recent investigations by the US Department of Commerce (USDOC) with regards to countervailing duty (CVD) and anti-dumping duty (ADD) on shrimp exporting nations could have a bearing on their competitiveness. Albeit, the final determination of CVD for Indian exporters and the key competing nations, along with the outcome of ADD investigations by the USDOC on Ecuador and Indonesia, will be monitorable.

Govt Trout Fish Farm Khag Achieves Record Production of Rainbow Trout Fish Seedlings

Budgam, Apr 08: The Government Trout Fish Farm Khag in central Kashmir Budgam district has achieved a significant milestone this year by producing over four lakh rainbow trout fish seedlings, surpassing all previous records. This farm hatchery is currently working on increasing production further. Deputy Inspector at Government Trout Fish Farm Khag, Riyaz Ahmed Khan said that rainbow trout are raised and cultured in the hatchery, making it the sole fish farm in Budgam district with a hatchery that serves private fish farms in the district as well as in Central and North Kashmir.

"The previous seed production record was one and a half lakhs, but this year, the hatchery has produced over four lakh rainbow trout fish seedlings," he said. Khan said that rainbow trout fish are consistently available at the farm, allowing customers to purchase them throughout the year. Additionally, the growth rate of rainbow trout fish is slower compared to common carp and brown trout, especially in their natural habitat. He said the hatchery plants green fertilized eggs, which typically take about two months to reach fry size (seedlings) depending on the water temperature. "The Department of Fisheries has implemented various programmes to offer job opportunities to unemployed young individuals. Under these programs, financial aid is provided to help them establish raceways and other necessary infrastructure for setting up their own units," Riyaz said, adding that they are given free seedlings for the initial year. He said currently, there are approximately eighty-five (85) Private Rainbow Trout Fish Farms operating in the district. These farms not only generate employment for their owners but also for others in the area, Khan added.

India's Seafood Exports Touch All-time High by Volume in FY 2023-24

India's seafood exports touched an all-time high in volume during the financial year 2023-24 despite various challenges in significant export markets. India shipped 17,81,602 MT of seafood worth Rs 60,523.89 crore (US$7.38 billion) during 2023-24. Frozen shrimp remained the major export item in quantity and value, while the USA and China became the major importers of India's seafood. During FY 2023-24, the export improved in quantity terms by 2.67 per cent. In 2022-23, India exported 17,35,286 MT of seafood worth Rs 63,969.14 crore (US$8,094.31million). "India recorded an all-time high export in terms of volume by shipping 17,81,602 MT of seafood worth US$ 7.38 billion, despite the several challenges in its major export markets like the USA, EU & the UK," D V Swamy IAS, Chairman, Marine Products Export Development Authority (MPEDA), said. Frozen shrimp, which earned Rs 40,013.54 crore (US$4881.27million), retained its position as the top item in the seafood export basket, accounting for a share of 40.19 per cent in quantity

and 66.12 per cent of the total dollar earnings. Shrimp exports during the period increased by 0.69 per cent in quantity terms. The export of frozen shrimps during 2023-24 was pegged at 7,16,004 MT. The USA, the largest market, imported 2,97,571 MT of frozen shrimp, followed by China (1,48,483MT), the European Union (89,697 MT), Southeast Asia (52,254MT), Japan (35,906MT), and the Middle East (28,571 MT). The export of black tiger (BT) shrimp increased by 24.91 per cent, 11.33 per cent and 8.28 per cent in quantity, value and US$ terms, respectively, in 2023-24. BT shrimps were exported to the tune of 38,987 MT worth Rs. 2855.27 Cr (US$347.84 million). China (including Hong Kong) turned out to be the major export destination for black tiger shrimp with a share of 28.43 per cent in terms of US$ value, followed by the USA (18.21 per cent), European Union (18.06 per cent) and Japan (13.12 per cent). Scampi exports have shown a positive trend of 6.42 per cent, 23.22 per cent and 18.96 per cent in quantity, value and US$ terms, respectively, in 2023-24. The Vannamei shrimp exports have grown in 2023-24 by 0.33 per cent by volume; however, they declined by 11.56 per cent from US$ 4809.99 million to US$ 4253.86 million. As for overseas markets, the USA continued to be the major importer of Indian seafood in value terms, with an import worth US$2,549.15 million, accounting for a share of 34.53% in terms of US$ value. Exports to the US increased by 7.46% and 1.42% in quantity and value ₹ terms; however, they declined by 3.15% in US$ terms.

CMFRI Develops seed Production Technology for High Value Marine Fish Golden Trevally

In a significant achievement in India's mariculture sector, the researchers of the ICAR-Central Marine Fisheries Research Institute (CMFRI) has succeeded in captive breeding of golden trevally (Gnathanodon speciosus), a high value marine fish. Scientists at CMFRI's Visakhapatnam Regional Centre achieved successful bloodstock development, captive breeding and larval rearing of the fish after five years of research. The achievement is expected to open up a new avenue for sustainable seafood production and boost the country's mariculture activities, including sea cage farming. Golden trevally or golden king fish is an ideal candidate species for mariculture (marine aquaculture) due to its faster growth rates, good meat quality and huge market demand for both consumption and ornamental purposes. The farm-gate value of the fish is ₹400-500 per kg. It is a reef-associated fish and lives in the company of larger fishes like skates, sharks, groupers etc. Interestingly, juveniles of this species act as pilots for sharks. It is a silver grey fish with yellowish colouration on the belly, with scattered black patches and all fins coloured yellow and a black tail. The juveniles are more golden in colour with the black bands giving them a very attractive look and hence a preference for aquarium keeping. As an ornamental variety, the fish is priced between ₹150-250 per piece. A team of scientists at the Visakhapatnam Regional Centre of CMFRI led by Ritesh Ranjan, Senior Scientist, started the research efforts on seed production of this fish in 2019. "This is a significant milestone in Indian mariculture", said A Gopalakrishnan, CMFRI Director.

