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THE MAGAZINE OF INDIAN POULTRY INDUSTRY | JANUARY 2025

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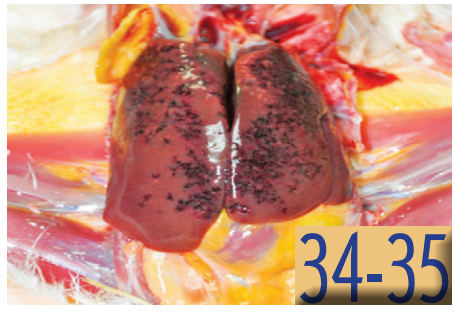

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HARNESSING BIG DATA FOR POULTRY HEALTH AND PRODUCTIVITY

In today's rapidly evolving agricultural landscape, the poultry industry stands at a transformative crossroads. With the global demand for poultry products surging, the need for efficiency, sustainability, and resilience has never been greater. At the heart of this transformation lies the power of data-driven decision-making, underpinned by big data analytics.

Big data has emerged as a game-changer in enhancing poultry health and productivity. By leveraging advanced technologies such as sensors, IoT devices, and artificial intelligence, poultry farmers can collect and analyse vast amounts of data., These insights enable precise, real-time interventions that optimise operations and reduce waste.

Moreover, data-driven approaches foster sustainability by minimising resource wastage and reducing the environmental footprint of poultry farming. By tracking and analysing energy and water usage, farmers can adopt practices that are both economically and environmentally sustainable.

However, the adoption of big data in poultry farming comes with challenges. High initial costs, the need for technical expertise, and data integration complexities can deter small-scale farmers. Bridging this gap requires collaborative efforts from governments, industry stakeholders, and technology providers to ensure accessibility and affordability of data-driven solutions.

As we look toward a future shaped by innovation, the poultry industry must embrace big data as a cornerstone of growth. Big data is not just a tool—it is the key to unlocking the full potential of modern poultry farming.

G. N. Ghosh
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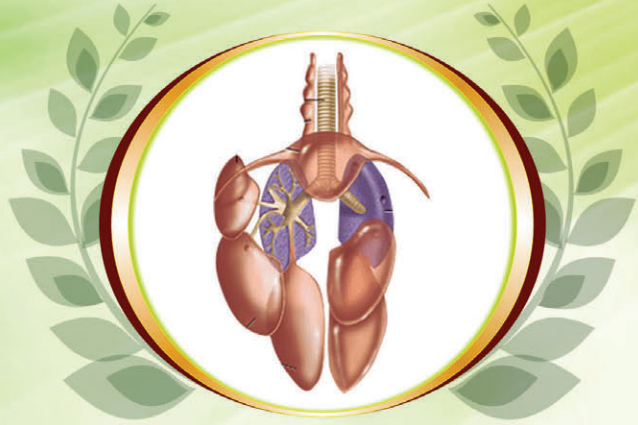

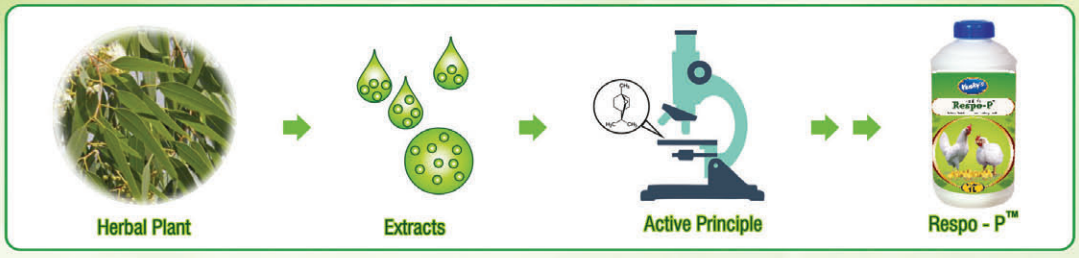

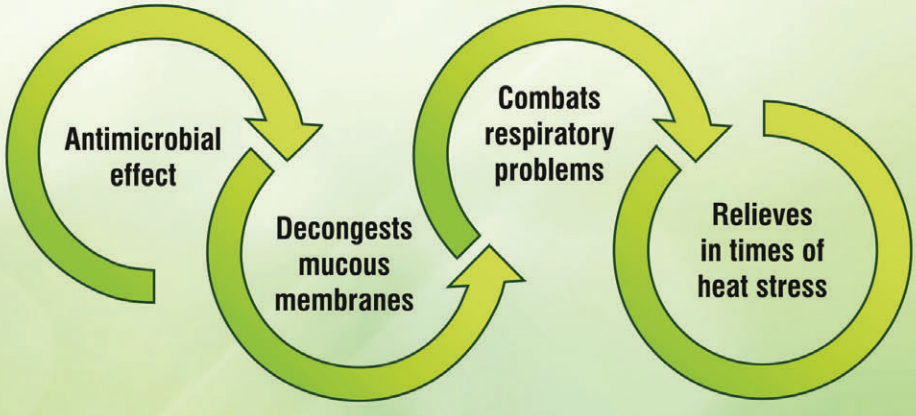

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The Science Behind Colours and Shape of Eggs

By
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Introduction

Have you ever wondered why eggs come in different shapes and colours? From pristine white to rich brown, and even shades of blue and green, some round some spherical some ovoid, the variety of eggshell hues and shapes has intrigued farmers, scientists, and food enthusiasts alike. While the colour of an egg might seem like a small detail, it is the result of a fascinating interplay of genetics, chemistry, and evolution. Each colour tells a story about the hen that laid it-her breed, biology, and even her environment. But beyond aesthetics, there are countless myths surrounding eggshell colours, from their impact on nutrition to their influence on taste. Is there any truth to these claims? And what exactly gives an eggshell its unique hue?'

1.1. Chemistry of Eggshell Colours- The primary pigments responsible for the colouration of eggs in both wild and domestic birds are protoporphyrin IX, biliverdin IX, and biliverdin zinc chelate (1). Kennedy and Vevers in 1976 further confirmed this, identifying traces of coproporphyrin III as well (2). These pigments are deposited in the surface layers of eggshells and, whether acting alone or in combination, create the wide variety of shell colours and shades seen in different bird species.

Research involving over 100 avian species has confirmed that blue-shelled eggs derive their colour exclusively from biliverdin IX and biliverdin zinc chelate. In contrast, the colouration of brown-shelled eggs is primarily attributed to protoporphyrin, with uroporphyrin and coproporphyrin also detected in smaller amounts. White eggs, such as those commonly laid by White Leghorns, lack pigmentation entirely, resulting in their characteristic colour. Additionally, the combination of green and brown pigments produces shells in olive green or grey-green shades (3).

1.2. The Role of Genetics in Egg Color- Wragg et al. (2013) identified SLCO1B3 as the key gene responsible for the blue-eggshell phenotype in chickens, with its high expression in the shell gland attributed to the insertion of EAV-HP. As SLCO1B3 plays a role in biliverdin transport, it is likely that other regulatory genes also contribute to the concurrent deposition of both protoporphyrin-IX and biliverdin in eggshells (4).

In further studies, the expression of ABCG2 in the shell glands of blue-eggshell chicken lines was found to be higher than in white-shelled layers but lower than in brown-shelled layers. Additionally, ABCG2 expression was observed to be greater in hens producing olive and green eggshells compared to those laying blue and light blue eggs. These findings suggest that ABCG2 predominantly influences the transport of protoporphyrin-IX, playing a significant role in the regulation of eggshell pigmentation (5).

The expression of HMOX1, a gene involved in biliverdin production, was significantly elevated in hens with blue-green-shelled subtypes compared to those laying white-shelled eggs. This indicates that HMOX1 directly contributes to the increased production of biliverdin, thereby influencing the blue-green colouration of the eggshells. Together, these findings highlight the interplay of multiple genes in determining eggshell pigmentation through their roles in pigment synthesis and transport (6).

1.3. The Evolutionary Perspective- The ancestral bird egg was likely white and unpatterned. Fundamental differences in eggshell colouration among bird families are thought to have arisen through early diversification in nest placement. Brown and speckled eggs are commonly associated with ground-nesting species, such as many passerines, and are considered adaptations for crypsis to reduce predation risk. In general, speckled eggs are more frequently observed in nests that are particularly exposed to predators. Similarly, blue eggs may offer camouflage in certain nests built within vegetation.

Nest site and architecture also play a significant role in the variation of eggshell colouration, both among species within the same family and among clutches within a single species. The pigmentation of quail eggs serves as a form of camouflage, helping to protect them from predators. The speckled and varied patterns can blend into the natural surroundings, making the eggs less visible. Predation pressure often drives the evolution of camouflaged eggs in some birds, whereas in others, such as cuckoos, eggshell colouration has evolved to mimic the host species' eggs, facilitating successful brood parasitism (7).

1.4. Grading with Colour Fans – Korean shell colour fans are used for grading brownness of eggs shell ranging from 1 to 15 where 1 is for white and 15 is for dark brown this colour grading is similar to the yolk colour grading with DSM Roche's Yolk colour fans.

Science Behind Shape of Eggs

Over the years, bird enthusiasts and scientists have proposed various theories to explain egg shape, most of which are linked to the bird's life history or its environment. Factors such as adult body mass, diet, the number of eggs in a nest, nest type, nest location, environment, and the hand-wing index (HWI) all play a role in determining egg shape. One clear factor affecting egg shape is the size of the mother bird's oviduct. However, egg shape is also influenced by the balance between internal pressures from the egg's contents and external pressures from the oviduct, moderated by the thickness of the egg membrane just beneath the shell—not the shell itself (8).

1.1. Oviduct shape and thickness - The bird's oviduct is divided into several parts, each contributing to the formation and shape of the egg. The interplay between these parts of the oviduct and the pressures from within the egg and the oviduct itself results in the diverse shapes of bird eggs. The thickness of the egg membrane also plays a role in moderating these pressures, ensuring the egg maintains its structural integrity.

a. **Infundibulum: Captures the egg yolk and starts forming the outer layers**
b. **Magnum: Adds the egg white (albumen), shaping the egg.**
c. **Isthmus: A**dds shell membranes, maintaining shape and providing a barrier
d. **Uterus (Shell Gland): Forms the hard shell and shapes the egg**
e. **Vagina:** Stores the egg briefly before laying

1.2. Rolling off - Spherical eggs are prone to rolling off cliffs due to their shape. In contrast, conical eggs roll in a tight circle, making them ideal for birds that nest on cliffs.

1.3. Conservation of Calcium - Spherical eggs have a reduced surface area, which may aid in conserving calcium in regions where the mineral is scarce.

1.4. Clutch size matters - The appearance of eggs in a clutch can be influenced by their number, with certain shapes being optimised for even nutrient distribution and maintaining a physiological balance of nutrition.

1.5. Degree of asymmetry- When comparing birds within the same order, those with stronger flight capabilities generally have more asymmetrical eggs.

Eggshell colouration and shaping are complex traits shaped by the interplay of evolutionary, genetic, and biochemical factors. From an evolutionary perspective, diverse shell colours and patterns have developed as adaptations to ecological pressures such as predation and environmental conditions. At the genetic level, key genes such as SLCO1B3 and ABCG2 regulate the transport and deposition of pigments like protoporphyrin IX, biliverdin IX, and their derivatives, which determine the final shell colour. This genetic framework highlights the intricate mechanisms controlling pigmentation and points to the interdependence of genetic expression and ecological requirements. Contrary to popular belief, brown eggs are not inherently healthier or more nutritious than white or blue eggs. Nutritional differences in eggs are primarily influenced by the diet and management of the hens, not by shell colour. Dispelling such myths is essential to promoting a scientific understanding of eggs and their production.

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Article

Nextgen Innovations to Support On-Site Challenges

Dr. Shiva Kumar
Technical Director
Trouw Nutrition South Asia

Sustainable farming is based on three pillars: environmentally sound, socially responsible and economically viable. For all these pillars, innovation will be key and hence, advances in animal nutrition will play an important role, where we have concrete challenges in economical optimisation of the value chain and meeting product quality demands, whilst safeguarding animal wellbeing and human health.

Creating the perfect ration can help propel food-producing animals towards optimal nutrition, health and production, contributing to better usage of resources and sustainability. Origin and seasonality of raw materials can have a significant impact on nutritional profiles, making it challenging to know the actual quality of the product at the moment of feeding it to the animals.

This can impact the performance of the animals and/or production costs putting at risk the business objectives of the farm or unit. Meanwhile, farmers and feed producers are dealing with price fluctuations of feed ingredients, due to market demands, increasing the pressure on profit margins as well.

Feed Quality is Key

We also see that farm sizes have gone up in the past years. This gives the opportunity for direct purchase/access to raw material to farms which introduces new challenges: farmers need to know what they buy from a nutritional value point of view in order to optimise feed cost and performance. Overall, the diets have not changed so much, but the inclusion of new raw materials like by-products, has introduced new opportunities as well as challenges; as their quality is also variable. All of these changes in how and where the feed is produced demands that raw materials quality has to be monitored upon arrival in an easy way and everywhere you are. Lab testing, including wet chemistry, is often accepted as one of the most accurate ways of analysing the chemical composition of raw materials. Feed mills often favour lab testing. This testing process, however, is rigorous and lengthy which doesn't make it an accessible or viable option for many farmers.

New Portable Innovations with NIR

The development of new technologies in the area of raw material feed quality evaluation allows for monitoring at farm level to streamline this process and make it cost-efficient. Therefore, an increasing number of farmers are moving towards mobile precision feeding solutions, such as near infrared technology (NIR). NIR technology has already been identified by feed producers as an accurate and quick solution for feed and raw material analysis, providing cost-effective and easy access to real nutrient values in their purchased raw materials.

The technology can be used to scan raw materials or silage and provide detailed information, comparable to traditional lab analysis. Although this NIR technique

has been used on a large scale at feed producers and large size integrators, until recently the application has not been available for professional farmers. The technology is now accessible for farms of every size with the introduction of the NutriOpt On-site Adviser from Trouw Nutrition. It can analyse feed samples in minutes and, through its powerful nutritional database, provide practical solutions for farmers to optimise their ration and their business.

How Does it Work?

