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Poultry Fortune

Estd. 1991

Health • Nutrition • Technology • Marketing

June 2026

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Inside ...

ROSS 308 AP

BEST ACHIEVERS
NOVEMBER-2025

Aviagen® INDIA

Northern Region

COMPANY: Sampoorna Feeds

FARMER NAME: Mr.Jashandeep Singh Sidhu

NOVEMBER-2025	Top #1
Farm Type	Open House
State	PUNJAB
Chicks Placed	2509
Mean Age	33.0
Avg Body Wt	2460
FCR	1.260
cFCR	1.158
Livability%	97.0
Daily Gain	74.5
EPEF	573.9

Eastern Region

COMPANY: IB Group

FARMER NAME: Mr. Kamal Krishna Roy

NOVEMBER-2025	Top #1
Farm Type	Open House
State	BENGAL
Chicks Placed	1354
Mean Age	36.0
Avg Body Wt	2777
FCR	1.468
cFCR	1.295
Livability%	95.6
Daily Gain	77.1
EPEF	502.6

Central Region

COMPANY: Japfa

FARMER NAME: Mr. Suhas Patil

NOVEMBER-2025	Top #1
Farm Type	EC House
State	MAHARASHTRA
Chicks Placed	5972
Mean Age	33.4
Avg Body Wt	2463
FCR	1.369
cFCR	1.266
Livability%	97.1
Daily Gain	73.8
EPEF	523.3

South Region

COMPANY: IB Group

FARM NAME: K S Poultry Farms

NOVEMBER-2025	Top #1
Farm Type	EC House
State	KARNATAKA
Chicks Placed	25945
Mean Age	36.0
Avg Body Wt	2731
FCR	1.483
cFCR	1.321
Livability%	97.1
Daily Gain	75.9
EPEF	496.9

NOVEMBER-Top PERFORMANCE BY AREA

Area	Chicks Placed	Mean Age	BW	FCR	cFCR(2Kg)	Livability%	Daygain	EPEF
North EC House	12030	35.3	2631	1.370	1.230	97.2	74.5	528.3
North Open House	2509	33.0	2460	1.260	1.158	97.0	74.5	573.9
East EC House	6572	34.0	2357	1.427	1.348	97.2	69.3	472.2
East Open House	1354	36.0	2777	1.468	1.295	95.6	77.1	502.6
Central EC House	5972	33.4	2463	1.369	1.266	97.1	73.8	523.3
Central Open House	2793	32.3	2271	1.387	1.326	97.2	70.3	492.9
South EC House	25945	36.0	2731	1.483	1.321	97.1	75.9	496.9
South Open House	7616	36.0	2415	1.402	1.310	94.9	67.1	454.2

NOVEMBER-Top 10 FIELD PERFORMANCE

Flock	Farm Type	State	Chicks Placed	Mean Age	BW	FCR	cFCR	Livability%	Day Gain	EPEF
Flock 1	OPEN HOUSE	PUNJAB	2509	33.0	2460	1.260	1.158	97.0	74.5	573.9
Flock 2	OPEN HOUSE	PUNJAB	10390	33.0	2491	1.330	1.221	97.0	75.5	551.0
Flock 3	EC HOUSE	PUNJAB	12030	35.3	2631	1.370	1.230	97.2	74.5	528.3
Flock 4	OPEN HOUSE	PUNJAB	2505	32.1	2393	1.360	1.273	95.8	74.5	524.8
Flock 5	EC HOUSE	MAHARASHTRA	5972	33.4	2463	1.369	1.266	97.1	73.8	523.3
Flock 6	OPEN HOUSE	UTTAR PRADESH	9389	40.0	2960	1.347	1.134	95.1	74.0	522.3
Flock 7	OPEN HOUSE	PUNJAB	14630	32.0	2293	1.320	1.255	95.8	71.6	519.6
Flock 8	OPEN HOUSE	HARYANA	3775	29.0	1951	1.250	1.261	95.7	67.3	515.1
Flock 9	EC HOUSE	MAHARASHTRA	15489	32.6	2370	1.375	1.293	97.5	72.6	514.7
Flock 10	EC HOUSE	MAHARASHTRA	7875	35.0	2582	1.386	1.257	96.5	73.8	514.1

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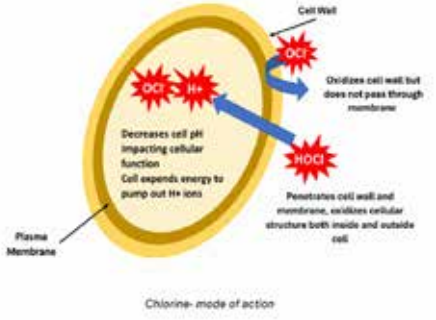

Chlorine- mode of action

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2026 Alltech Agri-Food Outlook shares global feed production survey data and insights for South Asia

Poultry birds are particularly susceptible to heat stress because of their higher metabolic rate, dense feather coat, and lack of sweat glands, which restrict their capacity to release excess heat. In high temperature and humid conditions, birds experience difficulty in maintaining thermal equilibrium, resulting in physiological stress. Even short-term exposure to elevated temperatures can lead to noticeable declines in feed intake, growth rate, egg production, and overall flock performance.

Dear Readers,

The June 2026 issue of Poultry Fortune is in your hands. In the news section you may find news about .....

Alltech brings together progressive farmers & industry leaders for the Agri-Nutrition Insights 2026 program. Alltech hosted the Agri-Nutrition Insights 2026 series across four key locations — Dhaka in Bangladesh; Ludhiana; Ahmedabad and Ajmer in India during the week commencing May 20, bringing together more than 300 progressive farmers, industry experts and stakeholders. The program served as a vibrant platform for knowledge exchange, industry discussions and collaborative learning, featuring technical sessions, interactive discussions and engaging Q&A sessions focused on practical solutions for the dairy and poultry sectors. The event agenda covered a wide range of important industry topics, with expert speakers sharing practical insights and market perspectives relevant to today's livestock industry. Dr Aman Sayed, Alltech's regional director for South Asia and managing director for India presented key perspectives on the Alltech Agri-Food Outlook along with important industry updates. Nick Adams, director of Alltech's Technology Group delivered an in-depth session on mycotoxin risks and mitigation strategies. Dr Lokesh Gupta, technical director for poultry at Alltech South Asia, discussed the importance of trace minerals and their role in improving animal performance. Dr Pradeep Mahajan, renowned dairy consultant shared on protein & mineral management, practical insights on optimizing cost effectiveness in the dairy sector. Dr K.S. Prajapati, noted poultry consultant highlighted respiratory health challenges and effective control measures. Alltech said that the events reflected Alltech's continued commitment to supporting the livestock industry through science-based solutions, technical expertise and meaningful customer engagement.

Venworld Connect Layer Meet focused on Productivity Improvement and Egg Quality Enhancement at Badami, Karnataka. As part of "Venworld Connect" initiative, Venkateshwara B.V. Biocorp Pvt Ltd conducted a technical meeting on 10 April 2026 at Badami, Bagalkot, Karnataka. The event witnessed strong participation from poultry farmers, integrators, and industry stakeholders, reflecting a growing shift towards scientific nutrition and performance-oriented management practices. Designed to benefit layer farmers, the meeting focused on delivering practical, field relevant knowledge backed by scientific advancements. During the inaugural session, Mr Lokesh R D, AGM – South and Mr M. Babu, Zonal Manager, addressed the gathering, emphasizing the critical role of nutrition in achieving consistent and efficient poultry performance. They reiterated Venworld's commitment to supporting farmers and industry partners through transparent, innovative and science driven solutions tailored to the evolving needs of poultry sector. The session also covered strategies to sustain egg production and improve egg quality throughout the laying period. Discussions emphasized the importance of balanced nutrition and gut health, particularly during the later stages of the laying cycle when maintaining productivity becomes more challenging. Special focus was given to achieving uniform egg size and consistent production, which are key indicators of efficient layer management. Dr Nadgauda highlighted that improved gut health enhances nutrient absorption,

Contd on next page

NRS GROUP

Poultry Fortune

Our Mission

Poultry Fortune will strive to be the reliable source of information to poultry industry in India.

PF will give its opinion and suggest the industry what is needed in the interest of the stakeholders of the industry.

PF will strive to be The Forum to the Stakeholders of the industry for development and self-regulation.

PF will recognize the efforts and contribution of individuals, institutions and organizations for the development of poultry industry in the country through annual Awards presentation.

PF will strive to maintain quality and standards at all times.

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directly influencing egg quality parameters such as shell strength, albumen quality, eggshell breakage etc.

2026 Alltech Agri-Food Outlook shares global feed production survey data and insights for South Asia. Data collected through 15th annual global feed survey estimates world feed production increased in 2025 by 2.9% to 1.44 billion metric tons. Alltech, a global leader in the agriculture industry, has released its 2026 Agri-Food Outlook, a report that includes the results of the company's annual global feed production survey. Based on that data, global feed production in 2025 reached an estimated total of 1.44 billion metric tons — representing an increase of 2.9% and 40.136 million mt from 2024. Most regions and sectors experienced growth, and the numbers suggest a strong recovery phase for animal agriculture; however, the data shows that growth was uneven, increasingly regionalized and driven less by herd expansion than by structural change, productivity gains and shifts in how production is measured and recorded. Now in its 15th year, the annual survey that serves as the foundation of the Alltech Agri-Food Outlook report collected data from 142 countries and 38,837 feed mills in late 2025. By analyzing compound feed production and prices — collected by Alltech's global sales team and in partnership with feed associations and official data-collecting organizations — the survey provides a comprehensive snapshot of global feed production. These insights serve as a barometer for the overall livestock industry, highlighting key trends across species, along with regional challenges and opportunities for growth.

In the Articles section, **Organic Glycinated Trace Minerals: The Next Generation of Trace Mineral Nutrition for High-Performing Poultry** authored by Dr Hanumant V. Dahiphale, Technical Manager, Uttara Impex Pvt Ltd says that Trace minerals such as zinc, manganese, copper, iron, selenium, and chromium are required in minute quantities but play a crucial role in poultry production. They are involved in enzyme activation, immunity, skeletal development, antioxidant defense, reproduction, eggshell formation, and overall metabolic efficiency. Modern poultry genetics have significantly increased growth rates, feed efficiency, egg production, and reproductive performance, resulting in a higher demand for biologically available trace minerals. As poultry genetics continue to evolve toward faster growth, higher egg production, improved feed efficiency, and superior reproductive performance, the demand for highly bioavailable trace minerals will continue to increase. Glycinated trace minerals offer a scientifically validated approach to meeting these nutritional demands while supporting profitability and sustainability. Why conventional inorganic minerals are inefficient. After entering the gastrointestinal tract, inorganic mineral salts rapidly dissociate under acidic conditions, releasing free metal ions such as Zn^{2+}, Mn^{2+}, Cu^{2+}, and Fe^{2+}. These highly reactive ions become vulnerable to numerous antagonistic interactions. As a result, a significant proportion of supplemented inorganic minerals remains unabsorbed and is ultimately excreted through manure. Besides increasing feed costs, excessive mineral excretion contributes to environmental contamination and reduced sustainability of poultry production systems.