India's Poultry Exports up at Record $184 Million on Demand from West Asia, Lanka

India's poultry exports touched a record $184.58 million ($1,530 crore) during the 2023-24 financial year on demand for products such as eggs and egg powder from countries such as Oman and Sri Lanka. During 2022-23, India's poultry exports stood at $134.04 million ($1,081 crore). Factors such as the Ukraine crisis and the earthquake in Turkey, which impacted the production and shipments to West Asia, helped India export more poultry products during the year, said Valsan Parameswaran, Secretary, All India Poultry Exporters Association. However, with the production returning to normal in those countries, Indian products are finding it tough to compete in the overseas markets as the prices have moved up.

Expensive in Gulf now

"The demand has slowed now. We are expensive in the Middle East market by about $4-$5 per box of 360 eggs each compared to other origins such as Turkey and Iran and even sometimes Ukraine. The government should provide some incentives to the produce-exporters to help sustain the growth and also the markets," Parameswaran said. Also, the poultry exporters are looking forward to the government support to tap new markets such as Russia, Indonesia and Malaysia among others, Parameswaran said. West Asia is the major market for Indian poultry products with Oman being the largest buyer accounting for close to a third of Indian exports. UAE and Qatar are the other major destinations in the West Asia. Sri Lanka has emerged as the second largest buyer of Indian poultry products during 2023-24 followed by Maldives.

Need for quality control lab

Parameswaran said setting up a dedicated laboratory for quality control in the major production hub of Namakkal can help reduce the costs for producers and exporters. Currently, producers are dependent on the lab in Bengaluru, he said. Indian poultry exports, which stood at ₹768 crore ($117.42 million) in 2015-16, had subsequently touched a six-year low of ₹435 crore ($58.70 million) during 2020-21 only to rebound in the past three years.

Urban Demand Boosts Egg, Chicken output in Karnataka

Bengaluru: In 2022-23, poultry farmers produced 33 per cent more eggs and 32.5 per cent more chicken meat in Karnataka than they did in 2018-19, according to data accessed by DH from the Department of Animal Husbandry and Fisheries. Growing demand in urban centres has contributed to the increase, say experts within the agriculture-allied activity. A more organised sector and progressive technologies have also contributed to the rise in production. The districts leading in broiler chicken production include Bengaluru Rural, Tumakuru, Kolar and Chikkaballapur. Ballari, Chitradurga, Davangere, Raichur and Koppal produced the most eggs. In all, the state produced about 90,000 lakh eggs and 1,79,908 tonnes of broiler chicken in 2023. "What we have been noticing over the past few years is an increase in demand from cities. While the consumption of meat was limited to annual feasts following festivals, nowadays, many families are able to afford meat about 2-3 times a week," says K S Ashok Kumar, a poultry farmer and trader. He added that the proliferation of restaurants and changing attitudes about eating out have also contributed to the demand in urban centres.

Though the sector has been expanding at an impressive pace, Kumar recognises that there is more room to grow. India's per capita consumption of protein is only 8 per cent of that in developed countries and this has only marginally changed in the last 60 years. India's protein intake falls significantly short of the 48 grams per day recommended by the Indian Council of Medical Research. For an average Indian adult, the recommended dietary allowance of protein ranges from 0.8 to 1 gram per kilogram of body weight. Despite this, the average protein consumption is approximately 0.6 grams per kilogram of body weight. "Chicken also is a more popular source of protein and one of the cheapest when compared to other sources like mutton or pork," he adds. The sector has also benefited from automation and an increase in the quality of feed. "Over the past 6-7 years, the quality of feed has really increased. Housing technology has also reduced the need for human labour. Banks have started recognising that poultry businesses is profitable. It is easier now to get a loan," says Pradeep Reddy, a poultry farmer based in Hosapete. As a result, in the recent past, many farmers have turned to the poultry sector. "Ultimately, growth has been driven by demand, while it has been supported by technology, conversion of feed and scientific technology," says K M Gurumurthy, deputy director of the Department of Animal Husbandry and Fisheries.

J&K's Dairy & Egg Production witness Surge

Srinagar, June 10: Jammu and Kashmir has witnessed a surge in dairy and egg production during the period of 2022-2023, with a total milk production of 828,173,088,635 kilograms and 178,712,752 eggs produced across all districts. According to official data obtained by Rising Kashmir, Jammu district emerged as the top producer of milk, accounting for 282,037,082 kilograms. Anantnag district followed closely as the second-highest producer, contributing 272,754,290 kilograms of milk, while Budgam district secured the third position with 211,823,892 kilograms. Other districts that made significant contributions to the state's milk production include Rajouri, Baramulla, Udhampur, Pulwama, Kathua, Poonch, Kupwara, Kulgam, and Shopian. In terms of egg production, Poonch district emerged as the top producer with 23,377,222 eggs.

Baramulla district ranked second with a production of 19,159,947 eggs, followed by Kupwara in third place with 18,973,397 eggs. Other districts that made significant contributions to the state's egg production include Rajouri, Budgam, Doda, Bandipora, Jammu, Kulgam, Anantnag, Ganderbal, Kathua, Kishtwar, Pulwama, Ramban, Reasi, Samba, Shopian, and Srinagar. The rising demand for milk and egg production in Jammu and Kashmir is creating employment opportunities for the people of the union territory. The high demand for milk and eggs in the market is also expected to continue in the future.

Nutritional Intervension In Building Immunity In Poultry Health And Production

PROF. R.N.SREENIVAS GOWDA*

Poultry immunity, health, and production are several factors that challenge the future growth of the poultry industry. Pollutants, environmental, physical and physiological stress, depletion of ozone, and climate change have influenced and thus altered biological, physical, and immune functions of different animal species. Thus, poultry also have become less resistant to microbiota and harmful organisms. This phenomenon has adversely affected the health, welfare, and performance of poultry

Interactions between nutrition and the immune system have been the center of attention in scientific communities over the past several years. It is already known that most nutrients are involved in the development of the immune system and its responses.