The NutriOpt On-site Adviser is a handheld scanner, combined with a mobile app. Once both devices are connected, which takes a matter minutes, anyone, can have the nutritional report (energy and protein, fat, fibre, amino acids, etc) of a

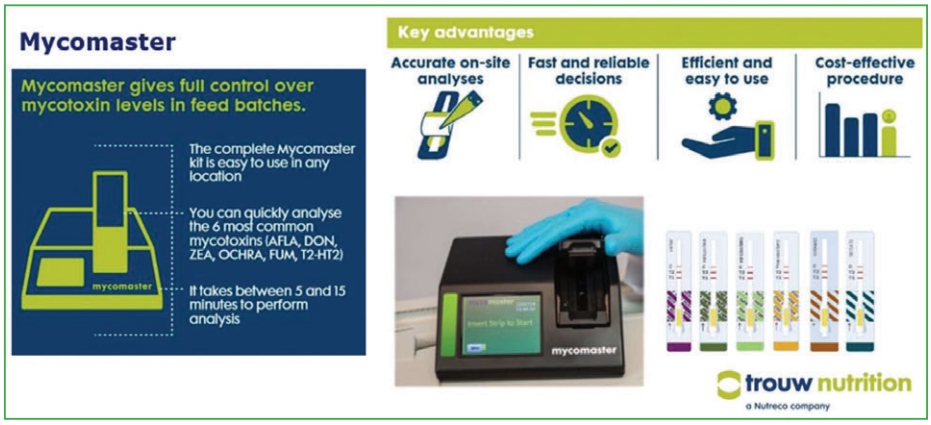
defined raw material displayed on their smartphone. With the information of the report, the farmer can already assess how the different nutrients deviate from the targets set by their nutritionist. This is possible thanks to a coloured bar placed next to the actual nutritional value. The bar represents a target range (minimum and maximum levels) of the defined nutrient, and the measured value is also placed inside of the bar helping the farmer to, on the spot, evaluate in a quick and accurate way what to do. When measured values are outside of the recommended range, an attention dot is displayed, so action can be taken immediately. With a simple click, the report can be shared with any person, to request further advise helping in a close contact between the farmer and the consultant/nutritionist. This means that farmers and suppliers, as well as their consultants, can scan samples onsite on every batch, giving them more control over quality consistency, performance and costs using good quality data.

Know What's in the Feed - Mitigating Mycotoxin Risk

Feed safety can only be guaranteed when we have accurate information on what is in the feed (or not). Mitigating mycotoxins is a key topic along the feed production chain, from raw material procurement to homemixing at farm level. Testing of

mycotoxins in raw materials and finished feed has become more important, as these toxins pose a serious risk to animal health, milk quality and overall animal performance.

raw materials per region and to adjust purchasing decisions of raw materials and feed by farmers and feed mills (better risk assessment). This is where Mycomaster plays an important role. This on-site rapid



Having accurate data on contamination levels can be used to monitor trends of

analysis reader gives a reliable indication of mycotoxin contamination in both raw materials and complete feeds

Mycomaster provides rapid, cost-effective and quantitative mycotoxin analyses of over 40 validated feed raw materials and final feed. And it works on-site, bringing flexibility to testing frequency, in support to quality control, formulation decisions and remediation strategies.

Trouw Nutrition is an organisation that deeply cares about building a more sustainable future – both for our industry and for consumers. We are committed to transform science into actionable, practical nutrition and farm management solutions to help customers produce quality poultry meat and eggs. We support food producers with the technology that puts advice and data at their fingertips. NextGen technologies ensure that farmers can get control over the diets fed to their animals on a daily basis in order to make informed decisions that will impact their business.

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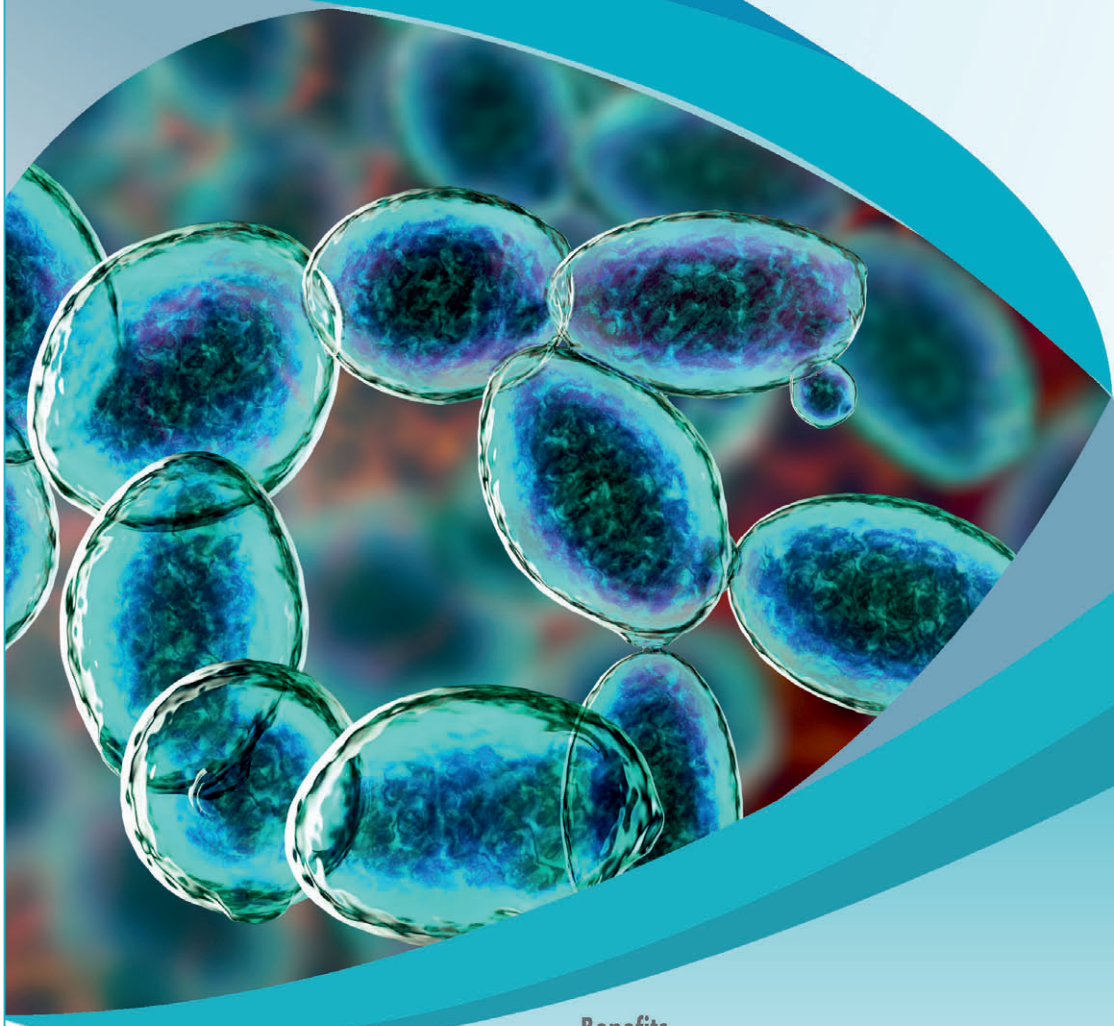

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Article

Organic Trace Minerals: An Effective Tool for Sustainable Poultry Production

Channegowda and Akanksha Patel
Technical services
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India produces about 14 MMT of broiler feed,13 MMT of layer feed and 3 MMT of breeder feed per annum. In addition to energy, protein, amino acid and vitamins, minerals are also crucial for optimum growth, reproduction and immunity.

The general functions of the minerals

- Give rigidity and strength to skeleton (calcium, phosphorus, magnesium)
- Serve as constituents of organic compounds (sulphur in proteins, cobalt in vitamin B12, iron in red blood cells)
- Activate enzyme systems (phosphorus, manganese and zinc)
- Osmoregulation and acid base balance (sodium, potassium, chloride)
- Required to synthesise hormones thyroxine (Iodine)
- Muscle contractions and transmission of nerve impulses (sodium and calcium)

Classification of Minerals

In general, minerals are classified into macro and microminerals. Macro minerals such as calcium, phosphorus, magnesium, sodium, potassium, chloride and sulphur are required in comparatively higher amounts(g/kg). Whereas microminerals (trace minerals) are required in lesser amounts (mg/kg or ppm).

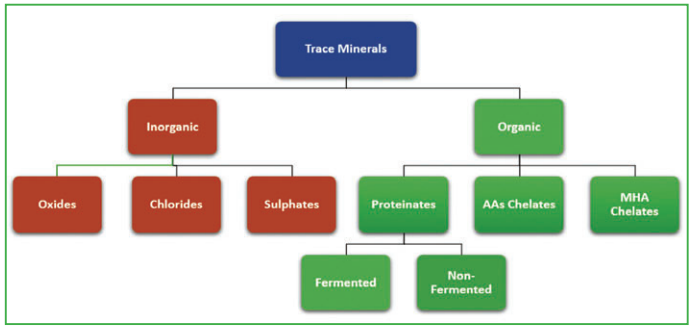

Figure 1. General classification of trace minerals:

Though trace minerals (TMs) are required in small quantities, their undersupply can result in deficiencies, while oversupply may lead to toxicity. Therefore, it is very important to deliver the optimum level of all trace minerals to prevent deficiencies and to get optimum performance. The inclusion level of trace minerals in poultry feed ranges from 0.1 to 0.13% of the diet, contributing to an approximate annual usage of 0.027 to 0.038 MMT.

Traditionally, trace minerals are incorporated in the form of inorganic salts such as oxides, chlorides and sulphates. Inorganic trace minerals are highly soluble and get ionised during digestion, forming 'free' reactive ions. These free ions can interact with other minerals or other components of the diet to form insoluble and unabsorbable complexes.The inorganic trace minerals can also bind with natural chelating agents present in feeds, such as phytic acid and oxalic acid, which can also limit their absorption. These interactions make the minerals partially or completely unavailable to the animal, resulting in reduced bioavailability.

To address this, poultry producers have increased the inclusion levels of inorganic trace minerals in poultry diets from0.75 to 1.5 kg/tonne of feed which is often higher than the requirement. The higher inclusion levels lead to an over-supply of minerals not only resulting in unnecessary wastage but also contributing to environmental pollution (manure/soil). Additionally,inorganic trace minerals tend to get contaminated with heavy metals (lead, mercury, arsenic, cadmium) and dioxins which are not only toxic to poultry but also raise concerns for food safety.

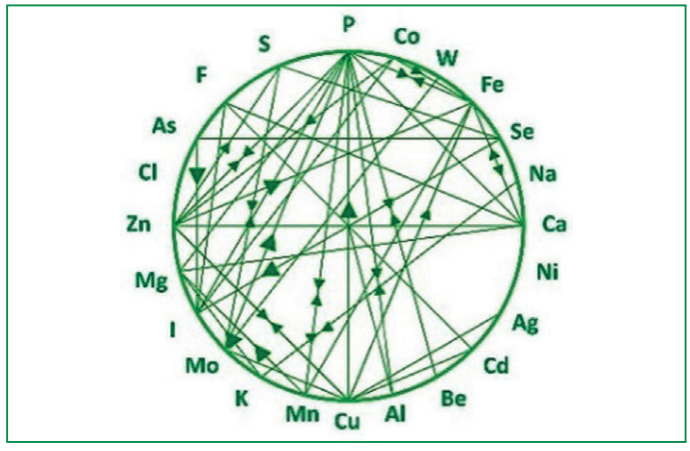

Figure 2. Minerals show antagonistic effect to each other on ionised form

Poultry producers and nutritionists are increasingly aware of the disadvantages of poorly metabolised inorganic trace minerals, leading to replacement of inorganic trace minerals with organic trace minerals. Currently, organic trace minerals are widely used in animal nutrition and the percentage of organic v/s inorganic trace minerals fed in the ration has been changing over a period of time. The guidelines provided by the NRC/ ARC/BIS/INRA are for the use of inorganic trace minerals only and not for the organic minerals. In practice, most nutritionists feed organic trace minerals up to 30 to 50% of inorganic trace minerals. The positive responses have also been observed when inorganic trace minerals are completely (100 percent) replaced with organic trace minerals.

Various Forms of Organic Trace Minerals

Organic and inorganic trace minerals differ fundamentally. Inorganic trace minerals are typically presented as finely ground mineral salts. These can be transformed into organic trace minerals by complexing them with an organic molecule known as ligand. The ligand could be single amino acid (chelates) or a chain of amino acids (proteinates). This binding process can be achieved either by a chemical reaction,where trace minerals are bound to synthetic amino acids like glycine/methionine or by a biotechnological process (fermentation) where trace minerals are complexed with peptides derived from hydrolysis of soy proteins. This process of complexation protects organic trace minerals from interactions and antagonism which makes them more stable and bioavailable. The approximate bioavailability of organic trace minerals is twice or greater than that of inorganic minerals (Spears, 2003).

Supplementation of fermented organic trace mineral resulted in improved retention and less excretion

Table 1. Result of supplementation of fermented organic minerals

Groups	% Excretion	% Retention
100% Inorganic copper	58.39a± 2.59	41.62c± 2.45
50% Organic copper	39.18bc± 3.45	60.81ab± 1.35

P ≤ 0.05 *Aminullah et al., 2021: Indian Journal of Animal Research*

Application and Benefits of OTMs in Poultry Nutrition

Organic trace minerals are incorporated into poultry diets by various means which are given here below.

Complete replacement: Complete replacement of inorganic with organic allows a significant reduction in the inclusion rate. The standard inclusion rate for inorganic is 1 kilo per ton of feed, while the organic requires a lower inclusion rate of 500 g per ton of feed. Whereas the fermented organic offers an even lower inclusion rate of 350 g per ton of feed. This reduction in inclusion level not only saves space in the feed formula but also helps to reduce environmental pollution.

Combined Application: In practice, most of the poultry nutritionists/ producers prefer a 50:50 ratio of inorganic and organic trace minerals. Several genetic companies also recommend this method of application.

On-Top Application: The on-top application of organic trace minerals is also not uncommon. In this method, organic trace minerals are added between 20-30% of inorganic trace minerals without altering the standard inclusion level of inorganic. This approach allows the nutritionist to understand the beneficial effect of organic trace minerals at farm level.

Table 2. Supplementation Of Organic Trace Minerals in Poultry Diets

Treatment	Gain (g/bird)	FCR
Inorganic 750 g/t	2824a	1.466b
Fermented organic 375 g/t	3007b	1.404a

P≤0.05 *Bob Swick et al., 2018: Poultry Science*

Table 3. Breast Meat Yield of Vencobb 400 Broilers

Treatment	Breast meat %of carcass
Inorganic: 1 kg/ton	22.05a
Fermented organic:0.50 kg/ton	24.21b

P ≤ 0.001 *S Haldar, 2012: unpublished*

Table 4. Bone Ash in Cobb 400 Broilers

Groups	Zn	Mn	Cu
Inorganic (1.2kg/t)	236b	168 b	29b
Fermented organic (0.5 kg/t)	257a	196 a	35a

P ≤ 0.05 *S V Ramarao,2009: unpublished*

The supplementation of organic trace minerals enhances poultry production, especially in parents, organic minerals boost fertility, which in turn improves the hatchability that could result in 1or 2 additional chicks per mother per cycle.

In egg laying hens, organic trace minerals improve shell strength, decrease the number of broken and thin shelled eggs, improves the thickness of egg white (Haugh Unit Score) and helps the producers/farmers to store the egg for longer duration at room temperature specially in summer.

In broilers, improved skeletal development and bone ash improves lameness score. Additionally, improved breast growth and meat quality contribute to higher economic returns.

Conclusion:

The change-over from inorganic to organic addresses several critical issues.