Another Article titled, **PhyMune: Advanced Phytogenic Immunomodulation for Precision Poultry Nutrition** by Avitech Nutrition Pvt Ltd discussed that the Challenge of Modern Poultry Production modern poultry production faces continuous physiological and immunological challenges arising from high stocking densities, intensive vaccination programs, environmental stress, and reduced antibiotic usage. In this demanding production environment, immune competence plays a critical role in influencing flock performance, feed efficiency, vaccine response, and overall profitability. PhyMune is an advanced phytogenic immunomodulator formulated with scientifically selected bioactive compounds including andrographolides, mangiferin, hydrolysable tannins, gallic acid, and ellagic acid.

Another Article titled, **Mitigating Heat Stress: Comprehensive Nutritional and Management Approaches for Poultry** authored by Dr Vaani Shreeya (Nutritionist), Dr Himasree Kancharapu (Formulator) said that poultry farming is one of the most rapidly growing industries of livestock sector, significantly contributing to food security and offering accessible, high-quality protein, especially in developing nations. The global population is projected to reach 10 billion by 2050, resulting in a substantial increase in the demand for animal-based products. However, maintaining productivity under these circumstances is progressively challenged by environmental stressors, with heat stress being one of the most significant. Poultry birds are particularly susceptible to heat stress because of their higher metabolic rate, dense feather coat, and lack of sweat glands, which restrict their capacity to release excess heat. In high temperature and humid conditions, birds experience difficulty in maintaining thermal equilibrium, resulting in physiological stress. The issue is further exacerbated in modern commercial strains, where selection for higher productivity has reduced inherent thermotolerance. Heat stress is no longer a seasonal concern but a recurring challenge in many production systems. Even short-term exposure to elevated temperatures can lead to noticeable declines in feed intake, growth rate, egg production, and overall flock performance. Addressing this requires a well-integrated approach combining nutrition, environmental management, and long-term adaptive strategies.

Another Article titled, **Flock health influences carotenoid deposition in the yolk** 8 Color is one of the most important factors affecting consumer choices through sensory evaluation of food, including egg yolks. In most countries, golden yolks have been traditionally associated with good health, and despite regional differences on the preferred shade of red and yellow, intense, bright colors are recognized as a sign of a healthy yolk. Moreover, eggs with vivid yolk color can be used to cook attractive pasta, bakery products or sauces. The yolk consists of fats, proteins, vitamins, minerals and carotenoids. Carotenoids are responsible for yolk color, but also required for the development of other physiological functions. One of the most important of them is a competent immune system, essential for laying hens.

Another Article titled, **Redefining Poultry Nutrition: Water Quality at the Core** by Neotle Global Pvt Ltd, Effective water treatment programs are essential for maintaining flock health, reducing microbial contamination, improving water hygiene, and enhancing poultry production efficiency. Proper management of drinking water quality supports better feed utilization, gut health, bird performance, and overall farm productivity.

Readers are invited to send their views and comments on the news, special feature and articles published in the magazine which would be published under "Readers Column" in the magazine. Time to time, we shall try to update you on various aspects of Poultry sector. Keep reading the magazine Poultry Fortune regularly and update yourself. Wish you all fruitful results in your efforts.

M.A.Nazeer
Editor & Publisher
Poultry Fortune

Alltech brings together progressive farmers & industry leaders for the Agri-Nutrition Insights 2026 program

Agri Nutrition Insights- Dhaka

Bangalore: Alltech successfully hosted the Agri-Nutrition Insights 2026 series across four key locations — Dhaka (Bangladesh), Ludhiana, Ahmedabad and Ajmer — during the week commencing May 20, bringing together more than 300 progressive farmers, industry experts and stakeholders. The program served as a vibrant platform for knowledge exchange, industry discussions and collaborative learning, featuring technical sessions, interactive discussions and engaging Q&A sessions focused on practical solutions for the dairy and poultry sectors.

The event agenda covered a wide range of important industry topics, with expert speakers sharing practical insights and market perspectives relevant to today's livestock industry.

Agri Nutrition Insights-Ludhiana

Agri Nutrition Insights- Ahmedabad

Agri Nutrition Insights- Ajmer

- Dr. Aman Sayed, Alltech's regional director for South Asia and managing director for India presented key perspectives on the Alltech Agri-Food Outlook along with important industry updates.
- Nick Adams, director of Alltech's Technology Group delivered an in-depth session on mycotoxin risks and mitigation strategies.
- Dr. Lokesh Gupta, technical director for poultry at Alltech South Asia, discussed the importance of trace minerals and their role in improving animal performance.
- Dr. Pradeep Mahajan, renowned dairy consultant shared on protein & mineral management, practical insights on optimizing cost effectiveness in the dairy sector.
- Dr. KS Prajapati, renowned poultry consultant highlighted respiratory health challenges and effective control measures.

The series attracted strong participation from dairy and poultry producers, feed manufacturers, consultants and cooperatives, creating opportunities for networking and meaningful dialogue across the value chain. Attendees actively interacted with speakers during the Q&A sessions, making

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the discussions highly engaging and relevant to field-level challenges and opportunities.

The Agri-Nutrition Insights 2026 series was widely recognized as a valuable platform for learning, collaboration and strengthening industry relationships, leaving a strong and positive impact across all regions. The events reflected Alltech's continued commitment to supporting the livestock industry through science-based solutions, technical expertise and meaningful customer engagement.

About Alltech:
Founded in 1980 by Irish entrepreneur and scientist Dr. Pearse Lyons, Alltech delivers smarter, more sustainable solutions for agriculture. Our diverse portfolio of products and services improves the health and performance of animals and plants, resulting in better nutrition for all and a decreased environmental impact.

We are a global leader in the agriculture industry. Our team produces specialty ingredients, premix, supplements, feed and biologicals, backed by science and an unparalleled platform of services.

Strengthened by more than 40 years of scientific research, we carry forward a legacy of innovation and a unique culture that views challenges through an entrepreneurial lens. As a private, family-owned company, we adapt quickly to our customers' needs and focus on advanced innovation.

We believe agriculture has the greatest potential to shape the future of our planet. Our more than 5,000 talented team members worldwide share our purpose of Working Together for a Planet of Plenty®. Together, we can provide nutrition for all, revitalize local economies and replenish the planet's natural resources.

Headquartered just outside of Lexington, Kentucky, USA, Alltech serves customers in more than 140 countries, has five bioscience centers, and operates more than 75 manufacturing facilities across the globe.

Venworld Connect Layer Meet: Focus on Productivity Improvement and Egg Quality Enhancement at Badami, Karnataka

As part of "Venworld Connect" initiative, Venkateshwara B.V. Biocorp Pvt. Ltd. successfully conducted an impactful technical meeting on 10th April 2026 at Badami, Bagalkot, Karnataka.

The event witnessed strong participation from poultry farmers, integrators, and industry stakeholders, reflecting a growing shift toward scientific nutrition and performance-oriented management practices. Designed to benefit layer farmers, the meeting focused on delivering practical, field-relevant knowledge backed by scientific advancements.

During the inaugural session, Mr. Lokesh R. D. (AGM – South) and Mr. M. Babu (Zonal Manager) addressed the gathering, emphasizing the critical role of nutrition in achieving consistent and efficient poultry performance. They reiterated Venworld's commitment to supporting farmers and industry partners through transparent, innovative and science-driven solutions tailored to the evolving needs of the poultry sector.

Enhancing Performance through Precision Nutrition

Dr. Sunil Nadgauda (DGM – Technical, VBVBC) led the technical session, sharing valuable insights into modern poultry nutrition. He emphasized that precision nutrition is essential for achieving optimal performance in today's long -laying birds.

He explained that targeted nutrition directly impacts key performance indicators such as Feed Efficiency (feed per egg), Egg production and Liveability. Achieving consistent results depends on efficient nutrient utilization at the bird level and maintaining the right balance of energy and other nutrients in feed formulations. The session also covered strategies to sustain egg production and improve egg quality throughout the laying period. Discussions emphasized the importance of balanced nutrition and gut health, particularly during the later stages of the laying cycle when maintaining productivity becomes more challenging. Special focus was given to achieving uniform egg size and consistent production, which are key indicators of efficient layer management. Dr. Nadgauda highlighted that improved gut health enhances nutrient absorption, directly influencing egg quality parameters such as shell strength, albumen quality, eggshell breakage etc.

He also stressed the importance of maintaining an optimal calcium-to-phosphorus (Ca:P) ratio across different production phases to support proper eggshell formation and minimize egg breakage.

Additionally, Dr. Sachin Kadam (Product Executive, VBVBC) elaborated on key nutritional strategies for layers, reinforcing the role of precise nutrient balance in sustaining production and improving egg quality.

Highlight: EGGXTRA 5% Composite Premix

A key highlight of the meeting was EGGXTRA 5% Composite Premix, a targeted nutritional solution developed specifically for commercial layers. The formulation is designed to support sustained egg production, improve egg quality, and ensure a consistent supply of essential nutrients required for optimal flock performance.

The premix is thoughtfully designed to meet the nutritional requirements of layers across all production phases. It supports phase feeding, recognizing that birds have different nutritional needs during pre-lay, peak production, and late laying stages. By addressing these stage-specific requirements, the Eggxtra 5% composite premix helps maintain consistent productivity, egg quality and flock health throughout the laying cycle.

Additionally, the premix offers flexibility, allowing farmers to incorporate

locally available raw materials, making it both practical and cost-effective. Furthermore, the VBVBC nutrition team showcased their expertise in developing customized, farm-specific feed formulations tailored to individual farmer requirements. This approach enables farmers to optimize feed efficiency, effectively manage input costs, and achieve improved economic returns without compromising performance.

Positive Response and Commitment to Excellence

The sessions received highly positive feedback from participating farmers, who appreciated the practical insights, field-oriented recommendations, and strong technical support provided by the Venworld team. The successful execution of the event was made possible through the dedicated efforts of Venworld's sales and technical teams. Through such initiatives, Venworld continues to strengthen its commitment to advancing poultry nutrition through science, innovation, and farmer-centric solutions.

By emphasizing precision nutrition, gut health, and biosecurity Venworld remains a trusted partner in helping poultry farmers achieve improved performance, enhanced productivity and sustainable growth.

Lumis Enzymes Attracts Strong Industry Interest at SIPSA-FILAHA, Algeria

18 to 21 May 2026: Lumis Enzymes exhibited at SIPSA, the largest trade fair dedicated to livestock and agricultural equipment in Africa, held in Algeria.

SIPSA-FILAHA 2026 brought together leading companies, innovators, industry experts, and key decision-makers from across the agricultural and livestock sectors. The event showcased advanced technologies, sustainable solutions, and the latest industry developments through exhibitions, forums, and conferences.