Poultry encounter stressors each day in their life. These stressors cause Physiological and hormonal changes, leading to declines in feed intake, altered nutrient metabolism and **suppressed immune function.**

The successful poultry enterprise is the one in which the nutritionist, production manager, veterinarian and other personnel have an understanding of stress and make an attempt to do everything possible to minimise the stressors in the operation.

"A three-way interrelationship exists among nutrition, immunity and stress and in order to totally understand the metabolic consequences that each one has on bird performance they must always be considered together because of this interrelationship,"

In the present poultry farming systems, the farmer expects faster growth, better feed efficiency, improved meat production and a higher proportion of breast meat. However, this development has had negative effects on the immune system, leading to an increase in the incidence of metabolic disorders, reduced resistance to infectious disease and higher mortality.

Appropriate **nutrition** may aid in minimising the incidence of diseases by enhancing **immunity**. An understanding of the pressures imposed by evolution that underlie **poultry nutrition** as well as those which underlie **immunity** provides focus to the field of **nutritional immunology.**

Many reports have suggested that chicks in the first week after hatch lack adequate immune responsiveness and they are therefore highly susceptible to infections. It is important to understand the development of the immune system in broilers and its capacity to respond effectively to the diversity of antigens required for protection during early life. The immune system provides the body with the ability to mount a defense against foreign organisms and antigenic substances.

Avian immune system

The immune system of poultry is a complex one, both functionally and structurally. The immune system is widely dispersed throughout the body and it is composed of organs, cellular elements and soluble (humoral) elements.

The immunity in birds develops through the lymphoid system. Organs of the immune system can be classified into primary (central) and secondary lymphoid organs.

The bursa of Fabricius and thymus are primary lymphoid organs in which lymphocyte precursors develop into immune-competent native lymphocytes. Secondary lymphoid tissues are the spleen, bone marrow, Harderian gland, pineal gland and organised lymphoid tissues associated with 1) mucosal surfaces (MALT), 2) bronchial-associated lymphoid tissues (BALT), 3) gut-associated lymphoid tissues (GALT), 4) conjunctival associated lymphoid tissues (CALT) and 5) other less well organised clusters of lymphoid cells in various organs. These lymphoid tissues are located at strategic sites where foreign antigens entering the body from either the skin or a mucosal surface can be trapped and concentrated. Lymphocytes, antigen transporting and presenting cells and other regulatory cells are also located in these anatomically defined tissues and are thought to be organised into structures that optimise cellular interactions that support the efficient removal of unwanted pathogens.

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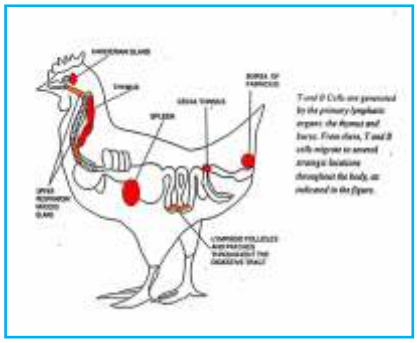

Fig 1. Organs of immune system.

Mechanism of Immune system

Birds respond to antigenic stimulation by generating antibodies as well as cellular **immunity**. The innate effector **mechanisms** include those mediated by natural killer (NK) cells and antibody dependent cellular cytotoxicity (ADCC). Recently, genes of several **avian** cytokines have been cloned and expressed.

The **innate immune system** provides this kind of nonspecific protection through a number of d**efense mechanisms**, which include physical barriers such as the skin, chemical barriers such as antimicrobial **proteins** that harm or destroy invaders, and cells that attack foreign cells and body cells harbouring infectious agents

The avian immune system is divided into **non-specific and specific immune mechanisms.**

Non-specific immune mechanisms include the innate or inherent ways in which the chicken resists disease. This protective system is often not considered when designing a poultry health program. Many programs tend to rely primarily on vaccinations and/or antibiotics to maintain flock health.

The importance of non-specific immune mechanisms should be realized. Examples include **Genetic factors** - birds may not have complementary receptors to allow many disease organisms to infect them. For example, some strains of chickens are genetically resistant to the lymphoid leucosis virus.

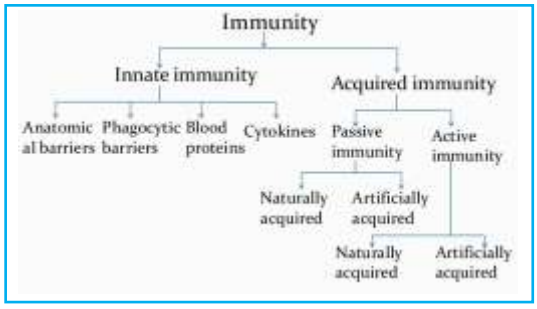

Fig 2 . Types of Immunity

1. The **nonspecific immunity mechanisms** in chicken include:

a) **Anatomic barriers**—many disease organisms cannot penetrate skin and mucous membranes or are trapped in the mucus secretions. Some nutritional deficiencies (biotin deficiency) or infectious diseases compromise the integrity of the body coverings, allowing penetration of disease organisms.

b) **Body temperature**—the high body temperature of the chicken protects birds from many diseases. If the body temperature of the chicken is lowered, the disease may occur.

c) **Normal microflora**—the skin and gut normally maintain a dense stable microbial population. This stable microflora prevents invading disease organisms from gaining a foothold. Improper use of antibiotics or poor sanitation can disrupt the balance of the microflora.

d) **Respiratory tract cilia**—parts of the respiratory system are lined with cilia which remove disease organisms and debris. If the air in the poultry house is of poor quality due to high levels of dust or ammonia, the ciliary system may be overwhelmed and become ineffective.

The innate resistance develops and maintains with proper nutrition, environment (avoid heat/cold stress), age (young/old animals are more susceptible to disease), inflammatory processes, metabolic factors, complement, and interferon.