- Improve growth, performance and meat quality
- Better immune response
- Lower inclusion rate saves space in feed formulations
- Higher retention addresses environmental pollution

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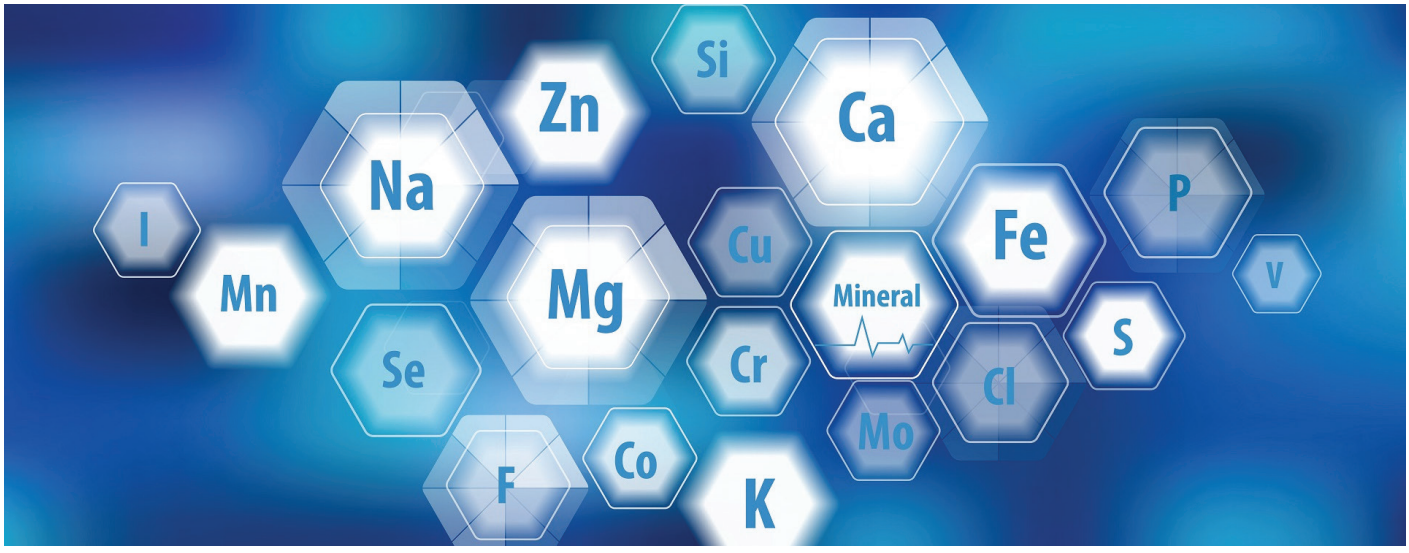


THE CASE OF EMERGING BACKYARD POULTRY

One of India's biggest challenges is feeding nutrient-rich proteins to its staggering population. This case study in real time shows how backyard poultry producing desi chickens can be a crucial strategy for boosting rural India's income and enhancing family nutrition, particularly for women and children. IPR delves into this idea of making BYP a sustainable livelihood model

The potential growth of the poultry industry was halted globally during COVID-19 although poultry birds were not affected directly by the virus. Distress in the poultry industry during the pandemic was primarily due to restriction of movement imposed on various items such as poultry feed, chicks, medicine and vaccines, and poultry products both locally and globally particularly in Asia, where 10 countries executed national lockdowns and 12 countries employed localised lockdowns.

Rumours about spreading of SARS-CoV-2 virus through poultry caused further collapse in the domestic market economy. The export market of poultry products has declined in certain regions like Asia, Europe and North America. It is expected that worldwide chicken meat trade may be lowered by 4% although there is increased demand for animal protein among consumers. Hence an integrated approach is needed to revive the poultry industry.

Apart from commercial poultry maintained in integrated farming systems with moderate to high level of biosecurity, there is the "backyard" or village level poultry sector with minimal biosecurity. In the backyard sector, native birds or locally available breeds are maintained and the birds or their products are mostly consumed locally.

The strategy to adopt backyard poultry as an alternative system to generate income not only augmented poultry production, but also guaranteed the availability of animal protein to the poorer section of society, as well as improved the purchasing capacity of this section, and guarded against reverse migration of labour during the COVID-19 period. Furthermore, smallholders could play a vital role in fulfilling the demand for animal products in developing coutries.

Some initiatives to distribute chicks, feed and medicine for rearing among the marginal farmers were detected in India, Bangladesh and Cambodia during lockdown to mitigate the catastrophic effect of COVID-19 on the rural economy.

In Asia, most of the poultry sector is represented by smallhoders and village poultry production systems, says FAO. In Cambodia 75 % of poultry production is carried out by subsistence farmers, who own an average of a dozen birds. Their poultry is mainly for domestic consumption, but the farmers manage to sell 10-15 chickens per year to generate US$ 15-20 in income, which can secure food for 6-8 weeks for a household for five. The majority of poultry is concentrated near cities on agricultural land, and adjacent to the Thai border in the northwest and the Vietnamese border in the southeast. The Department of Animal Health and Production of the Ministry of Agriculture, Forestry and Fisheries has categorised commercial production into three classes: small-scale (500 to 1000 birds); medium-scale (1000 to 5000 birds) and large-scale (over 5000 birds). Commercial farms include 138 broiler farms, 68 layer farms and 977 duck farms, representing one-quarter of the country's production. Most are small scale holders.

Current estimates of poultry population in China are about 12 billion chickens and 3 billion domestic waterfowl (ducks and geese). There is an ongoing export of poultry from certified farms in southern China to the Hong Kong Special Administrative Region. A significant proportion of poultry in China is sold through live bird markets. H5N2 vaccine is produced at the Harbin Veterinary Research Laboratories, among others, to prevent H5N1 infections in this poultry trade.

Indonesia has a large poultry industry. Production is mainly aimed at the national market, although some export of processed products and one-day-old chicks exists, and can be regionally important, e,g. from Sumatra. The poultry population of Indonesia comprises broilers, indigenous poultry, layers and ducks. 80% of the poultry in Indonesia is produced by large commercial companies, which are vertically integrated poultry production systems of substantial capacity. 70% pf the total poultry production in Indonesia is carried out in Java.

In Japan, the total chicken population is in millions, with its highest density in southern Kyushu (layer) and in northern Shikoku (broiler). The average number of birds per farm is 33,500 in layers and 38,000 in broilers. There are also some turkeys. About 25 % of the layer farmers keep fewer than 5000 birds, representing nearly 20% of the total layer population. About 255 of the broiler farmers send fewer than 50000 birds per year to the poultry slaughterhouse. However, their total share is less than 4 percent of the overall poultry meat production in Japan.

In Thailand, industrial production represents 80% of the poultry sector. The industry is dominated by large multinational and transnational companies. Before the AI crisis occurred, Thailand was the fourth largest exporter of chicken meat and products in the world.

In Vietnam, poultry production plays an important role in rural development. More than 80% of the poultry production in Vietnam is based on traditional production systems at the smallholder level, even though a number of families now keep flocks of between 1000 to 10000 birds. Poultry serves as a supplier of high-quality protein to farming families, as well as providing cash income through the sale of meat and eggs. Most of the production comes from backyard poultry raised by about eight million smallholders, while commercial poultry farming is represented by a number of small family producers and about 1000 modern poultry farms of more than 2000 birds, including 60 with over 10000 birds. The domestic bird population is mostly composed of chickens, ducks and geese.

The commercial poultry population in Pakistan has developed freely under minimal regulatory controls. There are some professionally integrated poultry production systems, but most of the farms are small. There are some 21000 established farms, and 38 million chickens are kept in backyard operations. Poultry and poultry products are intended for the local markets and are not meant for export. Chickens are kept close to areas with a large human population. Live broilers are sold to consumers directly. Poultry breeders are mainly concentrated in the area of Abottabad, in the north of the country. There are a major long-distance transport lines for consumer eggs or for broilers, except for some movements towards the Karachi region in the south.

Backyard poultry focussing on desi chickens has been a staple crucial strategy for rural India for boosting income and enhancing family nutrition for a long time. Especially among Self-Help Group (SHG) households. Traditionally, it has served as a vital source of nutrition supplemental income, particularly for marginalised communities. The growth of the poultry population in India – rising by 16% to 851.8 million from 2012 to 2019 – signals a promising opportunity to elevate the livelihoods of SHG households through more structured poultry interventions.

Despite high demand, desi chickens only hold a 7-8% market share, presenting an opportunity for growth, especially with the rising popularity of local delicacies in restaurants and dhabas. Desi chicken fetches a higher selling price than broilers, with eggs priced at Rs. 9-10 each. The poultry sector is growing rapidly, with egg production increasing by 6.77% and chicken meat by 7-9% annually. In 2022-23, out of 9.77 MMT total meat consumption, poultry accounted for 4.995 MMT. BYP also promotes the preservation of indigenous breeds and serves as a sustainable livelihood model, particularly empowering women in rural communities.

Despite it's potential, BYP farming faces several challenges like high mortality rates due to inadequate healthcare, poor housing conditions and reliance on scavenging for feed, hindering productivity. A pressing need for better breed selection, enhanced diseases management and more effective training for SHG members add to it.

In response to these challenges, Heifer International, in collaboration with Cargill under the HATCHING HOPE programme and with the technical inputs from Forum of Enterprises for Equitable Development (FEED), has developed an innovative backyard poultry model. Initially piloted in Odisha, this model, focuses on improving productivity and reducing mortality through advanced practices. Now, the model is expanding to seven states across India with support from various stakeholders,

aiming to offer a scalable solution for rural development and poverty alleviation through backyard poultry farming.

The Model USP

The training and capacity building component of the backyard poultry model focuses on equipping participants with essential skills for successful implementation. Key elements include:

- Community Resource Person (CRP) Training: Local women are trained as Community Agro-vet Entrepreneurs (CAVEs) to provide veterinary services and agricultural inputs, receiving technical training in poultry health, management and biosecurity
- Community Member Training on Biosecurity: Hands-on sessions are conducted for community members on best practices in housing, feeding and disease prevention
- Awareness Campaigns: Campaigns educate community members on the economic and nutritional benefits of improved poultry practices, promoting broader adoption
- Continuous Learning and Support: Ongoing support and learning opportunities, including workshops and refresher courses, ensure that CAVEs and community members stay updated with the latest practices and technologies
- Vertical Integration: the model involves different stages of poultry production system, including breeding, hatching, brooding, fattening and marketing handled by different groups of farmers and FPOs

KEY COMPONENTS OF THE NEW MODEL

1 Improved Houisng Design

The new backyard poultry model enhances safety, comfort and predator protection, increasing productivity and reducing mortality. It offers each bird 2 sq.ft. during the day and 1-2 sq.ft. at night, with ventilation, natural lighting and easy maintenance. This scalable design accommodates various flock sizes, supporting sustainable poultry farming.

2 Alternate Feed Strategies

The new model emphasises alternate feed strategies to reduce costs and improve nutrition. Of a total 100 grams of feed, 50% consists of Azolla, 30% of concentrate, and the rest of local feed ingredients aand local waste. Cultivating protein-rich Azolla, utilising local resources like agricultural by-products and household scraps, and promoting insect farming for natural protein. Supplemental feeding is also incorporated to enhance growth and egg production.

3 Community Agro-vet Entrepreneurs (CAVE) Model

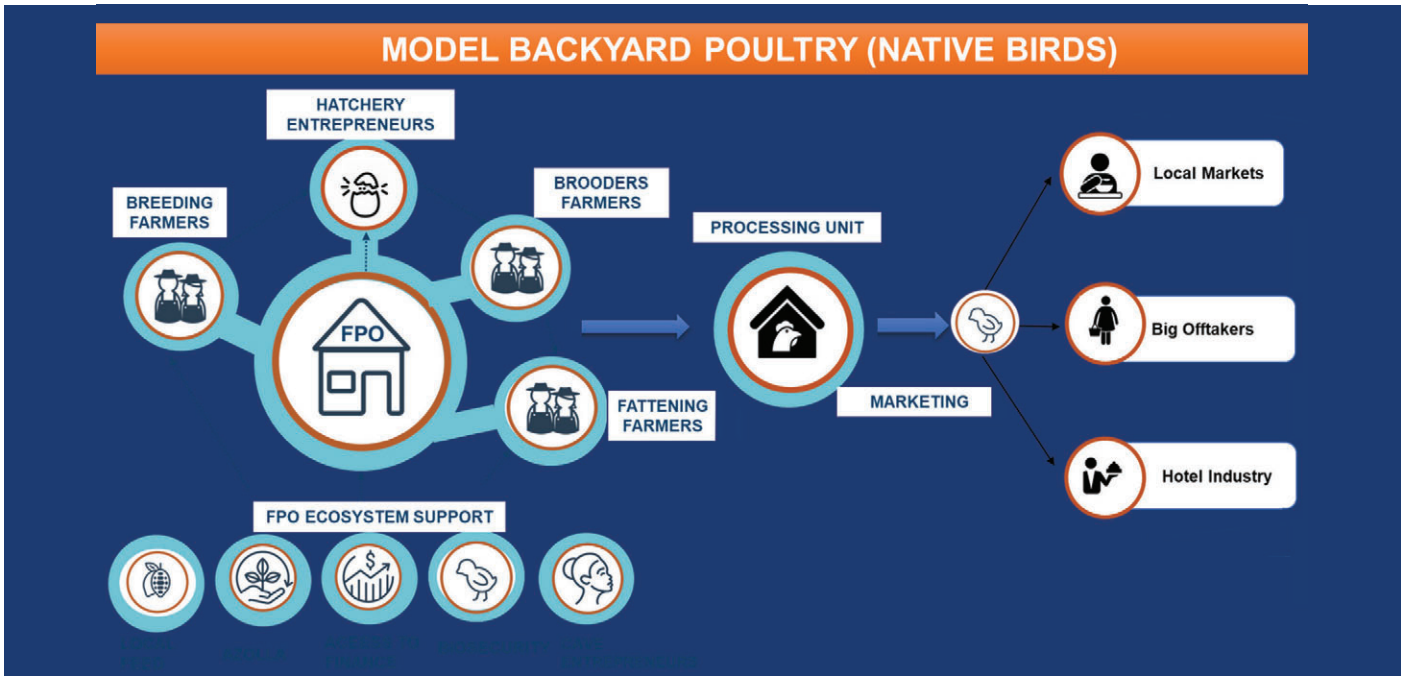
The model trains local individuals, primarily women to provide affordable animal health services and agricltural inputs to smallholder farmers. CAVEs serve as vital links in the agricultural ecosystem, using their farms as demonstration sites to share best practices in poultry management.

4 Weather-Protect Insurance

It is a tailored financial product designed to shield smallholder poultry farmers from climate risks like extreme temperatures and rainfall. It offers coverage to maintain production levels and prrotect farmers' livelihoods, ensuring they can repay loans and sustain their operations. This insurance is crucial in areas where climate variablity threatens agricultural productivity, providing a safety net for farmers.

5 Linkages with Government Schemes

The success of the backyard poultry model depends on effectively linking SHG members with government schemes. Key steps include identifying relevant programs like the National Livestock Mission (NLM), National Rural Livelihood Mission (NRLM) and MGNREGA, facilitating access through workshops and documentation support, and training members to optimize the benefits. Collaborations with local government bodies ensure timely technoical assistance, while monitoring and reporting ensure continued support.