Lumis Enzymes received an excellent response throughout the exhibition, with strong visitor engagement and productive discussions with feed manufacturers, distributors, integrators, and livestock professionals from across Africa and international markets. Our innovative enzyme solutions for animal nutrition and feed efficiency attracted significant interest from industry stakeholders seeking sustainable and high-performance solutions.

We were especially pleased to see the enthusiasm and positive feedback received during the fair, and our distributor team was delighted with the overwhelming response and business opportunities generated at SIPSA-FILAHA 2026. The exhibition provided an outstanding platform to strengthen existing partnerships, develop new collaborations, and reinforce our commitment to supporting the growth of the livestock and agricultural industries.

We look forward to continuing our journey of innovation and collaboration in the global animal nutrition industry.

2026 Alltech Agri-Food Outlook shares global feed production survey data and insights for South Asia

Data collected through 15 th annual global feed survey estimates world feed production increased in 2025 by 2.9%, to 1.44 billion metric tons

Raksha PR, Asst. Marketing Manager (India & Sri Lanka), rpr@alltech.com

BANGALORE, Karnataka: Alltech, a global leader in the agriculture industry, has released its 2026 Agri-Food Outlook, a report that includes the results of the company's annual global feed production survey. Based on that data, global feed production in 2025 reached an estimated total of 1.44 billion metric tons — representing an increase of 2.9% and 40.136 million mt from 2024.

Most regions and sectors experienced growth, and the numbers suggest a strong recovery phase for animal agriculture; however, the data show that growth was uneven, increasingly regionalized and driven less by herd expansion than by structural change, productivity gains and shifts in how production is measured and recorded.

Now in its 15th year, the annual survey that serves as the foundation of the Alltech Agri-Food Outlook report collected data from 142 countries and 38,837 feed mills in late 2025. By analyzing compound feed production and prices — collected by Alltech's global sales team and in partnership with feed associations and official data-collecting organizations — the survey provides a comprehensive snapshot of global feed production. These insights serve as a barometer for the overall livestock industry, highlighting key trends across species, along with regional challenges and opportunities for growth.

Top 10 countries

The top 10 feed-producing countries globally remained unchanged between 2024 and 2025. These 10 countries (listed below) collectively produced 65.2% of the world's feed in 2025 — and 47.7% of all global feed tonnage was produced in the top three countries: China, the U.S. and Brazil.

- China: 330.063 million mt; +4.8%
- U.S.: 267.383 million mt; -0.8%
- Brazil: 89.904 million mt; +2.8%
- India: 57.729 million mt; +4.5%
- Mexico: 41.883 million mt; +1.2%
- Russia: 38.347 million mt; +1.1%
- Spain: 37.507 million mt; -3.4%
- Vietnam: 26.524 million mt; +2.6%
- Türkiye: 25.480 million mt; +3.8%
- Japan: 24.006 million mt; -1.3%

Global feed volume results by species

- Broiler: 400.379 million mt; +3.7%
- Layer: 180.126 million mt; +3.2%
- Pig: 380.907 million mt; +3.0%
- Dairy: 170.294 million mt; +2.6%
- Beef: 134.181 million mt; +0.5%
- Aquaculture: 55.470 million mt; +4.7%
- Pet: 39.276 million mt; +2.4%
- Equine: 10.194 million mt; +0.2%

Notable regional results

- Asia (559.297 million mt): Asia remained the global center of feed production in 2025, with growth shaped by industrialization and price-conscious consumers increasing the demand for poultry and aquaculture. Continued shifts from on-farm mixing to commercial feed, especially in China, supported record output. Southeast Asia entered a rebuild-and-export cycle, with the recovery of the sow herd lifting pork output; additionally, while poultry feed tonnage also remained strong, disease outbreaks are now a consistent challenge and threat.
- North America (288.620 million mt): In 2025, North American feed tonnage contracted modestly (by 0.7%), primarily due to a historically tight cattle cycle and declining beef herd dynamics. The region still saw some selective, species-driven momentum, with growth concentrated in broilers and dairy. Stabilization also emerged in pork feed, and the egg and turkey sectors remained in recovery following health-related disruptions. Operational efficiency gains, sustainability pressures, formulation optimization, and consolidation among feed mills continue to reshape the feed industry across the region.
- Europe (274.061 million mt): Europe's feed sector in 2025 was differentiated, yet broadly resilient, growing by 1.0%. Lower raw material prices, supported by large global harvests of soybeans, rapeseed, wheat and maize, improved margins and stimulated production in several key markets.

Note: The figures used in Alltech's Agri-Food Outlook are updated throughout the year as official feed tonnage information becomes available. Our 2024 data has been adjusted to reflect final figures.

Despite ongoing disease pressure and regulatory constraints, the region stabilized overall. Modest gains in dairy and broilers offset pressure in other segments, while evolving trade frameworks and sustainability expectations continue to reshape production strategies across the region.

- Latin America (204.446 million mt): In 2025, Latin America solidified its position as the world's premier "protein basket." Compound feed demand expanded 2.8% year over year, rising by 5.536 million mt, supported by strong export markets and lower grain prices. Growth was broad-based, particularly in poultry, pork and aquaculture, although localized disruptions in parts of the Andean and Caribbean sub-regions tempered overall expansion.
- Africa and the Middle East (102.549 million mt): This region experienced a year of divergence in 2025. While Africa expanded strongly (+11.5%) on commercialization and rising compound feed penetration, the Middle East entered a structural plateau (+1.1%), balancing disease pressures and regulatory or resource constraints. Across both sub-regions, three forces shaped performance: protein affordability, input vulnerability driven by grain prices and currency volatility, and continued disease disruptions — particularly related to foot-and-mouth disease and avian influenza.
- Oceania (11.104 million mt): Oceania showed broad-based gains in 2025, with an overall 3.4% increase supported by population growth, resilient livestock sectors and strong export demand. Absolute increases were at their strongest in the broiler, layer, beef and pork sectors. High feedlot numbers and elevated cattle inventories sustained record beef production, particularly in Australia (+11%), with more moderate growth in New Zealand (+1.6%). Recovery in layer feeds following an avian influenza outbreak, along with steady demand for chicken and pork, contributed to a balanced regional expansion.

Alltech Agri-Food Outlook insights for South Asia

The Indian animal feed sector maintained steady growth in 2025 across major segments. Broiler feed production increased by 2.5%, driven by strong poultry meat demand and expansion by major integrators. Layer feed recorded a 4.47% growth, supported by consistent demand for eggs as an affordable protein source. Breeder feed also grew by 4.08%, reflecting continued industry confidence and ongoing investments in the poultry sector.

Dairy feed registered strong growth of 6.83%, driven by rising focus on productivity, better infrastructure, genetic improvement, and increasing demand for quality dairy products. Aqua feed sector grew by 5.35% with improving market demand and farm efficiency. Pet feed emerged as the fastest-growing segment with 16.24% growth, supported by rising pet ownership and premium nutrition demand. Swine feed also showed healthy growth whereas equine feed demand declined following the glanders disease outbreak and cancellation of races.

Bangladesh recorded a significant feed industry growth of 21.66% in 2025, driven mainly by the poultry and dairy sectors. Nepal achieved an 18.92% growth in total feed production, with poultry emerging as the major growth engine, while Sri Lanka registered a 22.13% growth in total feed production

The compound feed production totals and prices reported in the 2026 Alltech Agri-Food Outlook were collected in the first quarter of 2026 with assistance from feed mills and industry and government entities around the world. These figures are estimates and are intended to serve as an informative resource for industry stakeholders.

To access more data and insights from the 2026 Alltech Agri-Food Outlook, including an interactive global map, visit alltech.com/agri-food-outlook.

About Alltech:
Founded in 1980 by Irish entrepreneur and scientist Dr Pearse Lyons, Alltech delivers smarter, more sustainable solutions for agriculture. Our diverse portfolio of products and services improves the health and performance of animals and plants, resulting in better nutrition for all and a decreased environmental impact.

We are a global leader in the agriculture industry. Our team produces specialty ingredients, premix, supplements, feed and biologicals, backed by science and an unparalleled platform of services.

Strengthened by more than 40 years of scientific research, we carry forward a legacy of innovation and a unique culture that views challenges through an entrepreneurial lens. As a private, family-owned company, we adapt quickly to our customers' needs and focus on advanced innovation.

We believe agriculture has the greatest potential to shape the future of our planet. Our more than 5,000 talented team members worldwide share our purpose of Working Together for a Planet of Plenty. Together, we can provide nutrition for all, revitalize local economies and replenish the planet's natural resources.

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Organic Glycinated Trace Minerals:
The Next Generation of Trace Mineral Nutrition for High-Performing Poultry

Dr Hanumant V. Dahiphale, Technical Manager, Uttara Impex Pvt Ltd.

Introduction

Trace minerals such as zinc (Zn), manganese (Mn), copper (Cu), iron (Fe), selenium (Se), and chromium (Cr) are required in minute quantities but play a crucial role in poultry production. They are involved in enzyme activation, immunity, skeletal development, antioxidant defense, reproduction, eggshell formation, and overall metabolic efficiency. Modern poultry genetics have significantly increased growth rates, feed efficiency, egg production, and reproductive performance, resulting in a higher demand for biologically available trace minerals.

As poultry genetics continue to evolve toward faster growth, higher egg production, improved feed efficiency, and superior reproductive performance, the demand for highly bioavailable trace minerals will continue to increase. Glycinated trace minerals offer a scientifically validated approach to meeting these nutritional demands while supporting profitability and sustainability.

Why Conventional Inorganic Minerals Are Inefficient

After entering the gastrointestinal tract, inorganic mineral salts rapidly dissociate under acidic conditions, releasing free metal ions such as Zn^{2+}, Mn^{2+}, Cu^{2+}, and Fe^{2+}. These highly reactive ions become vulnerable to numerous antagonistic interactions.

Within the digestive tract, minerals may bind with phytates, phosphates, fiber fractions, oxalates, silicates, sulfur compounds, and other dietary constituents, forming insoluble complexes that cannot be efficiently absorbed. In addition, minerals often compete for the same intestinal transport systems, reducing overall uptake efficiency.

As a result, a significant proportion of supplemented inorganic minerals remains unabsorbed and is ultimately excreted through manure. Besides increasing feed costs, excessive mineral excretion contributes to environmental contamination and reduced sustainability of poultry production systems.

Dr Hanumant V. Dahiphale

Dr Hanumant Dahiphale is a veterinary pharmacologist and technical services specialist with expertise in animal nutrition, veterinary therapeutics, biologicals,clinical research, and regulatory affairs. Currently serving as Manager (Technical & Product Development) at Uttara Impex (Venky's) Pvt. Ltd., he specializes inadvanced feed additive technologies, organic trace minerals, and scientifically validated livestock health and productivity solutions.

Organic Glycinated Trace Minerals (UT-Glysomin) : A Modern Solution

Organic trace minerals were developed to overcome these limitations. Among the different organic mineral categories, glycinated trace minerals have emerged as one of the most scientifically advanced and biologically effective forms.