For example: the overuse of antibiotics or poor sanitation may lead to a disruption of the normal microflora; poor nutrition may lead to deficiencies which allow disease organisms to penetrate the protective body coverings; selection of disease resistant strains of chickens may preclude or lessen the effects of certain diseases; and others.

2. The Specific immune mechanisms (acquired system), on the other hand, are characterized by specificity, heterogeneity, and memory. This system is divided into cellular and non-cellular (humoral) components.

a) **The non-cellular component** includes immunoglobulins (antibodies) and the cells which produce them. Antibodies are specific (specificity) for the foreign material (antigen) to which they attach. The antibody againstNewcastle disease virus will attach only to the Newcastle virus, not to the infectious bronchitis virus (heterogeneity).

b) There are three classes of antibodies that are produced in the chicken after exposure to a disease organism: Ig M, Ig G, and Ig A. Ig M appears after 4-5 days following exposure to a disease organism and then disappears by 10-12 days.

c) Ig G is detected after 5 days following exposure, peaks at 3 to 3 1/2 weeks, and then slowly decreases. Ig G is the important protective antibody in the chicken and is measured by most serological test systems.

Thus, if we are interested in determining antibody titer levels following vaccination, we should collect sera after 3 to 3 1/2 weeks. If sera are evaluated prior to this time, the antibody titer levels are still increasing which makes interpretation of the vaccination program difficult. Ig A appears after 5 days following exposure. This antibody is found primarily in the mucus secretions of the eyes, gut, and respiratory tract and provides "local" protection to these tissues.

d) The cells which produce antibodies are called B-lymphocytes. These cells are produced in the embryonic liver, yolk sac and bone marrow. The cells move to the bursa of Fabricius (BF) after 15 days incubation through 10 weeks of age. The BF programs these cells which then move to the blood, spleen, caecal tonsils, bone marrow, Harderian gland, and thymus. Destruction of the BF at a young age by Gumboro disease or Marek's disease prevents programming of B-cells. Thus, the chicken will not be able to respond to diseases or vaccinations by producing antibodies.

When a disease organism enters the body, it is engulfed by a phagocytic-type cell, the macrophage. The macrophage transports the disease organism and exposes it to the B-lymphocytes. The B-cells respond by producing antibodies after day 5 following exposure. The lag period occurs because the B-cells must be programmed and undergo clonal expansion to increase their numbers. If the chicken is exposed a second time to the same disease, the response is quicker and a much higher level of antibody production occurs (memory). This is the basis for vaccinating. Antibodies do not have the capability to kill viruses or bacteria directly. Antibodies perform their function by attaching to disease organisms and blocking their receptors. The disease organisms are then prevented from attaching to their target cell receptors in the chicken. For example, an infectious bronchitis virus which has its receptors covered with antibodies will not be able to attach to and penetrate its target cells, the cells lining the trachea. The attached antibodies also immobilize the disease organism which facilitates their destruction by macrophages.

The T-lymphocytes include a more heterogeneous population than the B-cells. Some T-cells act by producing lymphokines (over 90 different ones have been identified); others directly destroy disease organisms; some T-cells act to enhance the response of B-cells, macrophages, or other T-cells (helpers); and others inhibit the activity of these cells (suppressors). The cellular system was identified when it was shown that chickens with damaged BF could still respond to and eliminate many disease organisms.

A chicken may become immune to a disease organism by producing antibodies itself or by obtaining antibodies from another animal. When the chicken produces its own antibodies following exposure to a foreign material, the process is called active immunity. This occurs after the bird is exposed to a vaccine or a field disease challenge. Active immunity is harmed by anything which damages the cellular or humoral immune systems.

Nutritional intervention

Nutrition is a key factor in immunity, disease control, and prevention. The relationship between nutrition and immunity for chickens is of vital importance from a quality and quantity point of view. Enhancing innate immunity is the frontline of disease prevention and control. Passive and active immunity and building antibodies are affected by nutrition, quantitative and qualitative feed constituents, and hygiene. Fatty acids, protein/amino acids, minerals, and vitamins are vitally important for enhancing immunity and health.(Fig.3).

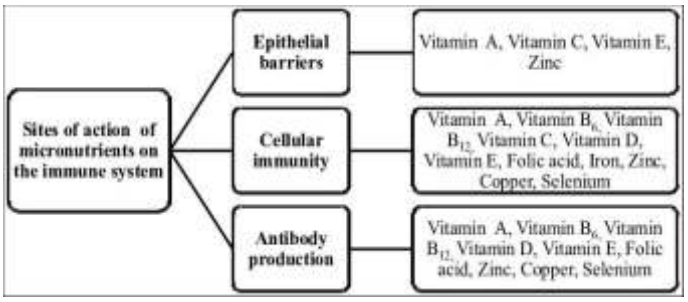

Fig 3.: Action of micronutrients on immune system

Amino Acids

An important issue that might affect poultry immunity, health, and performance is dietary constituents. Crude protein is the most expensive item in poultry nutrition, at both the protein level as well as the protein source; essential amino acids are crucial.

Immune function is a complex system that requires higher concentrations of nutrients (amino acids, fatty acids, vitamins, and minerals) than those for productive traits. Besides, immunity is given first priority with regard to nutrient distribution among body functions. Protein and essential amino acids are vitally important for growth and antibody formation and a well-functioning immune system. This goal is achieved by supplementation with industrial amino acids such as methionine, lysine, arginine, tryptophan, and threonine to ensure adequate intake of limiting essential amino acids.

Fats and Fatty Acids

Essential fatty acids, principally n-3 polyunsaturated fatty acids, are essential for health and immunity. The use of n-3-fatty acids to yield functional foods impacts the nutritive value of poultry products (and modulates animal and human immune function). The dietary n-6: n-3 ratio is essential for a proper immune system function.