This comprehensive approach aims to enhance productivity, income and livelihood security of rural communities.

THE COST DYNAMICS

Breeder Farmers

Breeder farmers rear birds for producing fertile eggs that are supplied to hatcheries to produce chicks, with a unit size of 200 birds and a male-to-female ratio of 15:85. The birds are reared for 2.5 to 3 years to ensure optimal egg production, size, and quality, after which they are sold for meat. Farmers provide both night and day shelters for the birds to scavenge and express natural behaviours, alonside preventive healthcare and biosecurity measures. They are trained in housing, strategic feeding, egg management and the benefits of Azolla as a cost-effective feed supplement.

Sl No.	Particulars	Amount (in Rs)
A	Total Fixed Cost	1,16,450
B	Total Recurring Cost	1,94,850
C	Total Return from Sale	3,03,840
D	Net Profit in 2 Years (C-B)	1,08,990

Hatchery Entrepreneurs

They operate hatcheries and incubate chicks from fertile eggs purchased from breeder farmers. They follow an agreement with breeder farmers to buy eggs at a price adjusted for inflation and production costs. The hatchery process involves 21 days of incubation under controlled temperature and humidity: 18 days in a setter and 3 days in a hatcher. Entrepreneurs receive training in essential hatchery functions, including temperature and humidity control, egg turning and egg management practices such as collection, transportation, storage and fumigation. Economics of a hatchery with 2000 hatching eggs capacity:

Sl No.	Particulars	Amount (in Rs)
A	Cost Incurred on Egg Purchase	2,52,000
B	Yearly Miscellaneous Expenses	30,000
C	Total Return from Sale on Chicks	4,44,976
D	Net Profit in a Year (C-[A+B])	1,62,976

Brooding Unit

In the brooding unit, day-old chicks are cared for intensively for up to 28 days to ensure their health and minimise mortality. The unit provides essential facilities including light, ventilation, feeders, waterers, starter feed and vaccinations. The main goal is to reduce mortality risks during the chicks' early life. After 28 days, the chicks are sold to fattening farmers. Entrepreneurs managing brooding units receive training on chick care and management practices. Economics for 1000 birds:

Sl No.	Particulars	Amount (in Rs)
A	Total Fixed Cost	80,000
B	Cost Incurred on Poultry Equip-ments (Per Year)	95,900
C	Working Capital	84,730
D	Gross Revenue	61,825
E	Net Profit per Batch (D-C)	7,095
F	Net Annual Profit (from 10 Battches)	70,950

Fattening Farmers

Fattening farmers purchase 28-day-old chicks from brooding units and rear them for 135 days, aiming for a weight of about 1 kg per bird. After 5.5 months, they sell the birds for meat to a farmer producer organisation (FPO) at a price per kg. Each fattening farmer manages a flock of 100 birds and can complete 2.5 batches annually. The setup includes night and day shelters, with preventive healthcare and biosecurity measures in places. Farmers receive training in housing, feeding, management practices and the benefits of feeding Azolla.

Sl No.	Particulars	Amount (in Rs)
A	Total Fixed Cost	55,500
B	Total Recurring Cost of Two Batches	45,421
C	Total Revenue from Two Batches	66,500
D	Total Profit fron 2.5 Batches	26,349

GOVERNMENT SCHEME ALIGNMENT

- **National Livestock Mission (NLM):** Entrepreneurship Development and Poultry Intervention: Subsidies for Capital Costs: The NLM offers 50% subsidies for capital costs related to poultry farming, which can help beneficiaries in building infrastructure like poultry shelters, hatcheries and breeder units as outlined in the model.
- **Animal Husbandry Infrastructure Development Fund (AHIDF) – Financial Assistance:** The AHIDF provides financial assistance, including 3% interest subvention loans for six years, which can help farmers cover working capital and operational costs related to breeder farms, hatcheries and feed supplies.
- **Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS):** MGNREGS can provide financial and labour support for constructon of poultry housing and shelters, which is a significant component of the model. This can be used to build fenced open areas and night shelters for backyard poultry.
- **National Rural Livelihod Mission's Financial and Technical Support:** Self-Help Groups (SHGs) and Farmer Producer Companies (FPCs) can leverage the NRLM support to facilitate collective marketing, access to credit, and capacity building for rural women engaged in backyard poultry.
- **NRLM Pashu Sakhi Model:** The model's focus on Community Agro-vet Entrepreneurs (CAVE), who provide veterinary services, aligns well with NRLM's Pashu Sakhi cadre. Training and capacity-building efforts for women SHGs in poultry management, healthcare and biosecurity can be interated into the NRLM framework to support local veterinary services.

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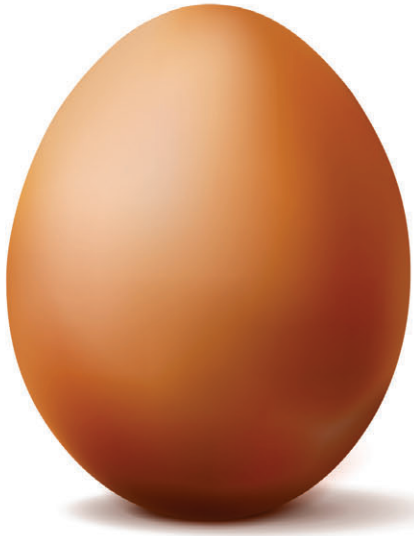

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Article

The Significance of Accurate Whole Bird Weighing in Poultry Processing

Kate Jørgensen
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BAADER

In the world of poultry meat production, precision and accuracy are paramount. One critical aspect that is often overlooked but plays a vital role in ensuring the right quality and highest yield of the process is the accurate weighing of whole chickens. Precise weighing ensures that each chicken is measured with exactitude, guaranteeing uniformity in size and weight. This consistency is fundamental in delivering a product of unwavering quality. Be it for packaging in retail or foodservice, consumers expect uniform chicken portions, and accurate weighing is the linchpin in meeting these expectations.

Accurate weighing is closely linked to profitability. An exact weight for each bird facilitates their best-fit allocation to downstream processes based on their size. This, in turn, maximises the yield and minimises waste, contributing significantly to a more sustainable business.

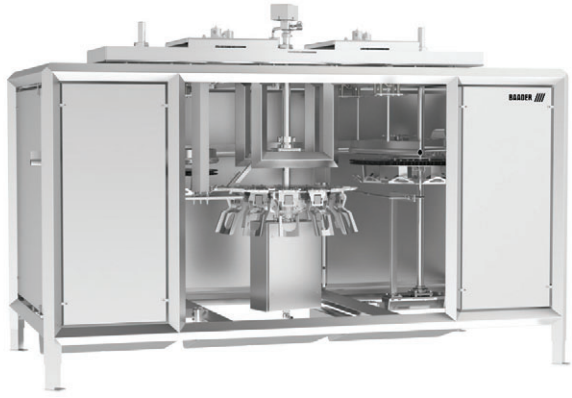
Furthermore, processors who package whole birds to fixed weights must be particularly mindful of accurate weighing. Failure to do so can result in excessive "give-away," where products are over-allocated, leading to unnecessary losses and reduced profitability.

Accuracy is the key to correct decision-making.

BAADER Accurate whole bird weighing minimises the 'give-away' in packing *Picture Courtesy: BAADER*

Weighing after Water Chilling

The latest BAADER innovation to ensure accurate whole bird weighing is the TrueWeigher 707. The TrueWeigher 707 is installed on the distribution line after water chilling and manual rehanging. This in-line weighing machine captures the individual whole product weight to optimise downstream distribution – optionally together with individual quality grade and buffer transfer. After weighing, the products can be sorted into whole product drop-off and/or cut-up. The TrueWeigher 707 works together with the BAADER production software that controls the distribution process.



The automation of giblet harvesting reduces labour dependence and ensures consistent production quality *Picture Courtesy: BAADER*

Unique Weighing Principle

The machine operates with a static weighing principle, allowing for an accuracy better than ± 0.25%, even at high line speeds. The weighing shaft is equipped with several weighing units, each with a digital weigh cell connected to a weighing computer. Every product is weighed on its own load cell without interference from the chain, shackle or trolley. Zero-taring is performed after each weighing cycle to maintain the highest weighing accuracy throughout the production day.

Easy Control of the Weighing Process

The TrueWeigher 707 is controlled by an office-located weighing computer that provides the operator with performance data for monitoring purposes such as system status, shackle counts, alarm history, etc. It allows the operator to easily set up key parameters and perform various tasks, e.g. calibration. Optionally, a touch screen mounted on the machine (HMI) can give control directly from the plant floor.

Combined Weight and Quality Assessment

Vision technology has become increasingly important in the poultry processing industry, as it offers numerous advantages over traditional visual inspection methods. With the use of advanced cameras and Artificial Intelligence, vision technology can quickly and accurately inspect poultry products for defects, contaminants, and other quality issues.Along with accurate product weight, precise quality detection is crucial for optimal product distribution throughout the entire plant.

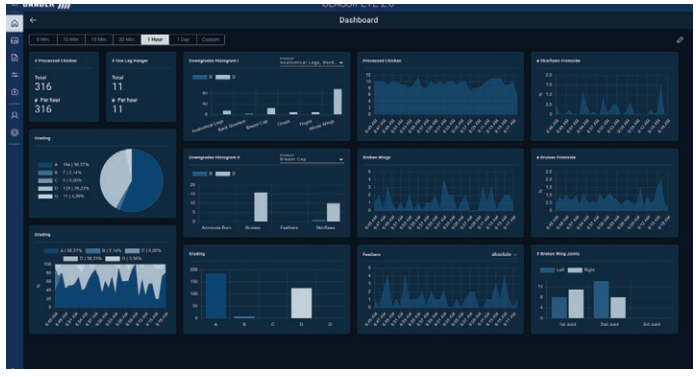
Advanced AI-Based Vision Technology

With the use of Artificial Intelligence (AI), vision technology can learn from previous inspections, continually improving its accuracy over time which is the case of ClassifEYE. The ClassifEYE 2.0 system uses the most advanced AI technology to adapt to the local production environment and to ensure the highest detection quality at all times. The system computes macro-grades for all parts of the bird and then combines them into a weighted bird grade, which can be used for further best-suited distribution to the downstream processes: whole bird packing, cut-up, deboning, retail and food service.

The AI-based vision technology, ClassifEYE uses advanced algorithms and machine learning to analyze visual data captured by the camera
Picture Courtesy: BAADER

Upstream Processing Improvements

ClassifEYE provides accurate defect detection and assistance in identifying the root cause through detailed and easy-to-understand detection widgets. The system's dashboard is accessible within the local ClassifEYE network and alarms the user once a value-reducing threshold is reached. Immediate adjustments of processing parameters result in a rapid decrease in carcass damage and fewer downgrades, ultimately leading to the optimal value of every part of the bird.



Article

Gut Health in Poultry— The World Within

Team Aviagen

SUMMARY

Introduction

A healthy gut is essential for the efficient conversion of feed into its basic components for optimal nutrient absorption. If gut health is compromised, digestion and nutrient absorption will be affected, and bird health, performance and welfare compromised.

Gut Inhabitants

The gastrointestinal tract (GIT) consists of a diverse community of mainly bacteria, fungi, protozoa, and viruses (gut microbiota). The development of this community begins at hatching; bacteria are picked up from the environment, the feed and the people handling the chicks post-hatch. Each of these three areas can, therefore, affect gut microbiota development.

Maintaining the Balance of Gut Health

Maintaining good gut health is critical for maintaining the growth, health and welfare of the bird. If digestion and nutrient absorption is compromised, an imbalance or overgrowth of the gut microbiota can occur which in turn will affect bird health and performance. The balance of the microbiota in the gut can be significantly affected by bird management and environment.

- Diet – feed changes, raw materials and physical quality all influence the balance of the gut microbiota
- Appropriate brooding conditions – the provision of optimal brooding conditions is essential for ensuring optimal gut microbiota development. Birds receiving appropriate brooding develop a gut that performs well and has a greater capacity to cope with the challenges of the broiler shed. Early access to feed and water is important
- Biosecurity – if clean-out and disinfection procedures are inappropriate, pathogens will be introduced into the poultry shed, exposure to these pathogens will influence gut health and development
- Risk periods - there are times during poultry production when the bird will be challenged, for example during feed change-overs or vaccination. During these periods, the gut microbiota can fluctuate and in some cases, if management is sub-optimal, dysbacteriosis can occur
- Environmental conditions - temperature and ventilation. Achieving optimal environmental conditions will promote good gut health
- Mycotoxins and infections will also impact gut health

Conclusion

Maintaining the balance of good gut health is a key aspect of ensuring the best bird performance and health. Management

styles, climate, disease and feed raw materials all affect gut health. Good bird management practices (brooding, feed, water, biosecurity and environment) are necessary to maintain gut, and, therefore, bird, health, welfare and performance.

The remainder of this article provides more detail on the points summarised on page one.

Introduction

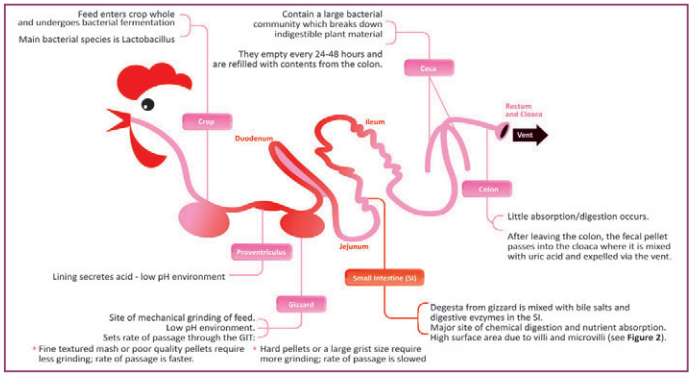
The efficient conversion of feed into its basic components for optimal nutrient absorption is vital for both broiler and broiler breeder production and welfare. Gut health, an intricate and complex area combining nutrition, microbiology, immunology and physiology, has a key role to play. When gut health is compromised, digestion and nutrient absorption are affected which, in turn, can have a detrimental effect on feed conversion leading to economic loss and a greater susceptibility to disease. In addition, recent changes in legislation on the use of antimicrobials, differing feed requirements and more efficient birds highlight the need for a better understanding of gut function and gut health. This article aims to explore the area of gut health and outline key factors that are important in the development and maintenance of optimal gut function.

An Overview of the Gut and How it Works

The intestinal tract of a bird is a specialised tube that starts at the beak and ends in the cloaca. The primary function of the gut is the conversion and digestion of food into its basic components for absorption and utilisation by the bird. The gut is separated into five distinct regions (Figure 1); the crop, proventriculus, gizzard, small intestine (duodenum, jejunum and ileum) and large intestine (ceca, colon and rectum). Each of these regions has a specific role in the digestion process and absorption of nutrients.