A glycinate is formed when a trace mineral is chemically bound to glycine, the smallest naturally occurring amino acid. This creates a highly stable mineral-ligand structure that protects the mineral throughout the digestive process.

Because glycine is small and highly soluble, glycinated minerals possess several advantages:

1) Superior stability across varying pH conditions. 2) Protection against mineral antagonisms. 3) Higher mineral concentration. 4) Improved intestinal absorption. 5) Better tissue retention. 6) Reduced mineral excretion. 7) Greater consistency and product quality.

Compared with proteinates, propionates, and several other organic mineral sources, glycinate technology provides an excellent balance of stability, mineral density, bioavailability and cost effectiveness.

The Science Behind Glycinate Technology (UT-Glysomin)

Advanced glycinate technologies such as B-Traxim®2C utilize in Production of minerals use in UT-Glysomin Gold & Plus. The Minerals are highly defined crystalline and polymer structure with more than 99% complexation efficiency. The mineral remains protected from gastric degradation and reaches the primary absorption sites within the small intestine in a biologically available form.

Modern manufacturing technologies such as spray granulation through spouted-bed processing further enhance product quality by producing:

Uniform particle size (200–300

µm), Excellent flowability, Dust-free handling, Improved mixing uniformity, Resistance to caking, High water solubility

These characteristics improve not only biological performance but also feed mill handling and premix stability.

Commercial Validation Under Indian Conditions

The effectiveness of glycinate technology use in UT- Glysomin has also been demonstrated under Indian commercial poultry conditions through trials conducted at Dr. B.V. Rao Institute of Poultry Management and Technology (IPMT), Pune.

In a 42-day broiler study, replacement of inorganic trace minerals with a glycinate-based trace mineral (UT Glysomin) program resulted in:

- At 500 g/ton feed improved final body weight by approximately 1.1%
- Better feed conversion ratio nearly 3 points.
- Higher breast and thigh meat yield
- Improved bone mineralization
- Increased tibia bone ash content by approximately 6.9%

A second large-scale evaluation comparing glycinate trace minerals (UT Glysomin) with inorganic minerals and another organic mineral source demonstrated:

- Approximately 2.8% higher body weight
- Superior feed conversion ratio
- Improved carcass characteristics
- Higher breast meat yield
- Nearly 9% improvement in tibia bone ash
- Better economic returns and profitability

These findings clearly indicate that highly bioavailable glycinated minerals can translate improved mineral utilization into measurable commercial benefits.

Enhanced Carcass Yield and Meat Quality

Modern poultry production increasingly focuses on saleable meat yield rather than only live body weight. Research has demonstrated significant improvements in carcass characteristics with glycinates Trace Minerals:

- Carcass yield increased by approximately 10%
- Breast meat yield improved by approximately 12.7%
- Drumstick yield improved by approximately 8.4%

Commercial broiler trials with UT Glysomin Gold and Plus further confirmed improvements in breast meat yield, thigh yield and overall carcass quality compared with conventional inorganic mineral supplementation.

These improvements are largely attributed to enhanced enzyme activity, better nutrient utilization, improved protein deposition, and superior skeletal support during rapid growth phases.

Scientific Evidence in Layers and Breeders

Improved Egg Production and Eggshell Quality in Layers

Modern layer strains place tremendous pressure on skeletal reserves and mineral metabolism, particularly during the late laying cycle. Trace minerals such as zinc, manganese, and copper play critical roles in eggshell formation, collagen synthesis, shell membrane integrity, and bone mineralization.

Recent research evaluating glycinate trace minerals in layer feed during the late laying cycle demonstrated significant improvements in eggshell quality and mineral utilization. Birds receiving glycinate trace minerals showed:

- Improved eggshell breaking strength
- Improved eggshell thickness
- Better bone strength and mineral retention
- Improved trace mineral absorption
- Reduced zinc and manganese excretion compared with inorganic minerals

Improved Fertility and Hatchability in Breeders

Trace minerals are essential for reproductive performance because they influence hormone synthesis, embryo development, eggshell formation, antioxidant defense, and immune function.

A Poultry Science study evaluating replacement of inorganic trace minerals with complexed UT-Glysomin Gold in broiler breeders reported several important improvements:

- Approximately 1.23% numerical improvement in laying rate
- Increased production of qualified hatching eggs
- Improved yolk color
- Enhanced liver antioxidant capacity
- Better mineral retention and utilization

Researchers concluded that replacing high levels of inorganic trace minerals with lower levels of glycinate trace minerals improved egg quality and antioxidant status in broiler breeders.

Sustainability and Future Poultry Nutrition

Modern poultry production must achieve a balance between productivity, profitability, and environmental responsibility. Glycinated trace minerals (UT-Glysomin) support this objective by improving mineral utilization efficiency while reducing mineral losses into the environment.

Because more of the supplemented mineral is absorbed and retained by the animal, lower inclusion levels can often achieve equal or superior biological responses compared with conventional inorganic mineral programs. This improves return on investment while reducing environmental mineral loading.

PhyMune: Advanced Phytogenic Immunomodulation for Precision Poultry Nutrition

The Challenge of Modern Poultry Production

Modern poultry production faces continuous physiological and immunological challenges arising from high stocking densities, intensive vaccination programs, environmental stress, and reduced antibiotic usage. In this demanding production environment, immune competence plays a critical role in influencing flock performance, feed efficiency, vaccine response, and overall profitability.

Introducing PhyMune

PhyMune is an advanced phytogenic immunomodulator formulated with scientifically selected bioactive compounds including andrographolides, mangiferin, hydrolysable tannins, gallic acid, and ellagic acid.

PhyMune provides a multi-pathway defense strategy that strengthens both innate and adaptive immunity. The product was scientifically evaluated in commercial broilers for its effects on growth performance, immune response, gut integrity, haematological and biochemical parameters, and overall production efficiency.

Scientific Evaluation of PhyMune

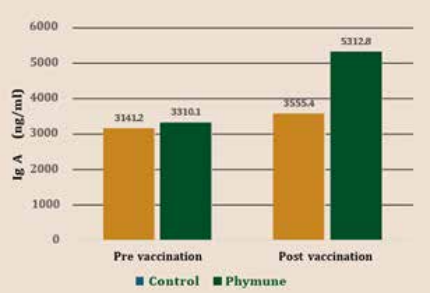
The study was conducted at the College of Veterinary Science & Animal Husbandry using commercial VenCobb 430Y broilers over a 42-day production cycle. A total of 120 birds were allocated into control and treatment groups, with PhyMune supplemented at 500 g/ton of feed.

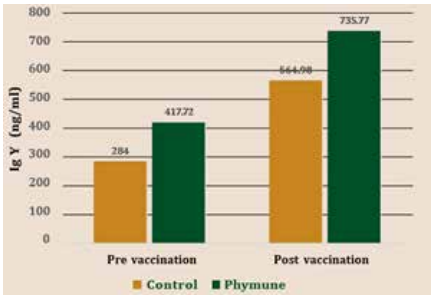
Strengthening the Humoral Defense & Vaccine Response

Effective vaccination programs depend on the bird's capacity to mount a strong antibody response. PhyMune acts as a potent nutritional adjuvant, enhancing B-cell activation and systemic antibody production.

Post-Vaccination Antibody Response

Parameter	Control	PhyMune
IgA (ng/ml)	3310.1	5312.8
IgY (ng/ml)	564.98	735.77





Antibody titers against the R2B vaccine, demonstrating improved humoral immune function. A substantial increase was observed in both IgA and IgY antibody concentrations following vaccination.

The elevated antibody titers suggest improved immune memory and enhanced vaccine responsiveness in supplemented birds.

Enhanced Cellular Immune Response

PhyMune exhibited a pronounced immunomodulatory effect on cellular immunity. Cell-mediated immune response was assessed using the Foot Web Index (FWI) following PHA-P challenge, where supplemented birds demonstrated significantly higher immune responsiveness compared to the control group.

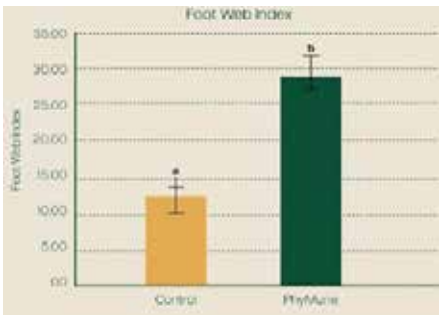
The enhanced FWI response indicates improved lymphocyte activation and stronger cellular defense against pathogenic challenges under intensive production conditions.

Enhanced Gut Integrity & Intestinal Morphology

The gastrointestinal tract is the largest immune organ in the poultry body. PhyMune directly supports the Gut-Associated Lymphoid Tissue (GALT) by optimizing the intestinal landscape.

PhyMune supplementation demonstrated significant improvements in villi height, villi width, and absorptive surface area throughout the small intestine.

Enhanced intestinal architecture increases the effective absorptive area, thereby supporting improved nutrient utilization, digestive efficiency, and immune competence.



The enhanced FWI response indicates improved lymphocyte activation and stronger cellular defense against pathogenic challenges under intensive production conditions.

Group	Duodenum			Jejunum			Ileum		
	Villi Height	Villous Width	Absorptive surface area (mm^2)	Villi Height	Villous Width	Absorptive surface area (mm^2)	Villi Height	Villous Width	Absorptive surface area (mm^2)
Control	1428.7	117.61	0.53	1425.6	92.43	0.41	1343.2	123.71	0.52
Phymune	1660.5	229.64	1.20	1666.6	259.84	1.36	1621.2	249.45	1.27

Group	Hematological parameters						
	Heterophil (M/mm^3)	Lymphocyte (M/mm^3)	H/L ratio	WBC (M/mm^3)	RBC (M/mm^3)	MCV (fl)	Hemoglobin (g/dl)
Control	35.02	57.32	0.62	1.15	1.89	96.10	8.57
Phymune	26.83	65.98	0.42	1.79	2.29	104.44	9.87

Biochemical Parameter			
Group	**ALT (IU/L)**	**AST (IU/L)**	**Cholesterol (mg/dl)**
Control	**10.02**	**290.53**	**161.16**
PhyMune	**9.43**	**257.23**	**147.30**

Reduction in Physiological Stress

Chronic stress indicated by high corticosterone levels is a known immune suppressor. One of the most significant findings in the PhyMune trial was the reduction of the Heterophil: Lymphocyte (H:L) ratio.

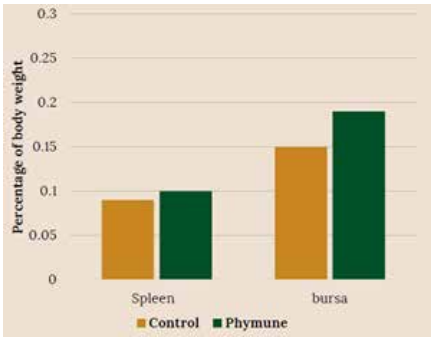
Birds supplemented with PhyMune achieved an H:L ratio of 0.42 (compared to 0.62 in the control group). This reduction serves as a definitive biomarker for lower physiological stress. Furthermore, improved levels of Haemoglobin (9.87 g/dl), RBC and total WBC counts confirm that the birds maintain a more stable internal environment, even under intensive production conditions.