The impact of fatty acids on immunity is linked to the improved antioxidant balance that affects immune system modulation via humoral and cellular immunity. Lymphocyte, splenocyte, and heterophil proliferation, maturation, and cytokine production are affected by omega fatty acids. In addition, immunoglobulin G (IgG) and IgM production are increased. The n-3 fatty acids addition enhances antibody production against the Newcastle disease virus and avian influenza.

Feed Additives

Nutritional immunomodulation can be altered through incorporating some feed additives, such as photogenic plants, plant extract, prebiotic, probiotics, symbiotic, yeast, and enzymes, have reported immunomodulatory effects (Fig.4). It is widely recognized that beneficial microbiota—probiotics, lactic acid bacteria, and Saccharomyces cerevisiae, with its cell wall constituents glucan and MOS—and organic acids are necessary for immunity and gut health. The probiotic as immunomodulatory interventions show the prospect to improve Poultry tolerance to bacterial diseases such as salmonella, help detoxify aflatoxin, and decrease the hasards of nitrate.

Fig 4. Feed additives in poultry production and health

The advantageous impact of immunobiotics on immunity and subsequent health. The proliferation and differentiation of cells, production of cytokines, secretion of IgA, synthesis of antimicrobial peptides, and increased intestinal cell tight junctions may be affected by the interaction activity between microorganisms and the response of both non-immune and immune cells.

Minerals

Microelements such as calcium (Ca), phosphorus (P), and vitamin D3 are essential for bone health and preventing bone disease (rickets, osteomalacia, and lameness). These benefits are critical for broilers and laying hens to prevent cage layer fatigue and poor eggshell quality. Essential micro-minerals such as zinc (Zn), iron (Fe), chromium (Cr), copper (Cu), selenium (Se) and iodine (I), are important as antioxidants and immune and health enhancers, and they are required for red blood cell and thyroid hormone functions.

A recent trend in mineral nutrition has focused on replacing inorganic minerals with organic sources and nanoparticles, particularly green nanoparticles obtained from plant tissues, on improving mineral utilization, poultry immunity, and decrease environmental pollution. these green nanoparticles are highly biodegradable and, therefore, do not exert negative consequences on the environment. Iron, Calcium and Zinc micro minerals are essential for building immunity. Zinc has many functions, including nucleic acid synthesis and repair, metabolism, immune response, redox homeostasis, and apoptosis, and it plays a vital role in the host-pathogen relationship. In addition, zinc is a cofactor for the thymus hormone thymulin and modulates cytokine release and proliferation. zinc has a role as a nonpharmacologic immune booster in broiler chicks. Zn requirement for immunity is 90.63 and 106 mg/kg diet, which is higher than that needed for growth and feed conversion ratio of broilers.

The trace mineral Selenium is essential for human and animal nutrition. It is used to sustain physiological function, immunity, health, and the quality of meat. Se is an essential constituent of the 24 selenoproteins in the avian genome. In addition, Se is a constituent of the antioxidant enzyme glutathione peroxidase (GPX). This enzyme guard cells against oxidative stress. Se is also part of the deiodinase enzyme essential for the activation of the thyroid hormone. The main functions of selenoproteins are control of redox of biochemical function, antioxidant balance systems, thyroid hormone anabolism and catabolism, anticancer protection, and immune function booster.

Table 1: Interaction of trace minerals with Immune system

TRACE MINERALS	INVOLVEMENT OF SYSTEMS
Cu,Zn,Fe,Se.	To build Immune system
Cu,Fe	Blood production
P,Cu,K,Mn.Zn,Mg	Reproduction
Fe,Mn,Zn,Cu, Mg, K	Hormone system
Mg,P,Mn,	Energy metabolism
Zn, Cu,MN,Mg,Fe	Enzyme system

Vitamins

Vitamins boost poultry immunity. Recent recommendations have been made to boost poultry immunity and health under normal and heat stress conditions using vitamins: 200 mg/kg diet vitamin C, 100–200 mg/kg diet vitamin E, and 2500–4000 mg/kg diet vitamin D_3, and vitamins such as vitamin C, E, and D_3. Water-soluble vitamin C improves the antioxidant balance, provides antiviral function, relieves oxidative stress, enhances immunity, and spares vitamin E. Vitamin E, is the most common natural fat-soluble vitamin; it acts as an antioxidant that guards cell membranes against oxidative impairment due to lipid peroxidation. It also enriches the function and proliferation of lymphocytes and macrophages and increases phagocytic activity and decreases oxidative damage under normal and heat stress condition.

Vitamin D_3 reportedly has immunological effects that considerably influence the progress of skeletal health, muscle, and Ca and P homeostasis. Eggshell formation and bone health in laying hens is essential and involves the integration between the metabolism of Ca, P, and vitamin D_3, Vitamin D_3, or its active form 25-(OH)D, both have strong immunomodulatory properties with the ultimate help of T cells (Th2).

Vitamin B groups are also essential for boosting immunity due to their crucial role in the metabolism of protein, fat, and carbohydrates, and adequate vitamin B intake is essential because water-soluble vitamins are not stored in the body, and daily supply must be ensured.

Table 2: Interaction of Vitamins with Immune system

NUTRIENT	EFFECTS
Linoleic Acid, Vitamin A	Development of the immune system
All Nutrients	Supply substrate to the immune system
Biotin	Nutritional Immunity
Energy, Protein	Changing the Hormonal milieu
Vitamin A,D,E, Poly saturated acids	Direct regulatory effect of nutrients on the immune system
Vit E	Antioxidant, immunity

These additives provides nutrients for the growth and development of both primary and secondary lymphoid organs. The immune system of the hatchling particularly the mucosal immune system also requires feed intake for rapid development. It has been reported that delayed access to feed impairs not only intestinal development but also development of gut-associated lymphoid tissue (GALT) like the bursa of Fabricius, Caecal tonsils and Meckel's diverticulum. Prolonged feed restriction is harmful to immune system development.