Key Management Points

- The gut is responsible for the digestion and absorption of nutrients
- If gut function is impaired, digestion and absorption of feed will be reduced and bird performance and welfare will be compromised



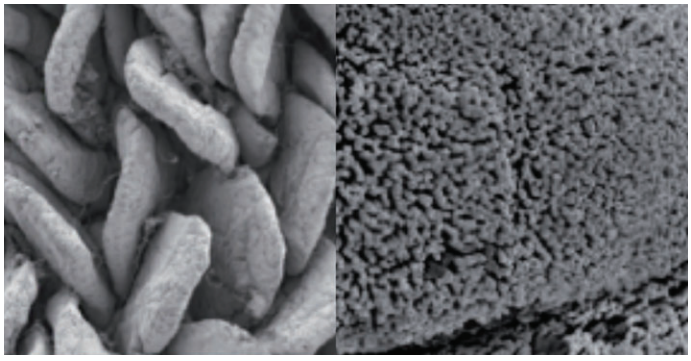


Figure 2 : Electron micrograph of villi (left) and microvilli (right) of the small intestine

The feed enters the crop where it is stored for a short period of time and partially fermented by the resident bacteria. The feed then enters the proventriculus where it is mixed with acid and pepsin (an enzyme which breaks down protein) and then on to the gizzard. The gizzard acts like a grinding mill to break the feed into smaller particles, it will then release the feed into the small intestine once the feed particles are small enough. While the gizzard grinds the feed, it is mixed with the acid and enzymes secreted by the proventriculus. This process allows for the break down of whole proteins into smaller peptides which can then be digested in the small intestine into amino acids for absorption. Within the small intestine, the carbohydrates and fats are also broken down so that they can be absorbed and used by the birds. During the normal digestion process, by the time the digesta reaches the last part of the ileum all the proteins, fats and carbohydrates should have been absorbed leaving behind the non-digestible components of the feed (e.g., cellulose, non-starch polysaccharides, etc.). This material has two fates; it is either passed out in faeces or taken up by the ceca where bacteria ferment these materials to form organic acids, short chain fatty acids and vitamins which the bird can absorb for extra nutrients. At the end of digestion, chickens produce two types of droppings, a cecal and a faecal which look very different (Figure 3).

Figure 3: The faecal dropping (left) should form a semi solid bolus comprising of waste material with a white uric acid cap – this should be checked for abnormalities such as excessive water, fat, mucus and feed particles. The cecal dropping (right) should be dark in color, have a paste like consistency and be free of gas bubbles.

Gut Inhabitants – A World to Discover

The community of microorganisms in the gut is referred to in many ways: friendly bacteria, gut flora, gut microbiota and gut microbiome. It is a diverse community of mainly bacteria, fungi, protozoa and viruses. While modern DNA-based technologies have given a much more accurate picture of the bacterial species present in the gut, it has become increasingly evident that a large number of bacteria in the gut are currently unknown and unclassified. Recent studies focusing on poultry have proposed that the gastrointestinal (GI) tract of a broiler chicken is colonised by an estimated 600-800 species of bacteria. The abundance and diversity of the microbiota varies along the GI tract and, predictably, the regions that have less tolerable conditions and faster passage of gut contents have lower numbers of bacteria. Even though bacteria can be found in the gut of the developing embryo, it is generally considered that the development of the adult gut microbiota predominately begins at hatching where bacteria are picked up from the environment, the feed and the people handling the chicks post-hatch. The crop is rapidly colonised within 24 hours. After one day post-hatch, the ileum and ceca are also both dominated by bacteria.

After three days, the level of bacteria in the small and large intestine increases ten-fold. The first bacteria to enter the gastrointestinal tract can be considered the pioneering bacteria as they rapidly multiply and colonise the gut environment. The composition of the pioneering bacterial community goes through a succession of changes as the gut develops and oxygen levels fall. It can take up to 3-4 weeks for the microbiota to form the climax (or adult) microbiota, but during this period, stability is seen in the gut if chicks are provided with optimal brooding conditions along with good feed and water quality.

Key Management Points

- The gut consists of a diverse range of bacteria, fungi, protozoa and viruses
- Development of the gut microbiota begins on hatching; bacteria are picked up from the environment, the feed and people. Each of these three areas can affect gut microbiota development

The crop harbours a large population of lactobacilli. These bacteria partially ferment the carbohydrates in the feed and produce lactic acid which reduces the pH of the crop environment. The conditions within the proventriculus are highly acidic creating an environment which is unsuitable for most bacteria. The gizzard also has an acidic environment but has a substantial population of lactobacilli which mainly originate from the crop. The bacterial population of the small intestine is made up of mainly lactobacilli although enterococci, E. coli, eubacteria, clostridia, propionibacteria and fusobacteria can sometimes be found.

The bacterial population of the small intestine evolves as the bird ages but will generally be stable by two weeks of age. The ceca provides a more stable environment which allows the colonisation of slower growing fermentative bacteria. Early in the life of the chick, the ceca is dominated by lactobacilli, coliforms and enterococci, but by two weeks of age, the cecal environment will have started to stabilise as the adult flora begin to dominate. At this stage, the pioneering species are replaced with bacteroides, eubacteria, bifidobacteria and clostridia.

Role of the Intestinal Microbiota

Within the GI tract there are multiple interactions between the host (bird) cells, the intestinal environment, bacterial cells and feed components. These interactions emphasise the extremely important role of gut microbiota in the health and well-being of

the host (as discussed below), although the exact way in which this is achieved is not yet fully understood.

The bacterial community of the intestinal microbiota form a protective barrier which lines the gut, preventing the growth of less favorable or pathogenic bacteria such as Salmonella, Campylobacter and Clostridium perfringens. This principle is most commonly known as competitive exclusion. Theories suggest that the commensal (or friendly) microbiota dominate attachment sites on the gut cells reducing the opportunity for attachment and colonisation by pathogens. Another proposed mechanism is that the intestinal microbiota is able to secrete compounds, including volatile fatty acids, organic acids and natural antimicrobial compounds (known as bacteriocins), that either inhibit the growth of, or make the environment unsuitable for, less favourable bacteria.

Studies using germ-free animals have also shown that the intestinal microbiota is important in the stimulation and development of the immune system. It is thought that the commensal microbiota maintain the gut immune system in a state of 'alert' so that it can react quickly to pathogens. The gut microbiota is also considered to be an important factor in the development and maturation of the immune system. Animals lacking a gut microbiota have been shown to be more susceptible to disease and have poorly developed immune tissues. In addition to protection against disease and stimulation of the immune system, the intestinal microbiota can influence host growth rates by producing extra nutrients through the fermentation of the plant fibers that the birds can't digest.

The Balance of Gut Health

Gut health relies on the maintenance of the delicate balance between the host, the intestinal microbiota, the intestinal environment and dietary compounds. This balance can be significantly affected by factors such as bird management, feed quality and the birds' environment. When gut health is optimal, there is complete digestion of the feed and absorption of the nutrient components. If there is a disruption to the normal processes in the gut, incomplete digestion and absorption of nutrients can occur, leading to malabsorption and gut imbalance. If there is any imbalance in the gut environment, gut health is then at risk of being compromised which can impact the health and performance of the birds. When digestion and absorption is not optimal, there is malabsorption of nutrients resulting in more nutrients being available to the small intestinal bacteria that can lead to an overgrowth of the bacterial population. A further consequence of malabsorption is the passing of proteins, sugars and fat into the ceca causing an overgrowth in the microbial population and a shift away from the beneficial fermentative bacteria. The balance of the microbiota in the gut can be affected by factors such as:

- poor gut development
- feed change
- feed (quality and raw materials)
- mycotoxins
- biosecurity
- environment (temperature and ventilation)
- brooding conditions
- infections with viruses, bacteria or coccidiosis
- water quality

Diet has been found to be the most influential factor on the composition of the gut microbiota and Figure 4 below highlights how diet can change the gut flora.

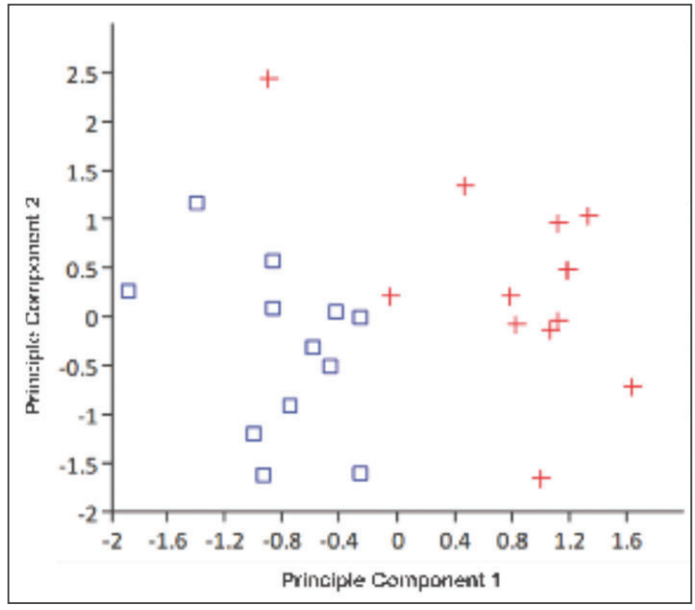


Figure 4: Principle Component Analysis of bacterial communities in the ceca of broilers fed on a high protein diet (+) (120% of standard diet) and low protein diet (□) (80% of standard diet). Each point on the chart represents one bird fed one of the diets. The closer the points on the chart are the more similar the bacterial population in the ceca. We can see that there is a separation of the red points away from the blue points (as shown by the dotted line) indicating that the bacterial populations are different in the ceca between the birds fed on the different diets.

Changes in raw material type, nutrient density and feed form have all been shown to impact the microbiota. During the life of a flock there are a number of feed changes where there is a shift in composition of the diets; this invokes a change in the micronutrients available for the gut microbiota. The consequence of this change can be a minor bacterial imbalance in the gut as the microbiota adjusts to the new feed. This imbalance is usually of no consequence unless there are other factors impacting gut health at the time of the feed change.

Feed form is very important for gizzard function. Excess fines or poor pellet quality can result in the gizzard passing feed into the small intestine too quickly. If this occurs, there is not enough time for the acid and pepsin enzyme to break down protein resulting in whole proteins entering the small intestine which is detrimental as the small intestine cannot properly digest whole protein. When this happens there is protein malabsorption and increased viscosity in the gut, both of which increase the risk of dysbacteriosis and in severe cases may lead to necrotic enteritis. The use of cracked corn, whole wheat or insoluble fiber can help with gizzard stimulation to ensure optimal mixing of the feed within the gizzard.

Changes in the bacterial populations of the small intestine and ceca that occur during an imbalance is commonly referred to as dysbacteriosis and, if prolonged, can have negative effects on the host (see box below). The shift in cecal bacterial activity results in the production of different bacterial metabolites (the compounds produced by bacteria when they break down nutrients). Some of these metabolites, such as amines produced from bacteria metabolism of amino acids, can cause gut irritation making the ongoing gut upset worse.

The presence of certain bacteria is increased during dysbacteriosis and the action of these bacteria further affects nutrient absorption. For example, some bacteria can reduce fat absorption by inactivating the bile acids which bind to dietary fats for absorption. Other bacteria can destroy the surface of the villi reducing the surface area available for nutrient absorption. When nutrient absorption is reduced, it is not uncommon for birds to

increase their feed intake in an attempt to meet their nutritional demands. This can lead to faster gut transit time, feed passage and wetter litter due to increased water intake.

What is Dysbacteriosis?

Dysbacteriosis is not a specific disease but a secondary syndrome. It is an imbalance in the gut microbiota as a consequence of an intestinal disruption. It results in poor nutrient absorption in the gut leading to poorer FCR and reduced live weight. If dysbacteriosis is severe enough it can contribute to wet litter.

The presentation of dysbacteriosis varies depending on severity but it is generally characterised by the production of wet faeces and foamy cecal droppings. Post- mortem examination of affected birds reveals thinning of the gut wall along with gassy and watery gut contents. Dysbacteriosis can result from environmental stress, viral or bacterial challenge, coccidiosis or in response to feed change.

Dysbacteriosis can be treated with antimicrobial drugs; however, it is preferable to use alternative treatments such as organic acids or probiotics if a gut imbalance is suspected.

If the primary cause of the dysbacteriosis is not identified it is likely to reoccur – therefore it is imperative to identify and rectify the cause of the intestinal disruption.

If the gut is properly developed and the immune system is not compromised the impact of a gut upset on bird growth (and FCR) can be reduced. After the birds hatch and get access to feed and water the gut is triggered into its final stages of maturation. Biosecurity, shed hygiene and brooding management are all key for chick health and the establishment of a healthy gut. During the first week of life the gut undergoes rapid maturation with rapid growth of the intestinal villi; the length of the villi after this growth phase is critical as it dictates the length of the villi in the adult bird. If villi growth is compromised during brooding the result is shorter villi in the adult bird which will impact upon performance. Optimal villi growth relies on correct brooding management along with good feed and water quality. In the field it has been observed that the chicks receiving good brooding tend to develop a gut that performs well and has a greater capacity to cope with challenges in the chicken shed.

Water quality and line management are critical for the long term health of the gut; failure to monitor and promote water quality on farm can be detrimental to gut health and bird performance. Water management strategies depend upon water source (e.g. mains water or open source water), water hardness, water pH and mineral levels in water. The box below outlines the steps for ensuring the supply of clean water to birds.

Water Quality

General Water Management Protocol

1. Ensure adequate cleaning between flocks

- Remove biofilm (e.g. 25-50 ppm Hydrogen peroxide in water line for 24-72 hours then flush)
- Remove scale (target a pH of 5 with weak acid, e.g., Citric acid – leave in line for 24 hours then flush)

2. Prior to bird arrival

- Use bleach solution in standing water
- Flush just before birds arrive.

3. Through life of flock

- Sanitise (e.g., Chlorine [2-4 ppm] or Chlorine dioxide [0.8 ppm])
- Acidify water (pH 5.5-7)
- Perform waterline biofilm removal at regular intervals through life of flock (biofilms can form in 6 weeks)
- Routinely check ORP (oxygen reduction potential) at the drinker furthest from the water tank to check

The colour of the gut surface, tone of the gut wall and the consistency of the contents are basic indicators of ongoing gut health and can help with the identification of the cause of the issue. The image on the left shows a healthy gut with the duodenum at the top then the jejunum and then the ileum. The gut surface is pink with the gut wall folding back on itself.

Gut Health Additives

There are many products available to support gut health, these products can either be added to water, added to the feed at the feed mill or top dressed on feed at the farm. Gut health additives vary in their mode of action which makes choosing the right product difficult. Some gut health products provide or stimulate beneficial bacteria, some promote the development of the gut tissues, some aid digestion and others inhibit pathogens. Consequently, when deciding which product to use, it is critical to investigate what is causing the gut health issue and ensure that any potential product has the ability to help solve the issue faced. These products often get called "alternatives to antibiotics" and they are used successfully in programs targeting a reduction in antibiotic use.

However, it is important to recognise that their use is more preventative and thus their use should be considered as an alternative strategy. As part of a strategic approach, the aim is to administer a product that offers a solution to the needs of the gut at significant points in the chicken's life. The gut has three predominant stages; development, transition and maintenance (see Figure 5). During the development stage, the aim is to promote bacterial colonisation and stimulate tissue and immune development. The transition stage refers to the time periods where there are fluctuations in the gut environment in response to impacting factors such as a feed change, vaccination and handling.