Metabolic Resilience and Efficiency

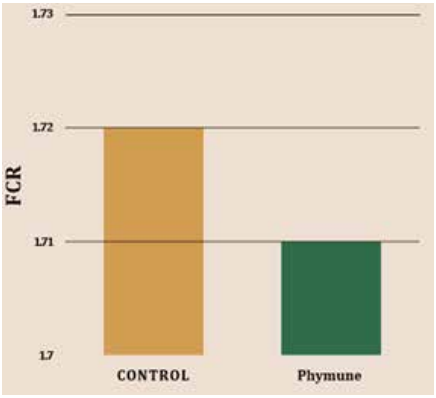
Immune activation requires energy. If the liver is stressed, performance suffers. PhyMune supplementation was shown to lower serum liver enzymes (ALT: 9.43 IU/l and AST: 257.23 IU/L) and reduce cholesterol levels (147.30 mg/dl). By reducing the metabolic burden, PhyMune allows the bird to divert more energy toward growth rather than stress recovery.

Improved Growth Performance & Production Efficiency

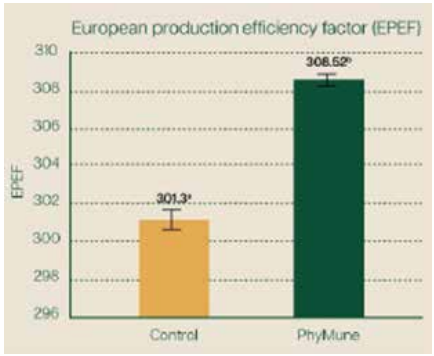
PhyMune supplementation improved overall production performance by improving feed conversion ratio (FCR) and European Production Efficiency (EPEF) in commercial broilers. The improved results may be attributed to better intestinal morphology, nutrient digestibility, and digestive efficiency, ultimately supporting improved growth performance.



The study further demonstrated a significant increase in bursa weight in birds supplemented with PhyMune, indicating positive effects on lymphoid organ development and immune system maturation.



Feed conversion Ratio (FCR) Improvement is optimized to 1.71.



European Production Efficiency Factor rose to 308.52 (vs. 301.3 in controls)

Key Performance Outcomes Conclusion

The findings from this scientific evaluation demonstrate that PhyMune functions as a comprehensive phytogenic immunomodulator capable of supporting multiple physiological pathways simultaneously. By enhancing immune responsiveness, improving gut integrity, reducing physiological stress, and supporting metabolic stability, PhyMune contributes to improved flock resilience and production efficiency.

The study validates PhyMune as an effective nutritional strategy for modern poultry systems focused on improving immunity, performance consistency, and sustainable productivity under commercial farming conditions.

Mitigating Heat Stress: Comprehensive Nutritional and Management Approaches for Poultry

By Dr Vaani Shreeya (Nutritionist), Dr. Himasree Kancharapu (Formulator)

1. Introduction

Poultry farming is one of the most rapidly growing industries of livestock sector, significantly contributing to food security and offering accessible, high-quality protein, especially in developing nations. The global population is projected to reach 10 billion by 2050, resulting in a substantial increase in the demand for animal-based products. However, maintaining productivity under these circumstances is progressively challenged by environmental stressors, with heat stress being one of the most significant.

Poultry are particularly susceptible to heat stress because of their higher metabolic rate, dense feather coat, and lack of sweat glands, which restrict their capacity to release excess heat. In high temperature and humid conditions, birds experience difficulty in maintaining thermal equilibrium, resulting in physiological stress. The issue is further exacerbated in modern commercial strains, where selection for higher productivity has reduced inherent thermotolerance.

Heat stress is no longer a seasonal concern but a recurring challenge in many production systems. Even short-term exposure to elevated temperatures can lead to noticeable declines in feed intake, growth rate, egg production, and overall flock performance. Addressing this requires a well-integrated approach combining nutrition, environmental management, and long-term adaptive strategies.

2. Effects of Heat Stress on Performance and Physiology

Physiological and Metabolic Changes

Heat stress induces a sequence of physiological modifications that disturb standard metabolic functions. Birds accelerate their respiratory rate (panting) to improve heat dissipation, which causes an excessive loss of carbon dioxide, leading to respiratory alkalosis. This imbalance affects bicarbonate availability, which is crucial for adequate eggshell development.

Electrolyte imbalances concerning sodium, potassium, and chloride additionally influence hydration, cellular functionality, and metabolic equilibrium. Heat stress impairs thyroid hormone activity at the hormonal level, resulting in a decreased metabolic rate, while simultaneously elevating corticosterone levels associated with the stress response.

These alterations redirect the avian metabolism from growth and reproduction to survival. Protein synthesis decreases, fat accumulation increases, and overall nutrient utilization become less efficient, leading to reduced performance.

Impact on Productive Performance

One of the earliest and most consistent responses to heat stress is a reduction in feed intake, as birds attempt to minimize metabolic heat production. At elevated environmental temperatures, feed consumption may significantly decrease, typically by 15-30% under extreme conditions resulting in reduced nutrient availability for growth and production.

In broilers, this results in reduced body weight gain, lower feed conversion, and alterations in carcass composition, including increased fat deposition and reduced muscle yield. Heat stress in laying hens adversely impacts egg quantity and quality, resulting in decreased egg output, reduced egg weight, and poor shell strength. With rising temperatures, feed consumption diminishes progressively, thereby restricting nutrient availability for egg production.

Gut Health, Immunity and Welfare

The gastrointestinal system is particularly susceptible to thermal stress. Disruption to the intestinal lining impairs nutrient absorption and increases permeability, allowing the entry of pathogenic organisms into the circulation. This increases vulnerability to diseases and adds to food safety concerns.

Concurrently, immunological function is impaired, characterized by inadequate antibody synthesis and increased oxidative stress. Birds display behavioural reactions include panting, wing spreading, decreased activity, and higher water consumption, all indicating thermal discomfort. Overall, heat stress adversely affects productivity, health, and welfare.

3. Mitigation Strategies

Feeding and Nutritional Management

Nutritional strategies remain one of the most effective tools for managing heat stress. Feeding during cooler parts of the day, such as early morning and late evening,

helps improve feed intake, while avoiding feeding during peak heat reduces metabolic load. The use of highly digestible ingredients further minimizes heat production during digestion.

Feed form also plays an important role under heat stress conditions. Pelleted feed is generally preferred, as it improves feed intake, nutrient digestibility, and energy utilization while reducing physical activity and heat production during feeding. However, particle size must be optimized; while coarse particles may support gut development, excessively coarse feed can increase heat load due to greater digestive effort.

Increasing dietary energy density is a widely adopted approach to compensate for reduced feed intake. In practice, fat inclusion is typically maintained in the range of 2-5%, as fats generate less metabolic heat and improve feed efficiency.

In practice, focusing only on crude protein is not sufficient under heat stress conditions as excess protein contributes to heat production. Instead, diets should be more effectively formulated using a well-balanced amino acid profile, increasing essential amino acids density by around 5-10%, adjusted for reduced intake and higher maintenance demand to sustain productivity in heat-stressed flocks.

Methionine (Met), being the first limiting amino acid in most practical diets, needs close attention during such periods. In field conditions, adequate Met levels help sustain protein deposition and reduce tissue breakdown. This is supported by its influence on pathways related to protein synthesis (IGF1, GHR, PI3KR1) and reduced expression of proteolytic markers such as atrogin1 and CTSL2. In addition, its role in antioxidant systems becomes more relevant as oxidative stress increases with high environmental temperatures.

Arginine (Arg) also plays a functional role under heat stress. Besides supporting protein accretion through polyamine synthesis, it contributes to creatine formation, which is important for energy buffering in muscle. More importantly, Arg is the only nitrogen donor for nitric oxide synthesis, and this can support vasodilation, helping birds dissipate heat more effectively under field conditions.

Threonine is another amino acid that should not be overlooked, particularly due to its role in maintaining gut integrity and immune competence both of which are often compromised during heat stress. Similarly, tryptophan and branched-chain amino acids can help stabilize the stress response and support overall physiological balance.

From a formulation standpoint, reduced feed intake also means that even non-essential amino acids can become limiting. Glycine is a common example in practical diets, and its inclusion (or glycine equivalents) may be necessary to maintain performance and metabolic efficiency during prolonged heat stress.