Conclusion

The importance of immune competence enhancing nutrition (called nutritional intervention) becomes more critical as antibiotics become less used. For poultry, nutritional intervention can include adding extra amino acids, vitamin D and E or selenium to the diet.

Nutritional deficiencies are associated with impaired cell-mediated immunity; reduced number of circulating T-lymphocytes, particularly CD4+ helper T-cells and CD3+ CD25+ T-cells that bear the interleukin (IL)-2 receptor; decreased lymphocyte stimulation response to mitogens and antigens.

Dietary bioactive food components that interact with the immune response have considerable potential to reduce susceptibility to infectious diseases.

Major classes of macronutrients including:

1) amino acids such as arginine or threonine.
2) lipids such as the n-3 polyunsaturated fatty acids, or
3) novel carbohydrates such as various sources of β - glucan
4) Vitamins such as D and E are commonly used as antioxidants,
5) zinc and selenium are minerals with a wide spectrum of effects on the immune system.
6) There is accumulating evidence for prevention of infectious diseases by probiotics and prebiotics, and these may also affect the immune response.

Understanding in directing nutritional immunology is essential to maintain bird's health.

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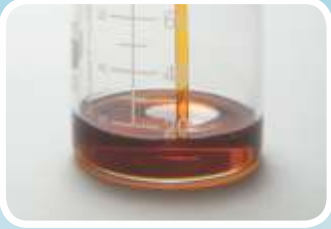
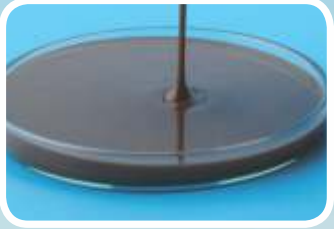

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Applications of Electron Microscopy for Advancement of Animal Nutrition Science

Antra Gupta, Chander Datt*, Sarita Kaushal, Gunjan Sharma and Shivendra Agrawal

Electron microscopy (EM) is a scientific technique that uses electron beams to image and analyze the ultrastructure of various samples at high resolution. It has revolutionized the understanding of the microscopic world and has become an essential tool in many scientific disciplines including animal nutrition. In the 21st century, advancements in electron microscopy continue to push the boundaries of imaging resolution and sensitivity, with techniques such as transmission electron tomography (TEM tomography) and scanning transmission electron microscopy (STEM) becoming widely used for three-dimensional imaging and analysis of nanostructures.

Principle of electron microscopy

The principle of electron microscopy is based on the interaction of electrons with a feed sample to produce detailed images at a very high resolution. It involves the use of a beam of electrons instead of light to image the sample, which allows for much higher magnification and resolution compared to traditional light microscopy.

Types of electron microscopy

1. **Transmission electron microscopy (TEM):** Herein, a thin feed sample is placed in the path of a beam of electrons. The electrons pass through the sample and their interaction with the specimen, including scattering and absorption, provides information about the internal structure of the sample. A series of lenses, including magnetic lenses are used to focus the electrons onto a fluorescent screen or a digital detector, which then generates an image based on the pattern of electrons that pass through the feed sample. TEM is used to study the internal structure and ultrastructure of biological samples, feed samples, nanoparticles and other materials at a very high resolution, often down to the atomic level.
2. **Scanning electron microscopy (SEM)**: In this, a beam of electrons is scanned across the surface of a feed sample, and the emitted secondary electrons or backscattered electrons are collected to generate an image. SEM provides a three-dimensional image of the surface topography of a feed sample at a high resolution. The electron beam scans the surface of the sample and the signal emitted from the specimen is detected and used to generate an image. SEM is commonly used for studying the surface morphology of a wide range of materials, including biological samples, materials science samples and geological samples.

In both the techniques, the resolution of the image is determined by the wavelength of the electrons, which is much shorter than the wavelength of visible light used in traditional light microscopy. This allows for much higher resolution images, revealing fine details of the sample's structure. However, EM requires special sample preparation techniques, including thin sectioning and metal coating, and specialized instruments due to the nature of electron beams, making it a more complex and sophisticated imaging technique compared to light microscopy.

Applications of electron microscopy in animal nutrition

Electron microscopy (EM) has been used in animal nutrition research to study the structure, composition and function of various feed ingredients, gut tissues and microbial populations in the digestive tract of animals.

1. **Feed analysis:** Electron microscopy can be used to analyze the structure and composition of feed ingredients, such as grains, forages and protein sources. It can provide detailed information on the cellular and sub-cellular structure of feed materials, which is important for understanding their nutritive value, digestibility and processing characteristics. It can also be used to study the impact of processing methods, such as pelleting, extrusion and ensiling on the structure and digestibility of feed ingredients.

2. **Gut morphology and ultrastructure:** Electron microscopy is used to study the morphology and ultrastructure of the gastrointestinal tract of animals, including the stomach, small intestine and large intestine. It can provide high-resolution images of the gut tissues, such as the mucosa, submucosa and muscularis and their cellular components such as enterocytes, goblet cells and smooth muscle cells. This information is crucial for understanding the structure and function of the gut, including nutrient absorption, gut barrier function and gut microbiota interactions.
3. **Gut microbiota analysis**: Electron microscopy can be used to study the structure and composition of the gut microbiota, which refers to the complex community of microorganisms, such as bacteria, fungi and protozoa that inhabit the gastrointestinal tract of animals. EM can provide insights into the morphology, size and spatial distribution of gut microbial populations, which are important for understanding their role in animal nutrition, gut health and disease resistance. The TEM and SEM techniques can be used to visualize the morphology and arrangement of gut microbes in the gut lumen, mucosa and biofilms.
4. **Nutrient absorption and transport**: Electron microscopy can be used to study the cellular mechanisms of nutrient absorption and transport in the gut. It can provide information on the structure and function of cellular organelles, such as microvilli, mitochondria and endoplasmic reticulum that are involved in nutrient uptake and metabolism. This technique can also be used to study the transport mechanisms of nutrients such as amino acids, carbohydrates and lipids across the gut epithelium including the transcellular and paracellular pathways.
5. **Gut barrier function**: This technique can be used to study the structure and function of the gut barrier, which plays a critical role in preventing the entry of harmful substances such as pathogens and toxins into the bloodstream. It can provide insights into the cellular components of the gut barrier such as tight junctions, desmosomes and mucus layers, and their role in maintaining gut integrity, immune function and host-microbe interactions.
6. **Nutritional pathology**: Ultra-structural changes in tissues and organelles associated with nutritional disorders and diseases in animals can be studied using EM. For example, EM can be used to study the impact of nutrient deficiencies such as vitamin deficiencies or mineral imbalances on cellular and tissue structure, and their consequences on animal health and performance.