These events can cause a change in the intestinal environment and increase the risk of malabsorption and bacterial overgrowth. The maintenance stage refers to the period when the gut has stopped developing and reached balance, however there is still the risk of disruption due to management or pathogen challenges, so it is still important to maintain support of the gut tissues at this time.

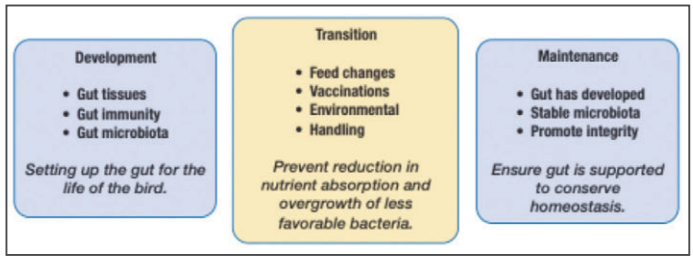


Figure 5: Understanding the needs of the gut at different points in the bird's life and the main goals of gut health support at these times

Key Management Points

- The gut microbiota has an important role to play in maintaining the growth, health and welfare of the bird
- An imbalance in gut microbiota will have an affect on bird performance
- The balance of gut microbiota can be affected by:
  - o Diet (feed change, raw materials, physical quality).
  - o Sub-optimal management, particularly during events that put pressure on the gut such as vaccination or feed change-overs
- Environmental conditions
- Mycotoxins
- Infections (viruses, bacteria or coccidiosis)
- Providing appropriate brooding conditions is vital for ensuring appropriate gut development:
  - o Adequate environmental temperatures and ventilation
  - o Adequate access to feed and water

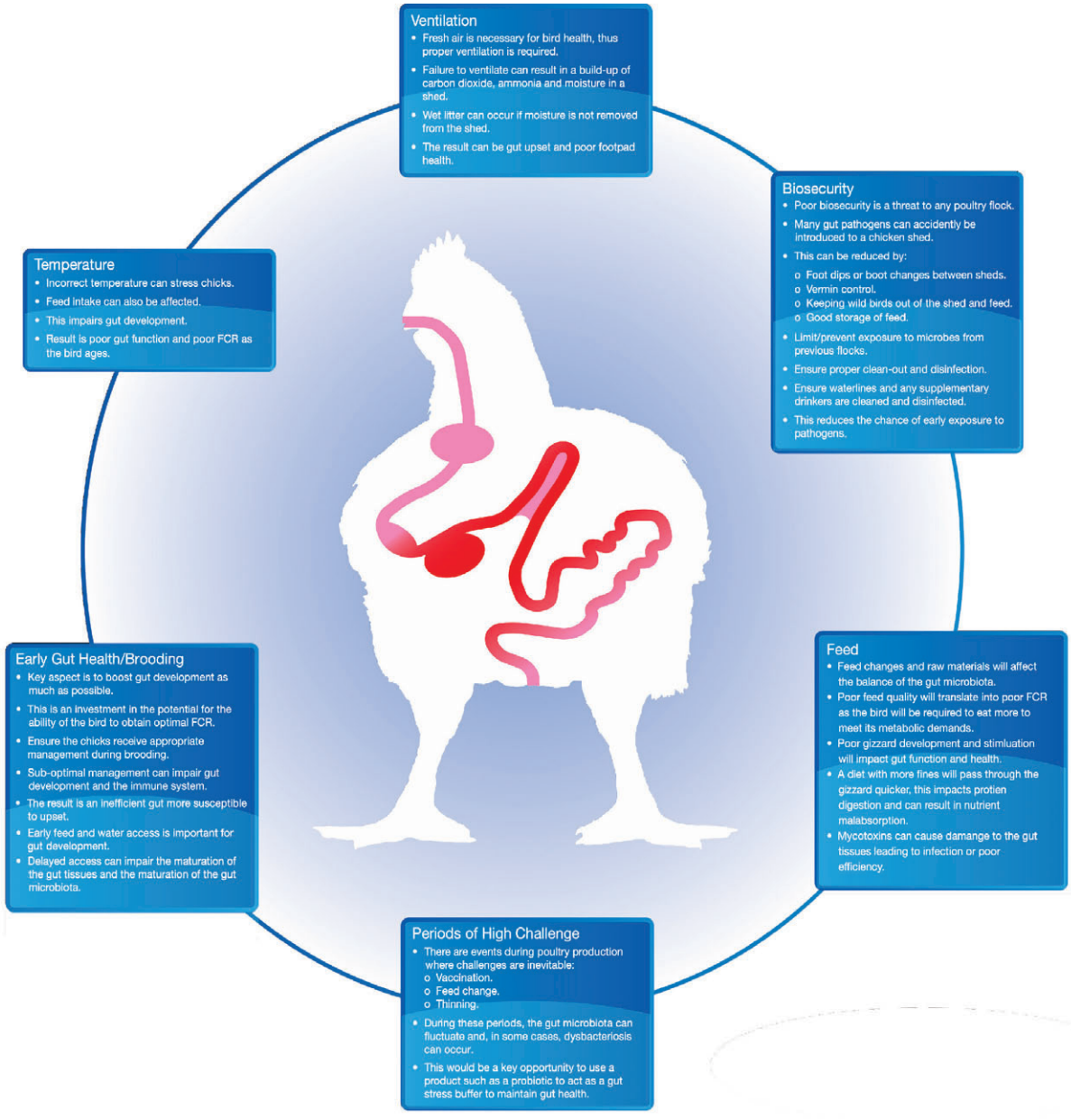
Gut Health Research

Gut health provides for an active area of research in both human and animal science. Aviagen is committed to gaining a better understanding of gut flora, gut function and gut immunity by undertaking internal research projects and collaborating with universities to ensure the latest technologies and knowledge are exploited to improve bird gut health in the field.

Conclusions

Maintaining the balance of good gut health is a key aspect of getting the best growth and FCR out of any food producing animal. Many researchers have attempted to understand gut flora, gut function and gut immunity. It is increasingly evident that the gut remains a highly complex area. Regional variations in poultry production, management styles, climate, disease challenge and feed raw materials add further complexity to maintaining good gut health, but what is clear is that developing and maintaining gut health through good bird management practices is key to maintaining bird health, welfare and performance.

See diagram below: Factors to Consider When it Comes to Gut Health.



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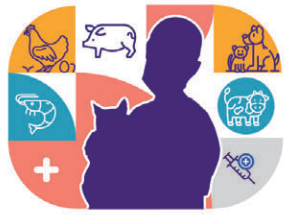

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Article

Levelling UpValue Chain; Driving Inclusive Growth in Poultry Industry


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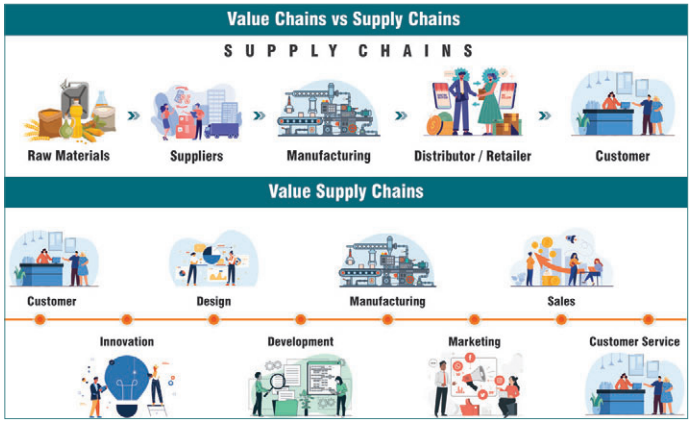
ABTL

The poultry industry is one of the fastest-growing sectors in global agriculture, providing a critical source of protein through meat and eggs. Beyond its contribution to food security, the poultry value chain serves as a significant driver of economic development, offering opportunities for inclusive growth across rural and urban communities. By leveraging its multi- faceted value chain, the industry can address social, economic, and environmental challenges while fostering equitable development.

Understanding the Poultry Value Chain

The concepts of supply chain and value chain are interrelated, as they both focus on the processes that transform raw materials into finished products and services. However, their perspectives differ, and understanding the correlation between the two can enhance business efficiency and value creation.

Supply chain and value chain are interconnected frameworks that complement each other. While supply chain ensures the smooth flow of goods and services, the value chain ensures each step contributes to customer value and competitive advantage. Businesses that harmonise these concepts can achieve sustainable growth, operational efficiency, and enhanced customer satisfaction. The poultry industry has historically worked towards building a robust supply chain and in part succeeded in doing so. Now, what remains to be explored and captured are strategies and implementation to establish a robust value chain



for the poultry industry to thrive.

The relationship or link between/among key variables that reflects reality includes only the key variables that are influential and have an impact on the outcome.

Meanwhile, simulation model starts from the"Broiler Chicks Lookup" variable where policymakers/farmers decide how many breeders can be reared in their whole process as a flock. All square boxes denotes level variable which plays an important role in the poultry supply chain.

By Aligning the Supply Chain and Value Chain

1. Businesses can deliver high-quality products efficiently and cost-effectively
2. They can address consumer demands while optimising resource use and profitability
3. It fosters an integrated approach where operational processes (supply chain) and customer-focused strategies (value chain) work in tandem

The methodology includes two models:
(i) a two-stage stochastic model that supports lot-sizing and inventory management decisions while considering scenarios of chicken growth uncertainty; and (ii) a mixed-integer linear programming model that supports lot allocation. The results of implementing the methodology in a poultry company farm improved costs by 8.6% while meeting tactical, biological, and biosecurity constraints.

The Role of Poultry Value Chain in Inclusive Growth

1. Job Creation and Livelihoods

- The poultry industry is labour-intensive, creating employment

at every stage of the value chain. For instance: Small-scale farmers can participate in rearing birds or producing feed ingredients

- Women and youth often find opportunities in backyard poultry farming, egg collection, and retail
- Skilled jobs arise in areas such as veterinary services, feed production, and processing

2. Empowerment of Marginalised Groups

The low entry barriers in poultry farming enable participation by marginalised groups, particularly in rural areas. Programs aimed at supporting women and smallholder farmers with microfinance, training, and access to markets have been shown to uplift communities economically and socially.

3. Food Security and Nutrition

Poultry products provide an affordable source of high-quality protein. Strengthening the value chain ensures consistent supply, enhances affordability, and contributes to the nutritional well-being of vulnerable populations. Poultry is rich in high-quality protein, vitamins (like B12), and minerals (like iron and zinc), which are critical for muscle growth, immune function, and overall health. Eggs are an excellent source of protein (about 6 grams per egg), along with essential nutrients such as vitamins A, D, B12, and folic acid, which support cognitive development, immune function, and general well-being.

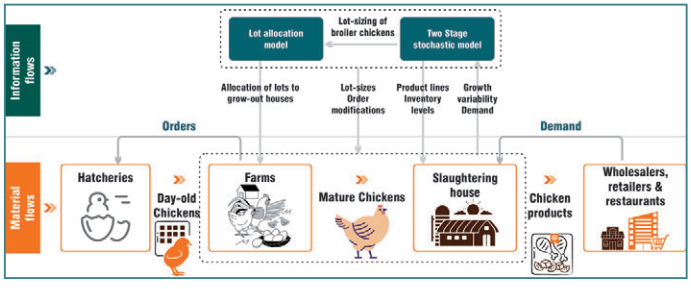
Poultry meat and eggs are particularly important in combating protein-energy malnutrition (PE M), especially in vulnerable groups like children and pregnant women.

4. Market Integration and Rural Development

By linking rural producers with urban markets and export opportunities, the poultry value chain bridges the urban-rural divide. Value chain interventions, such as cooperatives and farmer organisations, facilitate collective bargaining, reduce transaction costs, and ensure better prices for smallholders.

5. Economic Growth and Export Potential

Poultry is a significant contributor to agricultural GDP in many countries. Investments in advanced processing facilities and compliance with international standards can enhance export potential, bringing foreign exchange earnings and economic stability.



Strategies for Strengthening the Value Chain

To maximise the poultry value chain's contribution to inclusive growth, stakeholders must address these challenges through coordinated efforts:

1. Capacity Building: Training programs on modern farming techniques, biosecurity, and financial literacy can empower farmers and improve productivity

2. Access to Finance: Tailored credit schemes and microfinance can help small-scale producers invest in better inputs and infrastructure

3. Policy Support: Governments should provide supportive policies, including subsidies for feed and vaccines, and promote fair trade practices

4. Public-Private Partnerships (PPPs): Collaborations between governments, private companies, and non-governmental organisations can facilitate investment in critical infrastructure and technology

5. Market Linkages: Digital platforms and farmer cooperatives can improve market access and reduce dependency on intermediaries

6. Social Mapping: Social mapping of meat consumption in India reveals significant variation across rural, semi-urban, and urban populations due to cultural, economic, and geographic factors. The consumption of meat is higher in urban areas but is growing in semi-urban and rural regions due to economic growth, improved disposable income and changing dietary preferences

The supply chain and value chain are interconnected frameworks that complement each other. While the supply chain ensures the smooth flow of goods and services, the value chain ensures each step contributes to customer value and competitive advantage. Businesses that harmonise these concepts can achieve sustainable growth, operational efficiency, and enhanced customer satisfaction.

7. Changing Market Dynamics: Various studies published by agencies like KPMG's Report on Indian Poultry Industry, Behavioural Shifts in Food Choices (International Journal of Consumer Studies, 2019), Euromonitor collectively demonstrate that the changing food habits in India—marked by a preference for packaged chicken and eggs—are influenced by a combination of urbanisation, rising incomes, health consciousness, convenience, and concerns over food safety. The shift reflects broader social, economic, and cultural transformations, as consumers in India increasingly seek standardised, branded, and hygienic products that align with modern lifestyles. It is to be noted, that these changes need to be factored in while developing value chain that suits the current notion and trends of the market.

In sum, developing an inclusive and resilient poultry value chain is not only an economic necessity but also a social imperative. It aligns with the goals of nutritional security, economic empowerment, and sustainability, all while responding to the broader trends in food consumption.

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Article

Salmonellosis in Poultry: Impacts on Health, Production and Industry Control Strategies

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Introduction

Salmonella is one of the most prevalent foodborne disease-causing bacteria and causes many deaths each year. These bacteria are Gram-negative, rod-shaped and anaerobic belonging to the Enterobacteriaceae family. There are two main species, Salmonella enterica and Salmonella bongori. Salmonella enterica has over 2500 types that can infect humans and animals (Jajere, S. M. 2019). Among these, Salmonella gallinarum and Salmonella pullorum are non-flagellated and non-motile, primarily affecting poultry and causing significant economic damage.

Salmonella enterica serovar enteritidis is the most common serotype of Salmonella isolated from cases of foodborne gastroenteritis throughout the world. Chickens are the single largest reservoir host for Salmonella enteritidis and source attribution studies have determined that contaminated poultry and poultry products are the major sources of human infection.