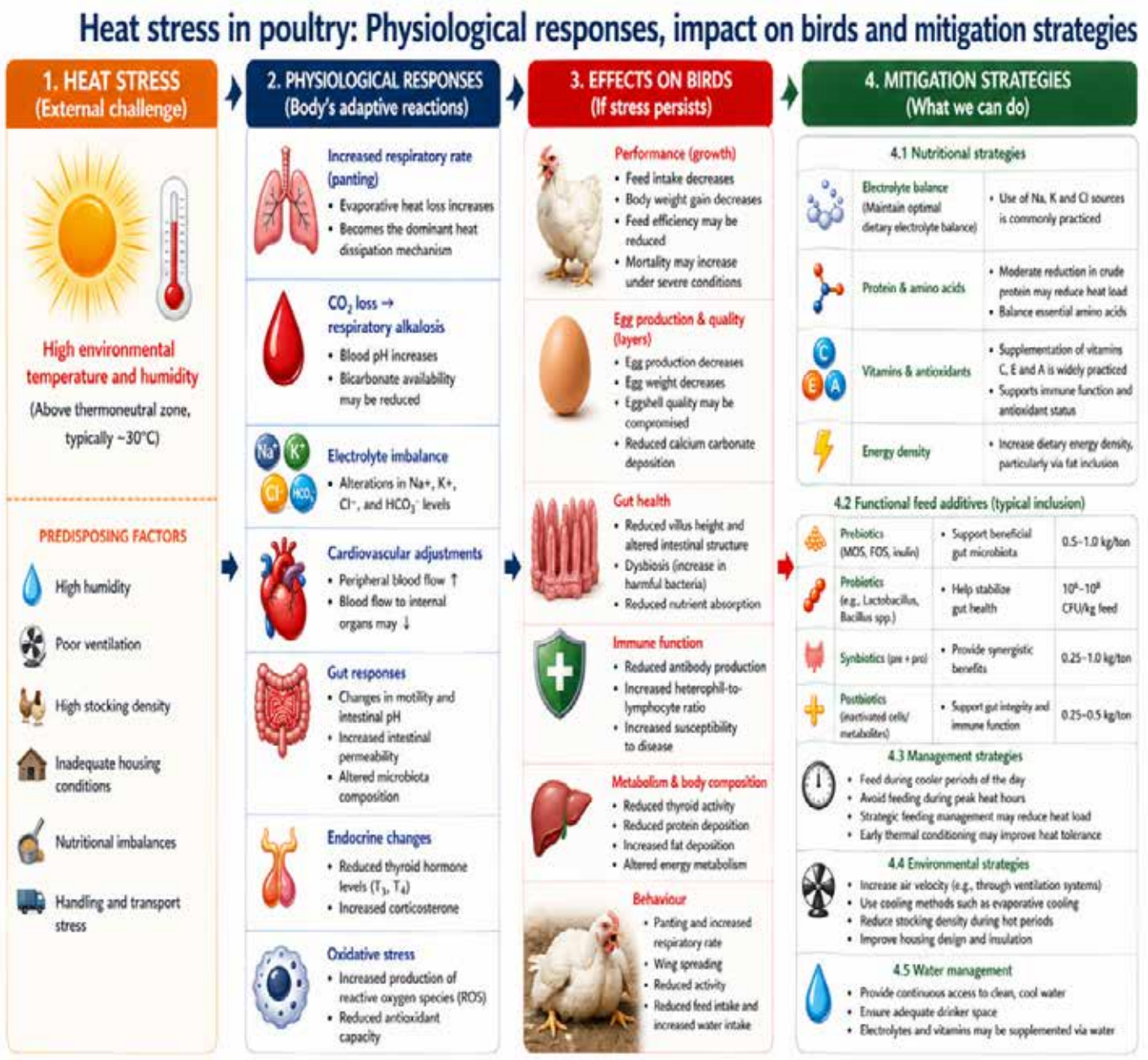
Electrolytes, Vitamins and Minerals

Maintaining electrolyte balance is a primary nutritional intervention during heat stress, as increased panting leads to loss of carbon dioxide and disruption of acid base equilibrium. Under practical feeding conditions, diets are typically adjusted to a dietary electrolyte balance (DEB) of 220-250 mEq/kg, commonly using sodium bicarbonate (1.5-2.5 kg/ton). This helps restore blood pH, improves water intake, and supports overall physiological stability in birds exposed to high environmental temperatures.

Heat stress also elevates oxidative stress, making antioxidant supplementation essential. Although poultry can synthesize vitamin C, endogenous production is insufficient under heat stress; supplementation helps modulate corticosteroid levels and improves stress tolerance. Vitamin C is widely used at 200-500 mg/kg in feed or 0.5-1 g/L in drinking water to alleviate stress and improve feed intake. Vitamin E (100-200 mg/kg) protects cell membranes from oxidative damage and enhances immune function, while also supporting lipid transport in laying birds. Since it cannot be synthesized, it must be supplied through feed. Vitamin A (10,000-15,000 IU/kg) supports epithelial integrity and overall health.

Mineral nutrition becomes increasingly important during heat stress due to reduced intake and increased excretion. Calcium and phosphorus are critical for maintaining eggshell quality and bone metabolism, both of which decline at elevated temperatures. Heat stress reduces calcium intake and impairs vitamin D_3 activation, along with lowering calbindin levels, thereby limiting calcium absorption. Under these conditions, simply increasing dietary calcium is not effective and may reduce feed intake. Instead, it is more practical to provide coarse calcium sources such as limestone or oyster shell grit (around 1 g/bird) during the afternoon to support eggshell formation during peak demand.

Electrolytes such as sodium, potassium, and chloride continue to support osmotic balance and cellular function. Trace minerals are equally important in stress adaptation. Zinc supports antioxidant defence and immune function through enzyme systems such as superoxide dismutase and metallothionein. Copper (5-8 ppm) contributes to antioxidant activity and is essential for eggshell membrane formation, with deficiencies often reflected



in poor shell quality. Iron supports oxygen transport and immune competence, which are particularly important under stress conditions.

Chromium improves glucose utilization through insulin action, enhancing energy efficiency when metabolic demand is high. Manganese supports enzyme systems, lipid metabolism, and eggshell formation, while iodine is essential for thyroid hormone synthesis, regulating metabolism and thermoregulation both of which are affected under heat stress.

Selenium (0.2-0.3 mg/kg) plays a central role in antioxidant defence and works synergistically with vitamin E to protect cell membranes from oxidative damage. It also supports immune response, improves nutrient utilization, and helps maintain intestinal and pancreatic integrity under stress conditions.

Overall, under field conditions, a coordinated approach addressing electrolyte balance, antioxidant support, and mineral nutrition is essential to sustain performance and resilience in heat-stressed poultry.

Feed Additives and Gut Health

Functional feed additives provide additional support to birds experiencing heat stress. Betaine is typically incorporated at approximately 0.5-1 kg/ton, functioning as an osmolyte to preserve cellular hydration and minimize energy expenditure related to ion homeostasis. It additionally promotes intestinal integrity and nutrient absorption.

Managing gut health is particularly important during periods of heat stress. Prebiotics are generally utilized at 0.5-1 kg/ton, whereas probiotics are incorporated at

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concentrations of 10^6-10^8 CFU/g feed to stabilize gut flora and enhance nutritional absorption. Synbiotics, typically incorporated at 0.25-1 kg/ton, have synergistic advantages, improving gut morphology and immunological function. Postbiotics, often utilized at 0.25-0.5 kg/ton, offer consistent antioxidant and anti-inflammatory benefits.

Furthermore, phytogenic compounds and bioactive molecules enhance oxidative balance, digestive efficiency, and overall performance in stressful conditions. Lycopene (from tomato and watermelon), resveratrol (present in foods such as grapes and peanuts), epigallocatechin gallate (EGCG) from green tea and curcumin from turmeric are natural bioactive compounds that help poultry cope with heat stress by improving antioxidant defence, immune function, and overall performance.

Water, Environment and Long-Term Approaches

Water management is the most immediate intervention during heat stress, since avian species may augment their water consumption two to threefold relative to typical conditions. Uninterrupted access to clean, cool water, preferably maintained at 20-25°C, is crucial, accompanied by sufficient drinking space and appropriate flow rate.

Environmental regulation is necessary for mitigating heat load in poultry housing. Increasing air velocity in ventilation systems, especially tunnel ventilation, improves heat dissipation, with air speeds generally maintained at 2-3 m/s. Cooling systems, including evaporative pads, foggers, and sprinklers, effectively lower ambient temperature, although their efficiency may fluctuate in conditions of elevated humidity. Decreasing stocking density by around 10–20% during elevated temperatures enhances airflow and birds' comfort, while appropriate housing design, insulation, and shading additionally facilitate thermal regulation.

Long-term strategies emphasize enhancing thermotolerance. Early thermal conditioning of chicks can improve their capacity to manage heat in later stages of life. Genetic strategies, like selection of heat-tolerant breeds like naked neck and frizzle birds, offer persistent benefits by minimizing metabolic heat generation.

Emerging techniques such as in Ovo feeding of bioactive compounds are also being explored to improve resilience from initial stages of development.

4. Conclusion

Heat stress continues to pose a significant concern in poultry production, impacting avian health, welfare, and productivity, and is anticipated to worsen due to evolving climatic circumstances. Although it cannot be entirely eliminated, its effects can be significantly mitigated with a comprehensive strategy that incorporates enhanced nutrition, deliberate feeding techniques, appropriate water and environmental management, and sustained genetic advancements.

Among all approaches, nutrition and feeding management are the most immediate and effective measures, directly affecting the bird's capacity to withstand thermal stress. When supported by efficient housing and management methods, these strategies sustain performance even in adverse conditions.

As global temperatures continue to rise, the emphasis needs to shift from only addressing heat stress to developing resilient poultry production methods. Producers employing proactive and scientifically informed strategies will be better positioned to sustain productivity, safeguard bird welfare, and attain long-term profitability.

Flock health influences carotenoid deposition in the yolk

8Color is one of the most important factors affecting consumer choices through sensory evaluation of food, including egg yolks. In most countries, golden yolks have been traditionally associated with good health, and despite regional differences on the preferred shade of red and yellow, intense, bright colors are recognized as a sign of a healthy yolk. Moreover, eggs with vivid yolk color can be used to cook attractive pasta, bakery products or sauces. The yolk consists of fats, proteins, vitamins, minerals and carotenoids. Carotenoids are responsible for yolk color, but also required for the development of other physiological functions.

One of the most important of them is a competent immune system, essential for laying hens. There is a trade-off between carotenoids transferred to the egg versus those used to support other functions. Only healthy birds are able to deliver most of feed-derived carotenoids to the egg yolk, therefore a bright yolk color can be considered an indicator of the good health and performance of the flock.

Carotenoids – brief history and benefits

Carotenoids are the most numerous and widespread group of pigments. In 1831, Wackenroder isolated from carrots the crystalline yellow carotenoid then called carotene and in 1837 Berzelius extracted the yellow carotenoids of autumn leaves and named them xanthophylls (Tee, 1992; Karnaukhov, 1990). 100 years later, the number of known naturally occurring carotenoids was about 15 in 1933, 80 in 1948, and rose sharply to about 300 over the next 20 years (Ong and Tee, 1992). Today, the carotenoid family is known to include over 750 compounds (Maoka, 2009) that provide different colors from light yellow to dark red. When complexed with proteins, they can produce green and blue colorations (Ong and Tee, 1992). Historically, carotenoids have been known for their egg yolk pigmenting properties and thought responsible to play specific roles in avian embryonic development (Surai, 2002). Nowadays, a growing body of research shows that when specific carotenoids such as canthaxanthin are added to the diet, they can improve the antioxidant capacity of eggs. (Rosa et al, 2012).

Benefits of carotenoids

- antioxidant activities.
- cell signaling and transcription factor regulation.
- promotion of cell differentiation.
- regulation of cell proliferation.
- regulation of intracellular communication via gap junctions.
- regulation of cellular levels of detoxifying enzymes.
- enhancement of immune function.
- natural colorants for birds, reptiles, amphibians, fish and various invertebrates.

Carotenoids are either carotenes, carotenoids that do not hold oxygen in their molecules, or xanthophylls / oxycarotenoids. Although carotenes are excellent sources of vitamin A, only less than 10% of known carotenoids can be converted into vitamin A. Clearly-defined roles for nonprovitamin carotenoids have still to be established, but evidence is emerging for several important functions (Surai, 2012) including antioxidant activities, cell signaling and transcription factor regulation, promotion of cell differentiation, regulation of cell proliferation.

It seems likely that both sexual display and immune defences can be influenced by carotenoid availability, providing support for the hypothesis that males allocating greater amounts of carotenoids to sexual pigmentation are advertising their superior health (Blount et al., 2003). Therefore, only fit and healthy birds can afford substantial amounts of carotenoids to be directed to the plumage. Any health-related problems (parasites, immunosuppression, oxidative stress, dietary deficiencies) would be associated with increased carotenoid usage for health reasons and fewer carotenoids would therefore be available for display purposes.

Carotenoid absorption and assimilation

Taking into account the role of carotenoids in various physiological processes, including immunity and antioxidant defences, it is reasonable to suggest that an adaptive mechanism has evolved to provide a developing embryo with maximum antioxidant protection related to high post-hatch viability.