Conclusion

Electron microscopy is gaining popularity for its use in animal nutrition research to achieve greater insights into the structure, composition and function of feed ingredients, gut tissues and gut microbiota and also their impact on the animal health, nutrition and performance. This technique has contributed towards understanding of the intricate interactions between nutrition, gut physiology and gut microbiota in animals.

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Use of DDGS in animal feeds

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Introduction

In India, ethanol has garnered significant attention as a key agenda in the 21st century, with the government setting forth a goal of achieving 20% ethanol blending in petrol by 2025. Consequently, there is a growing focus on the provision of ethanol byproducts, encompassing distillers' grains with solubles (DGS) available in both wet and dried forms, condensed corn distillers solubles (CCDS), corn germ, and emerging products facilitated by enhanced fermentation efficiency in next-generation ethanol plants.

In the present era, the sustainability of livestock farming encounters intricate hurdles, including constraints on natural resources such as land and water, alongside a steep escalation in the cost of traditional feed ingredients. Within this context, distiller's dried grain with soluble (DDGS) emerges as a potentially exportable feed ingredient boasting significant levels of energy, protein, water-soluble vitamins, and minerals for animals. Following the removal of starch, the concentration of the remaining nutrients in the grain increases approximately threefold, enhancing its nutritional value. It is the major byproduct of ethanol and beverage industries which contains at least three-fourths of the solids of the resultant whole stillage which is blended with the condensed solubles (syrup) during drying (AFFCO, 2006). The majority of DDGS used in livestock feed industry originate from fermentation of corn, rice and sometime other cereals (wheat, sorghum or barley).

Nutritional composition of DDGS:

The nutritional composition of DDGS is intricately linked to processing techniques, including fermentation conditions, drying methods, the quantity of solubles reintroduced, the type of grain utilized, and the grinding procedure employed. Moreover, the manufacturing process of DDGS can lead to the denaturation of a portion of the protein due to excessive heat during drying, rendering it less bioavailable to animals. Manufacturing practices may also diverge among ethanol plants, resulting in considerable disparities in the DDGS produced. Substantial nutrient variation has been observed not only between ethanol plants but also within individual plants themselves. Consequently, the nutritional profile of DDGS from one source may not sustain the same level of milk production achieved when feeding DDGS from another source.

NASEM (2021) lists three types of DDGS: high fat, low fat, and high protein. The high-fat DDGS contains 30% crude protein (CP), 32% neutral detergent fiber (NDF), and 11.5% total fatty acids (FA). The high-fat DDGS is also considered traditional DDGS. The low-fat DDGS or reduced-fat DDGS (RFDDGS) is similar in CP and NDF contents with 31 and 31%, respectively; however, total FA is about 3.5%-units lower (7.9% of DM). The high-protein DDGS contains 39% CP, 38% NDF, and 6.5 % total FA. The S content is similar with high-fat, low-fat, and high-protein DDGS at 0.67, 0.64, and 0.71%, respectively.

Table 1. Classification and nutrient composition of DDGS and other byproducts of ethanol industries (% DM) as per NASEM (2021)

Attributes	DDGS (high fat) Feed code: NRC16F59	DDGS (high protein) Feed code: NRC16F60	DDGS (low fat Feed code: NRC16F61	DDGS (modified wet Feed code: NRC16F62	DDGS Feed code: NRC16F63	Distiller solubles Feed code: NRC16F64
DM	89.1	91.1	89.9	49.2	33.2	31.2
Ash	5.4	4.0	5.3	5.6	4.5	11.1
CP	30.2	39	31.0	30.3	31.5	22.6
RUP % CP	47	47	47	44	42	25
NDF	32.1	37.6	30.8	27.1	31.7	4.8
ADF	14.6	17.7	14.8	14.4	16.1	3.2
ADICP	2.85	3.97	3.15	4.09	3.29	0.78
Starch	4.5	6.2	6.1	4.7	6.3	4.0
Crude fat	12.54	7.56	8.90	9.35	9.31	10.99
DE (Mcal/kg)	3.49	3.34	3.44	3.50	3.50	3.62
Ca	0.12	0.08	0.11	0.21	0.13	0.13
P	0.88	0.64	0.89	0.86	0.76	1.82
S	0.67	0.64	0.71	0.63	0.67	1.15

DDGS: distillers' dried grains with solubles; DGS: distillers' grains with solubles; DM: dry matter; CP: crude protein; RUP:

rumen undegradable protein; NDF: neutral detergent fibre; ADF: acid detergent fibre; DE: digestible energy; Ca: calcium; P: phosphorus; S: sulfur.

Utilisation of DDGS in lactating animals:

Removal of starch from grains (about 66 % in corn) resulted in approximately 3 times increase in protein (rumen undegradable protein), fat and fibre content of DDGS making it as a source of energy and protein. Therefore, utilisation of DDGS as feedstuff in dairy animals reduced overall starch consumption and increased digestible fibre intake which helps in prevention of the occurrence subacute acidosis associated with high grain intake. Research suggests a safe inclusion level of DDGS in dairy diets of up to 20% DM basis and above 20 % there is decrease DMI, digestibility of nutrients, milk production and milk fat depression. Major issues come with the higher level of PUFA and S (lower dietary cation and anion difference) which are mainly responsible for deleterious effect of DDGS.