S. gallinarum causes fowl typhoid leading to varying sickness levels and often high death rates, resulting in severe septicaemia. S. pullorum causes pullorum disease, a serious systemic illness with high mortality, especially in young birds. Pullorum disease in chicks can have up to 100 percent mortality with the highest losses in the second week of life. Fowl typhoid has a 10% to 90% infection rate with morbidity higher than mortality (Kebede et.al 2019).

Transmission

Salmonella primarily spreads through the faeces of infected chicks, contaminated feed, water, and litter. Human activities, such as farm visits without proper biosecurity and movement between chicken houses, also contribute to its spread. Transmission occurs via direct contact with infected birds or indirectly through contaminated environments. Vertical transmission, particularly through infected eggs, is key in sustaining outbreaks, as asymptomatic carriers can pass the bacteria to offspring for up to 14 weeks. These bacteria can survive in the environment for months under favourable conditions, though sunlight and high temperatures reduce their persistence. Wild birds, mammals, and insects, especially red mites, can act as vectors, complicating control efforts.

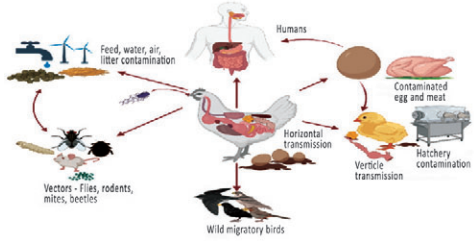

Fig.1: Transmission of Salmonella

Pathogenesis

Salmonella pathogenesis starts when bacteria are ingested, surviving the stomach's acidity to invade the intestinal mucosa using virulence factors like plasmids, toxins, fimbriae and flagella. They infect non-phagocytic cells and macrophages, triggering inflammation and evading the immune system. The bacteria spread via the bloodstream to organs like the liver, spleen and kidneys causing symptoms such as diarrhoea, loss of appetite and depression, leading to high mortality, especially in young chicks. Salmonella can be transmitted both vertically and horizontally. It induces inflammation, macrophage apoptosis, and can cause severe haemolytic anaemia, leading to rapid death. The incubation period is typically 4 to 6 days.

Clinical Signs

Pullorum disease mainly affects young birds particularly chicks under 3-4 weeks old, with peak mortality at 2-3 weeks. Infected embryos may die in the egg and recently hatched chicks often exhibit signs of acute septicaemia such as depression, weakness, loss of appetite, drooping wings, huddling, laboured breathing, dehydration, and ruffled feathers. White, viscous diarrhoea and faecal pasting around the vent are common. Older chicks may experience a less acute disease course, sometimes developing arthritis or blindness. Survivors may be underweight, poorly feathered and less productive as adults. Infections in birds older than 4 weeks are usually asymptomatic but can result in decreased egg production and fertility. Fowl typhoid affects birds of all ages with symptoms like depression, appetite loss, weight loss, dehydration, ruffled feathers, yellowish diarrhoea and respiratory distress. Older birds may experience decreased egg production, fertility, and hatchability leading to anaemia with pale, shrunken combs and wattles. Atypical outbreaks, such as one in quail characterised by decreased egg laying and high mortality without clear clinical signs can also occur.

Diagnosis

Over the past 30 years, advances in technology have greatly improved the ability to study and control Salmonella. Techniques like PCR, PFGE, DNA microarray, and sequencing help differentiate closely related strains, complementing traditional methods like serotyping and phage typing for

epidemiological research. Fowl typhoid and pullorum disease are diagnosed by isolating Salmonella gallinarum or Salmonella pullorum from affected birds, typically found in internal organs and cloacal swabs. In carrier birds, the bacteria are often present in the ovary and oviduct. Though isolating the bacteria from eggs, embryos, or the environment is more challenging, biochemical, serological, and PCR tests, along with advanced techniques like plasmid profiling and ribotyping, aid in accurate identification and differentiation.

Postmortem Lesions

The liver is yellowish in colour with haemorrhagic streaks. In chronic cases the ovary consists of pedunculate and misshapen ovules. The most obvious lesion includes enlarged and congested liver, which becomes dark red or brown (bile-stained liver) after exposure to the atmosphere. There may be multiple necrotic areas throughout the liver. There is congestion and necrosis of the liver and spleen with catarrhal enteritis.

Fig.2: Congestion and necrosis of liver

Antimicrobial Resistance

Antimicrobial resistance is a growing global challenge, worsened by insufficient assessments of Salmonella resistance and lack of regulation. The easy access to antimicrobials without prescriptions, along with incomplete treatments, exacerbates the problem. In poultry farming, the overuse of antibiotics has led to the development of resistant strains, including those producing extended spectrum beta-lactamases (ESBLs), posing a serious threat to both public health and the poultry industry (Parvej et al., 2016). Resistance mechanisms include bacterial target modifications, changes in cell membrane permeability, and efflux pumps. Misuse of antibiotics has resulted in the rise of multidrug-resistant Salmonella strains, making treatment more difficult and highlighting the need for more careful antibiotic use (Farhat et al., 2023).

Prevention and Control

Preventing and controlling salmonellosis on poultry farms is essential. Key strategies include removing infected birds, keeping healthy and sick birds separate and using testing methods like tube-agglutination to screen flocks. Strong biosecurity measures, such as strict hygiene, controlled farm access, and proper management of litter, feed, and water, help reduce disease spread. Without these measures, fowl typhoid poses a significant economic threat, highlighting the need for organised control programs with accurate testing and prompt action.

Vaccination plays a crucial role in preventing and controlling salmonellosis on poultry farms. Effective vaccines can help reduce infection rates of fowl typhoid and salmonella enteritidis providing long-term protection for flocks. In addition to vaccination, strategies like early identification and removal of infected birds, routine testing, and strict biosecurity measures (e.g., hygiene, controlled farm access) are essential for minimising disease spread. Combining vaccination with proper management of litter, feed, and water enhances flock health and reduces the economic impact of fowl typhoid, making it a key component of any comprehensive disease control program.

Stallen South Asia Pvt. Ltd. is offering a unique live vaccine BIO-VAC SG 695, against fowl typhoid and salmonella Enteritidis.

Key features of BIO-VAC SGP 695

- BIO-VAC SGP 695 contains the live attenuated strain SGP 695 AV of Salmonella gallinarum/pullorum that induces a strong active immunity in vaccinated pullets, against fowl typhoid, reducing mortality, clinical signs, pathological lesions, losses in eggs production and against Salmonella enteritidis infection, reducing the colonisation of internal organs and ovary
- In drinking water administration
- Stable attenuated and total apathogenicity of the vaccine strain
- Reduction of vaccination procedure costs

Why choose BIO-VAC SGP 695 than SG 9R salmonella vaccine?

Carcass yield (g)	BIO- VAC SGP 695	SG 9R vaccine
Strain	695 AV (Live attenuated)	9R (Rough strain with possible reversion)
Characteristics	Does not revert to virulence	Possible reversion to virulence
Targeted Infections	Salmonella gallinarum, Salmonella pullorum, Salmonella Enteritidis	Primarily Salmonella gallinarum (Fowl Typhoid)
Administration	Oral (via drinking water)	Subcutaneous injection
Vaccination Program	Initial dose at 6-8 weeks, second at 16-18 weeks. Early dose if early infection history.	Initial dose at 6 weeks, revaccination every 12 weeks for layers.
Effectiveness	Broad protection including Salmonella Enteritidis	Focused on protection against Salmonella gallinarum

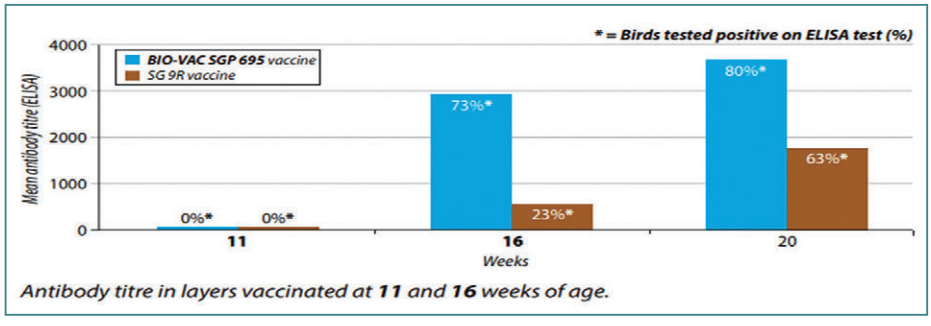

Fig 3: ELISA report of BIO-VAC SGP 695 and SG 9R vaccine

References available on request

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BIO-VAC SGP 695

Live attenuated vaccine for oral suspension,
against **fowl typhoid** and ***Salmonella Enteritidis***
infection

Composition:

One dose of vaccine contains:
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Benefits:

- Easy administration
- Stable attenuation and total apathogenicity of the vaccine strain
- Strong and long-lasting Immunity
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Recommended Use:

Vaccinate pullets at 6-8 weeks,
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Article

Understanding One Health: a Holistic Perspective

SHRIDHAR speaks

Tarun Shridhar
Director General,
Indian Chamber of
Food and Agriculture (ICFA);
and former Secretary,
Ministry of Fisheries, Animal
Husbandry and Dairying,
Government of India

The COVID-19 pandemic, a human public health crisis of unprecedented proportions resulted from a virus of potential animal origin. This emphatically underlined the critical importance of the One Health concept in understanding and confronting global health risks, which are, indeed, increasing of late. Drivers such as changes in climate and land-use, unsustainable agricultural practices, globalisation leading to increased movement of people and goods, the wildlife trade etc., provide multiple opportunities for pathogens to evolve into new forms, making spillover events from animals to humans more frequent and intense. The World Organisation for Animal Health (WOAH), against this background, warns that the risk is not only to humans, but animals too. "While most risk assessments focus on the transmission of pathogens from animals to humans, diseases can also pass from humans to animals, and generate great impacts on the health of animals, whether domestic or wild. COVID-19, tuberculosis, influenza, among others, can infect or be fatal to different species of animals."

Dr. Emmanuelle Soubeyran, the Director General of the organisation claims that "WOAH champions the One Health approach, recognising the vital interconnection between animal, human, and environment health to enhance global preparedness and tackle the root causes of health crises."

What is the One Health concept and approach? WOAH explains the "One Health" approach as "a concept that has been known for more than a century: that human, animal and plant health are interdependent and bound to the health of the ecosystems in which they exist. We envisage and implement it as a collaborative, whole of society, whole of government approach to understanding, anticipating and addressing risks to global health." The organisation, further, recognises that "numerous cross-cutting issues, such as "antimicrobial resistance, food safety, climate change and weak health care infrastructure, need to be addressed from a multisectoral and multidisciplinary perspective, which the One Health approach guarantees."

Now, it is curious that the issue of "antimicrobial resistance" (AMR) has been given a greater focus by the WOAH underlining these words in the text. This, in my view, amounts to a dilution of the One Health agenda by making it unidimensional. One Health is about health NOT about disease or medicine. AMR is only one of the several components of One Health, and certainly not the be all and end all of it as, unfortunately, our national and international policymakers have made it to be. The G-20 declaration too fell into this trap. Amongst other objectives, the declaration seeks to "Promote One Health-based approach driven by the Quadripartite's One Health Joint Plan of Action (2022-2026)" and "Implement and Prioritise tackling Antimicrobial Resistance (AMR) following One Health Approach..." There is not even a whisper about animal health in this discourse on One Health and AMR. Unfortunately, we seem to have fallen short of a holistic perspective of One Health: the declaration confines expression of concern for human health against the challenge of AMR. No wonder misgivings about AMR abound and the livestock sector becomes the victim of vilification. The WOAH, the apex international organisation dedicated to animal health, too has expressed concern to the growing challenge of AMR relegating to shadows the other crucial facets of One Health.

Let it also be forcefully clarified here that, contrary to what the WOAH states, the concept of One Health is not "more than a century old" but dates back to circa 400 BC: its roots are in ancient science and wisdom. The ancient Greek philosopher and physician Hippocrates, considered one of the most outstanding figures in the history of medicine and traditionally referred to as the "Father of Medicine" in recognition of his lasting contributions to the field, was the first in the recorded history of civilization to recognise the relationship between human and animal health. The central idea of Hippocratic philosophy is the principle of wholeness, that knowledge of nature is possible only when it is correctly approached as a whole: in a nutshell it recognizes that human health, animal health and environmental health are part of a whole body. Hippocrates advocated that administration of medicine should rest on the foundation of this holistic understanding. The concept and the terminology "One Health", may be a recent entrant in the medical lexicon: in fact, it is a recognition of what Hippocrates said circa 400 BC in his treatise "On Airs, Waters and Places" exhorting physicians to consider all aspects of a patient's life including the environment. Disease, according to him, was an outcome of an imbalance between man and environment. "One Health" is an approach that precisely recognizes this thought and theory that the health of people is closely connected to

the health of animals and our environment, which is shared by the two.

Dr. Calvin W. Schwabe, called the father of veterinary epidemiology, too recognized the relationship between animal and public health decades before the current One Health movement. "Veterinary Medicine and Human Health," is his seminal work published in 1964; he wrote, "Veterinary medicine is the field of study concerned with the diseases and health of non-human animals. The practice of veterinary medicine is directly related to man's well-being in a number of ways." Through this innovative term "non-human animal", he propounded the concept that public health is inclusive of veterinary health. An early advocate for integrating aspects of veterinary and human medicines, Dr. Schwabe is even credited with coining the phrase "One Medicine," although the term's origins are still debated. "One Medicine" as a scientific concept has been linked to the 19th century German physician and pathologist, Rudolf Virchow. He proclaimed that there should be no dividing line between human and animal medicine.

According to the WHO as also the World Animal Health Organisation, 60% of existing human infectious diseases are zoonotic i.e., they are transmitted to humans from animals either through direct contact or through food, water and environment; 75% of emerging infectious human diseases have an animal origin. Of the five new human diseases appearing every year, three originate in animals. If this is not scary enough, 80% of biological agents with potential bio-terrorist use are zoonotic pathogens. It is estimated that zoonotic diseases account for nearly two billion cases per year resulting in more than two million deaths; more than HIV/AIDS and diarrhoea put together. One fifth of premature deaths in poor countries are attributed to diseases transmitted from animals to humans. And all the pandemics in recent history, including the COVID-19 which had thrown our lives out of gear these days, have an origin in a zoonotic pathogen. Developing countries like ours have much greater stakes in strong One Health systems on account of small agricultural holdings and mixed farming systems resulting in uncomfortably close proximity of animals and humans.

One Health is the concept whereby human and animal healthcare advance hand in hand alongside respect for the environment, with all stakeholders including the veterinarians, doctors and researchers collaborating to ensure that all humans and animals benefit equally from progress which is sustainable

Should it not, therefore, be a matter of concern that on the one hand investment in animal health remains low on the governance agenda, and on the other the entire approach to One Health appears to have been narrowed down only to AMR.

In simple terms, One Health is the concept whereby human and animal healthcare advance hand in hand alongside respect for the environment, with all stakeholders including the veterinarians, doctors and researchers collaborating to ensure that all humans and animals benefit equally from progress which is sustainable. The underlying theory is that human and veterinary medicine could work together as humans and animals share a lot of their biology, and nearly 75% of all known causes of disease are shared between humans and animals. Even in ancient Greece, convergence between human and animal physiology was a normal part of science.