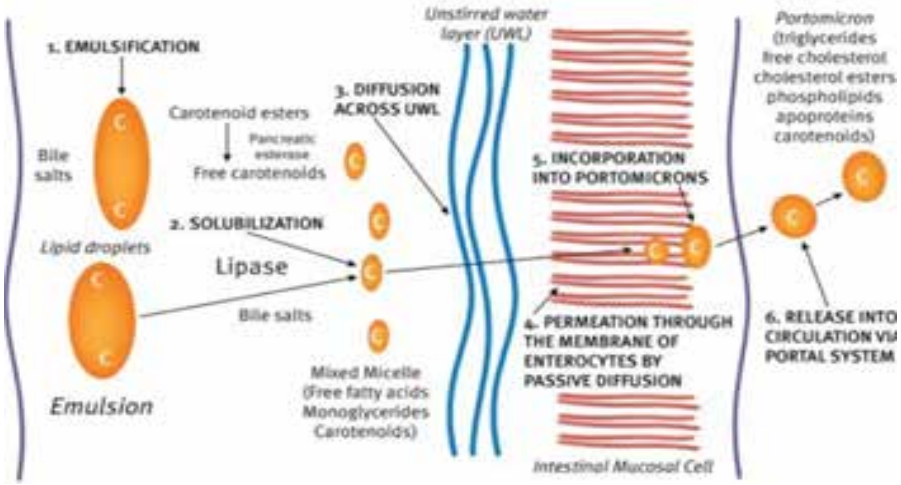


Figure 1. (Surai, 2015) shows a general scheme of intestinal absorption of carotenoids.

Stages of carotenoid absorption

- Emulsification.
- Solubilization.
- Diffusion across the unstirred water layer.
- Permeation through the membrane of the enterocytes.
- Incorporation into lipoprotein particles.
- Release into the circulation via lymphatic pathways

Carotenoids absorption from the intestinal tract is associated with the same intraluminal, membrane and intracellular events of dietary lipids. Despite gaps in our understanding of carotenoid absorption in avian species, it seems likely that in poultry, most of the carotenoids are absorbed in the jejunum. Figure 1 (Surai, 2015) shows a general scheme of intestinal absorption of carotenoids.

It should be mentioned that stress-related (feed toxicants such as mycotoxins, dietary oxidised fat) or disease-related (gut or liver disorders, parasites, viruses) disturbances at any of the aforementioned stages of carotenoid absorption would decrease carotenoid deposition into the egg yolk (Table 1) and decrease its color intensity.

After the ingestion of feed, carotenoids are released from the matrix by digestive enzymes, including lipase, and further emulsified by bile salts and phospholipids, also involved in the emulsification of dietary triglycerides and other fat-soluble nutrients like Vitamin A, E, K and D3.

The monoglycerides formed during hydrolysis of triglycerides, in the presence of bile salts, spontaneously form very small particles, called mixed micelles. The solubilizing of water-insoluble materials including carotenoids is a critical step in their digestion and absorption. Because of the very small size of mixed micelles, they are dispersed in the aqueous environment of the intestinal lumen and can diffuse into the glycoprotein layer surrounding the microvilli or brush border of mucosal cells, where they come into contact with the cell membranes (Tee, 1992). In general, movement through the unstirred water layer is a rate-limiting factor for lipid absorption (Westergaard and Dietschy, 1976) and on that basis, it appears reasonable to assume that the same is true for carotenoid absorption.

Thus, it is becoming increasingly evident that the micelles formed from dietary lipids serve as a delivery system for carotenoids to reach the absorptive surface of the gut. The micelles facilitate fat absorption by providing a high concentration of lipids in the unstirred water layer adjacent to the mucosal cells.

The feed matrix is thought to be an important determinant for the absorption of carotenoids, as the amount and type of feed determine bile secretion, while bile salts and fat determine micelle formation (van Vliet, 1996). The pH in the intestinal lumen may also affect absorption via an effect on the surface charges of both the micellar particles and the luminal cell membrane, with less diffusion resistance at lower pH (Hollander, 1981). It appears that carotenoids are absorbed by passive diffusion across the brush border membranes of the intestinal mucosal epithelium (Cohn, 1997) and the process is thought to be concentration-dependent (Bieri and Farell, 1976).

It is generally accepted that plasma lipoproteins serve as a transport system not only for lipids but also for carotenoids. The term lipoprotein refers to a set of complex spherical particles formed from lipids and proteins. These particles circulate in the bloodstream, transporting endogenous and exogenous lipids in the plasma (Alvarenga et al., 2011). Indeed, a major function of lipoproteins is to transport lipids through the vascular and extravascular body fluids.

In birds, portomicrons - lipoproteins produced by enterocytes - serve to transport lipids from the gastrointestinal tract to the liver via portal circulation. VLDL (Very Low Density Lipoprotein), LDL (Low Density Lipoprotein) and HDL (High Density Lipoprotein) are the major lipoprotein classes of avian plasma. It is important to understand interactions between lipoproteins and carotenoids to further understand the physiological status of birds. In the liver, some carotenoids are retained by non-parenchymal cells, but the major part is incorporated into newly synthesised VLDL and then released into the bloodstream.

Egg formation and carotenoid delivery

Egg formation is a complex process, involving a substantial increase in lipid and protein metabolism in the

Dietary factors
Fat increases absorption and stimulate bile flow from the gall bladder
Soluble fibre (e.g. pectin) interferes with uptake
Aflatoxin and ochratoxin depress carotenoid absorption
Vitamin A status (due to effect on intestinal conversion)
Protein level and status
Iron and zinc status
Dosage of carotenoid administered (reduced efficiency at higher levels)
Competitive interactions between carotenoids
Food Form
Location in plant tissues (e.g. plant cell chloroplasts may be less bioavailable than chromoplasts)
Mild heat treatment increases bioavailability
Reduced particle size (i.e., blenderizing) improves extractability
Biochemical and metabolic factors
Isometric form, but effect (positive versus negative) varies with carotenoid
Large inter-individual variability, likely due to metabolic or absorption polymorphism
Sex, Age, hormonal status and season effect carotenoid metabolism
Genetic make-up influence carotenoid metabolism (colour of Notherm Flicker has a genetic, not a dietary basis).
Subject characteristics
Intestinal parasites associated with reduced absorption
Coccidiosis, Newcastle disease or chronic respiratory disease decrease carotenoid assimilation
Malabsorption syndromes (especially involving fat) reduce absorption
Liver or kidney disease
Increased gastric pH associated with suppressed blood response
Environmental factors (captive vs wild)

Table 1. Effects of carotenoid absorption and assimilation (Courtesy of Dr. P. Surai, 2015)

liver and other organs. Yolk colour is completely determined by the types and amounts of carotenoids in the hen's feed and the ability of the hen to absorb and assimilate these pigments.

The hen's reproductive system is a very complex system that can produce an egg in 24-25 hours. An egg consists of the yolk (30 – 33%), albumen (~ 60%), and shell (9 – 12%). Ovulation usually occurs about 30 minutes after the hen has laid an egg (Lovell et al., 2003). In fact, a female chick is known to be born with a fully-formed ovary containing several thousand tiny ova, or future yolks. When the pullet reaches sexual maturity, the ova begin to develop, one at a time. At any time, an ovary contains ova in various stages of development, ranging from very small, white ova, to almost mature yellow ova, ready to be ovulated. Each yolk is enclosed in its own sac called a follicle. The yolk is kept intact by the surrounding vitelline membrane.

VLDLy (Very-Low-Density-Lipopotein yolk targeted) is the main delivery system for carotenoids into the developing oocyte and it is induced by estrogens (Walzem, et al., 1999). There are some specific unique features of VLDL in laying hens. First of all the diameter of VLDL particles synthesised in the liver of laying hens is about 30 nm, significantly smaller than that in immature hens, and secondly, these so-called yolk-targeted VLDLy are resistant to hydrolysis by LPL (Walzen, 1996). VLDLy small size allows it to pass through the granulosa basal lamina of the ovarian follicle and bind to the LR8 receptor in the oolemma (the membrane that covers the yolk). The receptormediated uptake of intact VLDLy by binding to the follicular apoB receptor for endocytosis (Walzen, 1996) means that carotenoids present in VLDLy will be transported in to the developing follicle.

Therefore, growth of the chicken oocyte is due in large part to the accumulation of yolk, and this has been shown to be due to a receptor-mediated process (Stifani et al. 1990; Schneider 2009). The yolk proteins and lipids are synthesized in the liver through the action of oestrogen, and these proteins are taken into the oocyte by a specific lipoprotein receptor s (LR8; Stifani et al. 1990). Carotenoids are deposited in the yolk to protect the embryo and increase hatchability (Rosa, 2012). Process that could be due to the capacity of carotenoids – such as canthaxanthin - to increase the antioxidant capacity of the egg when fed to the hen (Zhang, 2011).

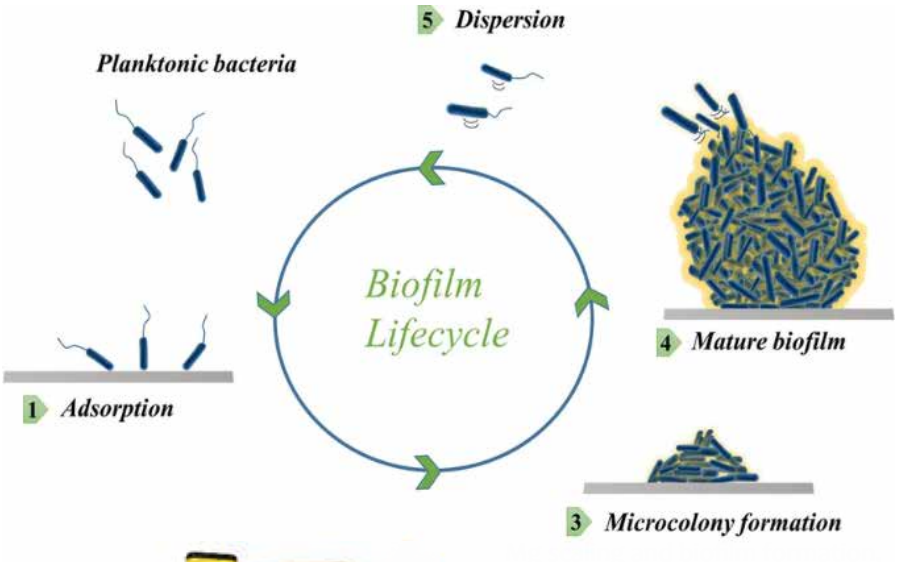
Conclusion

As consumers in many countries look at golden-yolk eggs as more appetizing and nutritious, it is in the hands of the farmer to offer vivid-coloured eggs to the marketplace. Only healthy birds will be able to produce golden-yolk eggs. As seen with gut infections, any stress or disease-related disturbances to the liver or ovary would decrease carotenoid concentration in egg yolk. The only way to deliver a bright-colored egg is to ensure optimal carotenoid intake and absorption. Healthy birds that receive enough carotenoid will accumulate them in their ovaries and then transfer them to the eggs, for eggs with a consumer-appealing color. A round, shiny and golden yolk always comes from a healthy hen.