Utilisation of DDGS in monogastric:

As compared to raw material (maize or other grains) DDGS have higher content of fat, non-starch polysaccharides (NSP) and altered amino acid composition during fermentation and drying processes. The most of researchers observed either no changes or slight improvement in body weight gain or feed efficiency in monogastric animals when a portion of corn, soybean meal, and inorganic phosphorus was replaced with DDGS.

Poultry: Broilers fed diets containing less than 10 % DDGS had the greatest improvement in body weight gain (BWG; 4.52%), followed by a 2.32% improvement in BWG when fed diets containing 10-20 % DDGS (2.32%). Above 20 % inclusion level, there was reduced BWG (1.02%). The improvement in BWG and FI can be further increased with addition of xylanase or cocktail of enzymes to DDGS-based diets.

Pig: Inclusion of DDGS upto 30 % with xylanase or enzyme cocktail in the diet of pig depending upon oil content, level of non-starch polysaccharides showed either improved or showed no changes in body weight gain, feed intake and efficiency of animals.

Table 2. DDGS inclusion level in different categories of the animals

Category	Inclusion level (% DM, maximum)
Pre weaned calves	25
Growing heifer	30
Dry cow	15
Lactating cows	20
Pig	30
Poultry	10-20

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Importance of Millets as Feed and Fodder

Ruchika Bhardwaj, R S Sohu and Ravi Prakash Pal

The agricultural sector is under tremendous pressure to maintain its sustainability in a changing environment and burgeoning human and cattle population. In these scenarios, crops are required to cope with a changing environment at the same time fulfilling the production demands. One such group of crops i.e. millets have been found to show a remarkable promise with multiple benefits, viz., production (short duration, less water consumption and climate resilience), consumption (nutrition and health), and ecology (carbon neutral). Once used to be cultivated as traditional crops, particularly pearl millet (Bajra), millets have come to be looked down upon as "coarse grains" in the present scenario. The millets also called nutri-cereals or dry land cereals are categorized into major millets as sorghum (jowar) and pearl millet (bajra), finger millet (ragi) and minor millets as foxtail millet (kangni), little millet, kodo millet (kodon), barnyard millet (samvatke chawal), proso millet (chena) and brown top millet (hari kangani). Many studies have shown that millet grains have evidently used to replace conventional grains in the feed of ruminants as well as birds. Even the feeding trials have shown the positive effect on growth of those animals and birds whose diets were substituted in different proportions with millet grains.

Millets for green forage and feed

Millets particularly bajra and sorghum are major fodder crops of *kharif* seasons. They are grown during summer and kharif and can be preferred over the contemporary crop maize as millets require very less water for crop growth. Exclusive forage producing sorghum and pearl millet varieties/ hybrids are available at PAU which produce superior quality fodder for feeding livestock. Many multi-cut type hybrids are available in these crops which ensure continuous supply of green fodder during *kharif* and *summer* seasons. Pearl millet uses less water per unit of forage production, tolerates both lower and higher soil pH and higher aluminium concentration, and is rich in minerals as compared to sorghum. However, sorghum has a wider range of adaptability and is more widely grown. Sorghum has forage quality better than that of other millets and next only to maize. Low-lignin brown mid-rib varieties of sorghum forage quality is equivalent to that of forage maize in USA. Sorghum is the major supplier of green and dry fodder in India and its role becomes important during the lean period of winter and summer months. It is estimated that sorghum fodder constitutes 20-45% of the total dry weight of feed of dairy animals during normal seasons and up to 60% during the lean summer and winter seasons. The importance of sorghum is more pronounced in areas where livestock enterprise is one of the important livelihood strategies of people.

Forage sorghums are principally cultivated in Punjab, Haryana, Delhi, western and central Uttar Pradesh and adjoining areas of Madhya Pradesh. In these states, it is grown during *kharif* and *summer* seasons, either as single-cut (mostly in *kharif*, as rainfed) or as a multi-cut (summer and *kharif*) irrigated forage crop. Intensive cropping, short growing season, nutritional quality and the need for continuous supply of green fodder created demand for forage sorghum in northern India.

Sweet sorghum is used to a limited extent in producing sorghum syrup and 'jaggery' (raw sugar) in India and has recently gained importance in ethanol production for blending with petrol under national biofuel policy. Sweet stalked sorghum is used to produce bioethanol which can be blended with petrol to reduce the pollution as well as cost.

Finger millet may also be used as sole forage crops as they provide good quality forage. Finger millet straw is used in many parts of the country for feeding all categories of animals, such as working animals, milch animals and dry animals. This serves as an important source of dry fodder which is a must in the daily ration at least in small quantities. It is said that for all kinds of cattle, finger millet straw is superior to that of rice.

Silage potential of millets

Sorghum and pearl millet have the potential to produce excellent yields of higher quality forage, especially during growing seasons with favorable moisture. It can provide high tonnage silage with good nutritive value. An adequate supply of quality fodder during the lean periods of Nov- Dec and May- June can be ensured by preserving the green fodder as silage. Non- legume fodders such as maize, sorghum, and pearl millet are rich in sugars and carbohydrates and low in protein, possess excellent quality for conserving as silage. Harvest the crop for silage when nutrient content is at their peak stage and it has enough dry matter. A crop with 30-35% dry matter conserves into a high-quality silage. Furthermore, in comparison to maize, which is in high demand by the farmers for its silage potential, it has been found in the research trials that both sorghum and bajra are suitable millets for silage making in terms of yield potential as well as quality. Thus, these millets can help in erasing the pressure for cultivation of maize as a silage.

Thus, the millets have a potential to ensure food security, nutrition, health and sustained economical livelihood. These crops can be rightly called as multi-faceted all season crops with multiple benefits. Even in case of bird feed and as ruminant's diets, millets particularly pearl millet has proven itself to be equivalent to corn or even superior.

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