Redefining Poultry Nutrition: Water Quality at the Core

By Neotle Global Pvt Ltd

Water is the most critical nutrient in poultry production, but often overlooked. Water consumed by birds is generally utilized for sustaining life processes, metabolic activity, and overall productivity. It acts as a universal solvent and transport medium, facilitating digestion, nutrient absorption, enzyme function, and thermoregulatory balance. Chickens normally consume twice as much water as feed during normal environmental temperature; any restriction quickly leads to dehydration, impaired circulation, and disruption of cellular metabolism. Because of its direct involvement in maintaining homeostasis, water intake has a more immediate impact on survival and physiological function than feed intake, making its continuous availability and quality a top priority in poultry management systems.



1.Parameters Influencing Water Quality in Poultry Production Systems

1a. Physical Quality

- Colour: Cloudy water indicates suspended particles (mud, clay, organic matter) that can affect watering systems and bird performance. Reddish-brown colour suggests excess iron; bluish colour may indicate high copper.
- Taste: Dissolved salts influence water taste. High ferrous and manganese sulphates can cause a bitter taste.
- Odour: Rotten egg smell indicates hydrogen sulphide, often linked to sulphate-reducing bacteria and black water formation.

1b. Chemical Quality

- pH: Acidic water (pH < 4) may impair digestion, corrode equipment, and reduce vaccine/ medication effectiveness. Alkaline water (pH 7.5–8.5) promotes Ca &
- Total Dissolved Solids (TDS): Reflects dissolved inorganic salts; levels below 1000 ppm are recommended for poultry.
- Hardness: Ca & Mg salts cause hardness. Levels above 200 ppm can lead to scaling, poor sanitation efficiency, and reduced medication efficacy.
- Contaminants & Toxic Substances: Excess magnesium/sodium sulphates may cause laxative effects and poor performance. High nitrates/nitrites indicate

Bacteriological quality		
	Parameters	**Recommendations**
Total flora	Total bacteria	
	At 22°C	<100(in 1 ml)
	At 37°C	<10(in 1 ml)
Indicator flora	Total coliforms	0(in 100ml)
	Faecal E. Coli	0(in 100ml)
	Intestinal enterococci	0(in 100ml)
	Sulphite-reducing bacteria	0(in 20ml)

fertilizer or waste contamination and reduce oxygen transport. Sodium above 50 mg/L increases water intake and wet litter problems.

1c. Microbiological Quality

Drinking water can carry harmful bacteria, viruses, fungi, and parasites, affecting flock health and performance. Presence of coliform bacteria indicates faecal contamination from runoff or contaminated water sources.

2. Preventive and Corrective Water Management Practices

aChlorine is recommended at a concentration of 0.5-3ppm depending on the pH of the water. It is a low-cost method but incorrect storage and presence of organic matter will inactivate the compound.

Hydrogen Peroxide

Hydrogen peroxide is recommended at a concentration of 30-50 ppm. It will act on biofilms and not sensitive to different pH. But it is also inactivated by organic matter and it may corrode the metal parts.

Peracetic Acid Cleaners

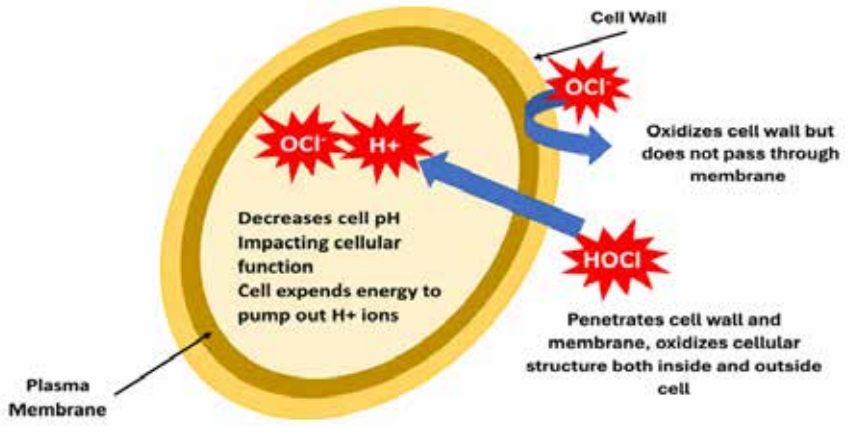
Peracetic acid is a powerful disinfectant commonly used for waterline sanitation and equipment cleaning. It is effective against bacteria, fungi, spores, and viruses even in the presence of organic matter. It also supports efficient biofilm removal and improves overall sanitation standards in poultry farms.

Ultraviolet (UV) Water Treatment

UV treatment uses ultraviolet light to inactivate microorganisms present in water. It is a chemical-free water treatment method that helps reduce bacterial and viral contamination without affecting water taste or composition. UV systems are commonly used to improve microbiological quality of drinking water.

Ozonation

Ozone treatment uses ozone gas as a strong oxidizing agent to sanitize water. It helps reduce microbial load, improve water clarity, and remove unpleasant odour from water systems. Ozonation is considered an advanced water treatment technology in modern poultry production.



Chlorine- mode of action

Iodophors

Effective water treatment programs are essential for maintaining flock health, reducing microbial contamination, improving water hygiene, and enhancing poultry production efficiency. Proper management of drinking water quality supports better feed utilization, gut health, bird performance, and overall farm productivity.

Iodophors are iodine-based sanitizers used in poultry sanitation programs for microbial control. They help maintain hygienic water systems and support effective disinfection practices at relatively low concentrations. Their stable antimicrobial activity makes them useful in farm sanitation management.

Quaternary Ammonium Compounds (QACs)

QACs are disinfectants commonly used for cleaning water systems, storage tanks, and poultry equipment. They help control microbial contamination and support improved hygiene practices across poultry operations. QACs are widely used as part of routine sanitation programs.

Acidifiers

Water acidifiers do more than just clean drinking water; they actively improve gut health, nutrient utilization, and flock performance. By lowering water and gut pH, acidifiers help to control harmful pathogens, enhance digestion and mineral absorption, and break down biofilms inside water lines.

Acidifiers Mode of action

In young chicks, this supports crop acidification, creating an unfavourable environment for harmful pathogens during early digestive development. A lower gut pH also enhances pepsin activation, improving protein digestion and feed utilization, which can positively influence growth performance. In addition, acidic conditions increase mineral solubility, supporting better absorption of essential nutrients from feed premixes and contributing to

overall flock health and productivity.

Unlike basic sanitizers or filters, organic acidifiers deliver both water hygiene and in-bird health benefits, making them a sustainable tool for better immunity, growth, and improved FCR. In addition, acidifiers work synergistically with sanitizers by optimizing water pH which significantly improves the effectiveness of chlorine-based disinfection.

Acidifiers are mainly classified into:

- Organic acids
- Inorganic acids

Organic Acids

Organic acids are widely used in poultry water treatment and nutrition programs. Common organic acids include formic acid, propionic acid, citric acid, lactic acid, and butyric acid. These acids help reduce water pH, improve microbial control, support gut health, and enhance digestion and nutrient absorption.

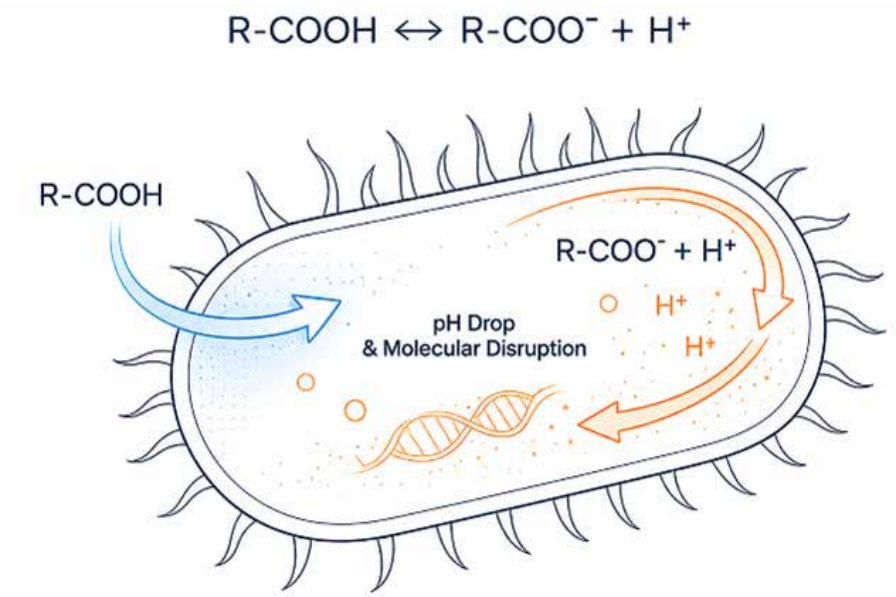
Organic acids are increasingly preferred in poultry production because they provide both water hygiene benefits and digestive health support.

Inorganic Acids

Inorganic acids such as phosphoric acid, hydrochloric acid, and sulfuric acid are mainly used for rapid water acidification. These acids help lower pH quickly and support microbial control in drinking water systems. Controlled application of inorganic acids can assist in maintaining water sanitation in poultry farms.

Importance of Buffered Acidifiers

An effective water acidifier should possess optimal acid concentration and buffering capacity, enabling stable pH reduction while maintaining water palatability to ensure consistent water intake by birds. Buffered acidifiers are advanced acidification systems designed to maintain stable water pH with better handling and improved system compatibility. They help to provide effective microbial control while supporting waterline safety and bird acceptance.



Buffered acidifiers are increasingly gaining importance in poultry production because they help maintain consistent water quality, improve water hygiene, support gut health, and reduce harmful bacterial load. Their stable acidification action also makes them suitable for continuous water management programmes in modern poultry farming.

Although economical alternatives for water treatment are available, acidifiers offer significantly broader functional benefits beyond basic water sanitation. Their role extends from maintaining water hygiene to actively supporting gut health, nutrient utilization, digestive efficiency, immunity, and overall flock performance.

Furthermore, acidifiers contribute to biofilm reduction in water lines and improve the efficiency of chlorine-based sanitizers through synergistic pH optimization. Compared to basic sanitizers or filtration approaches, buffered and organic acidifier systems provide a more sustainable and performance-oriented solution by simultaneously supporting water quality, gut integrity, immunity, and feed conversion efficiency (FCR).

Hence, modern poultry production increasingly considers acidifiers not merely as an economical water treatment option, but as an integrated tool for improving flock health, productivity, and overall farm performance.

Conclusion

Effective water treatment programs are essential for maintaining flock health, reducing microbial contamination, improving water hygiene, and enhancing poultry production efficiency. Proper management of drinking water quality supports better feed utilization, gut health, bird performance, and overall farm productivity.

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