Isn't it then an elementary common sense that the most effective and economic approach to protecting human health is to control zoonotic pathogens at their source. This would require close institutionalised and harmonised collaboration at local, regional and global level between the veterinary, health and environmental governance.

To reiterate, One Health is plain and simple common sense.

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Article

Biosecurity: What it is and Why it Matters

Team Huvepharma

Biosecurity was originally defined by Koblentz (2010) as "a set of preventative measures designed to reduce the risk of transmission of infectious diseases".

This has since been updated and adopted into EU Animal Health Law (2016) as "the sum of management and physical measures designed to reduce the risk of the introduction, development and spread of diseases to, from and within an animal population, or in an establishment, premises or location (including modes of transport)."

In modern livestock production facilities, biosecurity includes all the preventative measures used to avoid contamination with biological agents. This includes measures taken to prevent the introduction of biological agents onto farms, and their subsequent spread.

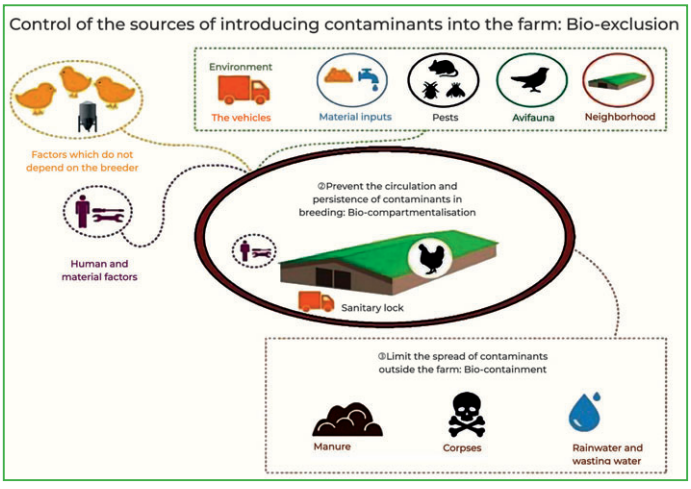

Fig 1: Illustration showing the three types of biosecurity measures
Source: ITAVI, 2018

Figure 1 illustrates the three types of biosecurity measures used by livestock producers.

1. Bio-exclusion – this aims to prevent and/or limit the introduction of new microbial, viral, or parasitic strains onto the farm
2. Bio-compartmentalisation – this consists of measures used to reduce the spread of germs inside the farm
3. Biocontainment – the means implemented to limit the risks of transmission outside the farm and possible propagation

Bio-exclusion encompasses the external biosecurity, including factors such as human and material factors, the environment, vehicles, inputs including feed and water supplies, and pests.

Bio-compartmentalisation covers internal biosecurity, making sure that sanitary measures are followed to keep clean areas of the farm free from potential contaminants. This might involve implementing procedures for entering a poultry or swine house

for example.

Finally, biocontainment ensures that waste products including manure, corpses and drain water are managed responsibly, and the risks of transmission of biological agents outside of the farm are minimised.

Sources of Contamination

There are numerous potential sources of contamination in livestock production units. It is important to identify all of them to implement suitable protective measures.

The main biosecurity risks are illustrated in Figure 2. The majority of these risk factors come from the movement of people, wildlife, domestic animals pests, vehicles and equipment between farms and production units. At the same time, special attention must be paid to the management of waste products being transported off the site, including manure or slurry, corpses, and wastewater, which can all diffuse contaminants outside the farm.

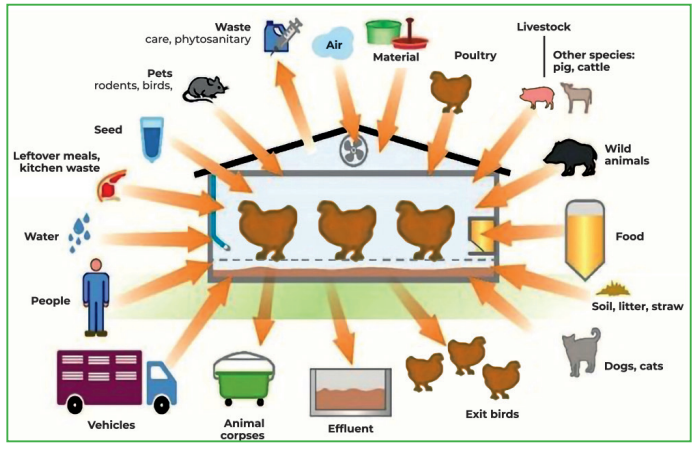

Fig 2: Main biosecurity risks on a livestock production unit
Source: IFIP, 2019

The different routes of contamination are shown in figure 3. Contamination can be spread by vectors and reservoirs. Vectors carry disease from one host to another in one of two ways. Mechanical vectors transfers the pathogen on its body from one host to another but do not become infected themselves. Biological vectors become infected by the pathogen before passing it on and infecting other organisms.

The reservoir of an infectious agent is where the agent usually lives and multiples. These can be living (e.g., a human), or non-living (e.g., soil or water).

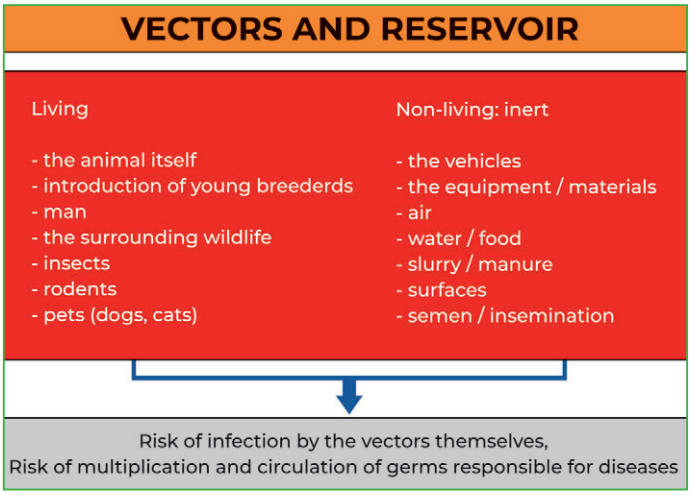

Fig 3: Different routes of contamination *Source: IFIP, 2019*

The Value of Biosecurity

In many parts of the world, diseases, including Foot and Mouth disease, African Swine Fever and Highly Pathogenic Avian Influenza (HPAI) have caused devastating economic losses. The appearance of such emerging or re-emerging diseases has fuelled the increase in biosecurity measures being implemented throughout the world. Growing consumer concern around food safety and increasing levels of globalisation in the agriculture industry will only increase the importance of biosecurity.

Inadequate biosecurity measures may result in the spread of pathogens to other breeding units, or even to other geographical territories. Once a pathogen has reached a farm, the health of the animals will deteriorate leading to increased costs for treatments, and a decrease in the zootechnical & financial performance of the farm.

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Article

Transforming Poultry Biosecurity with Foam-Based Disinfection Technology

Dr. Kalyani Sarode
Senior Product Manager
Optima Life Sciences Pvt. Ltd.

Maintaining optimal hygiene is critical to ensuring the health, productivity, and biosecurity of poultry operations. The poultry environment is highly susceptible to contamination from pathogens such as bacteria, viruses, and fungi, which can proliferate in equipment, structures, and facilities if proper disinfection measures are not taken. Foam-based disinfection has emerged as a scientifically superior method due to its efficacy in ensuring uniform application, extended contact time, and superior microbial control. Foam is particularly advantageous in poultry settings, as it can cling to both vertical and irregular surfaces, ensuring thorough coverage in complex environments. The stable foam prevents rapid evaporation, providing sufficient time for the active ingredients to work against resilient pathogens.

Scientific Benefits of Foam-Based Disinfection

1. Prolonged Contact Time and Surface Interaction

Foam increases the surface retention time of disinfectants, allowing them to exert their full antimicrobial activity. Studies have shown that prolonged contact with disinfectants results in better eradication of Gram-positive and Gram-negative bacteria, viruses, and fungal spores.

2. Effective Biofilm Removal

Biofilms present significant challenges in poultry environments. These protective matrices shield microorganisms from chemical disinfectants, reducing their efficacy. Foam penetrates the biofilm structure, disrupting the extracellular polymeric substance (EPS) matrix and exposing the pathogens to the active disinfectant.

3. Uniform Surface Coverage

Foam provides an even and visible layer across surfaces, ensuring that all areas, including cracks and crevices, are treated. This is especially important in environments such as layer cages, where structural complexity can hinder thorough disinfection.

Applications of Foam-Based Disinfection in Poultry Facilities

1. Hatcheries

Hatcheries are critical points in poultry production where eggs/young birds are most vulnerable to infection. Foam-based disinfection effectively sanitises hatching trays, incubators, and walls, ensuring the elimination of common pathogens such as Salmonella spp., Escherichia coli, and Aspergillus spp.

2. Empty Sheds

Terminal disinfection of empty sheds is vital for breaking the pathogen cycle. Foam ensures effective cleaning of floors, walls, and ceilings, targeting bacterial spores, viruses, and fungal contaminants that persist after previous production cycles.

3. Environment-Controlled (EC) Sheds

EC sheds are designed for large-scale poultry production with controlled environmental conditions. Foam-based disinfection enhances biosecurity by thoroughly sanitising ventilation systems, drinker lines, and feeders, thus reducing the risk of respiratory infections and waterborne diseases.

4. Layer Cages

Layer cages, due to their intricate design, can harbour significant pathogen loads. Foam-based disinfection allows the disinfectant to reach complex surfaces, ensuring complete microbial control, thereby improving egg safety, and minimising disease transmission.

Insights on Foam Droplet Size in Disinfection

Foam droplet size plays a crucial role in determining the efficiency, coverage, and effectiveness of foam-based disinfectants in poultry hygiene. The physical properties of foam—such as droplet size, density, and stability—directly impact its ability to cover surfaces uniformly and ensure optimal contact with pathogens.

1. Better Surface Coverage: Finer foam droplets increase the surface area of coverage, enabling the disinfectant to reach intricate and hard-to-access areas like cracks, crevices, and uneven surfaces. This is especially critical in environments like layer cages or ventilation ducts in EC sheds.
2. Uniform Layer Formation: Finer droplets form a consistent foam layer that adheres to vertical and horizontal surfaces, reducing the likelihood of untreated patches.
3. Optimal Contact Time: A foam with fine droplets clings longer to surfaces, preventing premature drying or runoff. This extended contact time enhances the efficacy of the active disinfectant, especially against resilient pathogens like bacteria in biofilms.
4. Biofilm Disruption: Smaller droplets can penetrate biofilms more effectively than larger ones, breaking through the extracellular polymeric substances (EPS) and exposing pathogens to the disinfectant.

Equipment Considerations for Fine Foam

Nozzle Design: Nozzles with a finer aperture produce smaller droplets, resulting in better foam consistency and coverage.

Pressure Settings: Higher pressure typically generates finer foam but must be optimised to avoid destabilising the foam structure.

Foaming Agent Quality: The formulation of the foaming agent also determines the stability and droplet size of the foam.

Recommendations for Effective Foam Application

- Ensure the disinfectant formulation is compatible with foam application machine for stability and efficacy
- Calibrate equipment to ensure uniform droplet size and even distribution across the intended area
- By optimising foam droplet size, poultry operations can achieve wider area coverage, improved disinfection efficiency, and enhanced biosecurity measures, ultimately contributing to healthier birds and safer production environments.

Conclusion

Foam-based disinfection represents a paradigm shift in poultry hygiene. By offering prolonged contact time, uniform surface coverage, and superior efficacy against biofilms, foam ensures robust microbial control across diverse poultry operations. For facilities aiming to improve biosecurity and productivity, integrating foam- based disinfection into their hygiene protocols is a scientifically sound decision.

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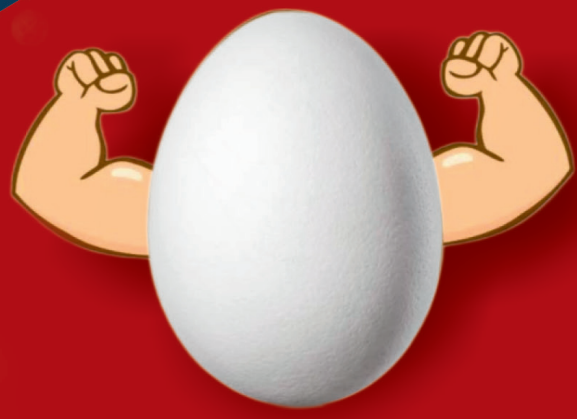

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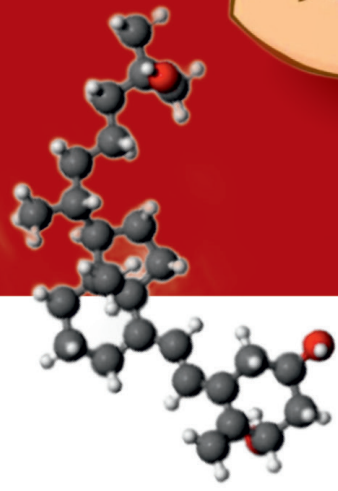

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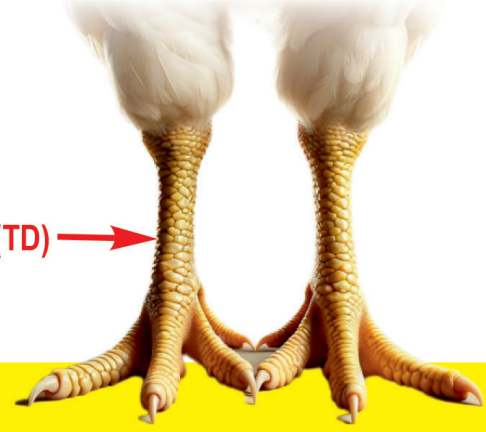

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IPR Knowledge Review, Nashik

Continuing the 2024-25 tour, an IPR Knowledge Review seminar was organised in Nashik on 11th January to deliberate on the transformative role of big data in enhancing poultry health and productivity.

Themed "Data-Driven Decisions: The Role of Big Data in Enhancing Poultry Health and Productivity," the seminar highlighted the growing significance of technology and analytics in shaping the future of the poultry sector.

The event commenced with a Keynote Address by Uddhav Ahire, Chairman, Anand Agro Group. This was followed by an address by Guest of Honour, Dr. Anil Phadke, Managing Partner, A J Poultry.

Other speakers at the seminar were:

- Mr. Prashant Kumar, Co-founder and Director, Sapience Agribusiness Consulting LLP
- Mr. Akshay Dhumal, Executive Director, Dhumal Industries
- Dr. Anju Deshpande, Director, Siddhivinayak Poultry Breeding Farms and Hatcheries
- Dr. Sandeep Dwivedi, Manager Technical Services, EW Nutrition

The IPR Knowledge Review at Nashik reaffirmed the critical role of data-driven decision-making in transforming the poultry industry, paving the way for sustainable growth and enhanced productivity.

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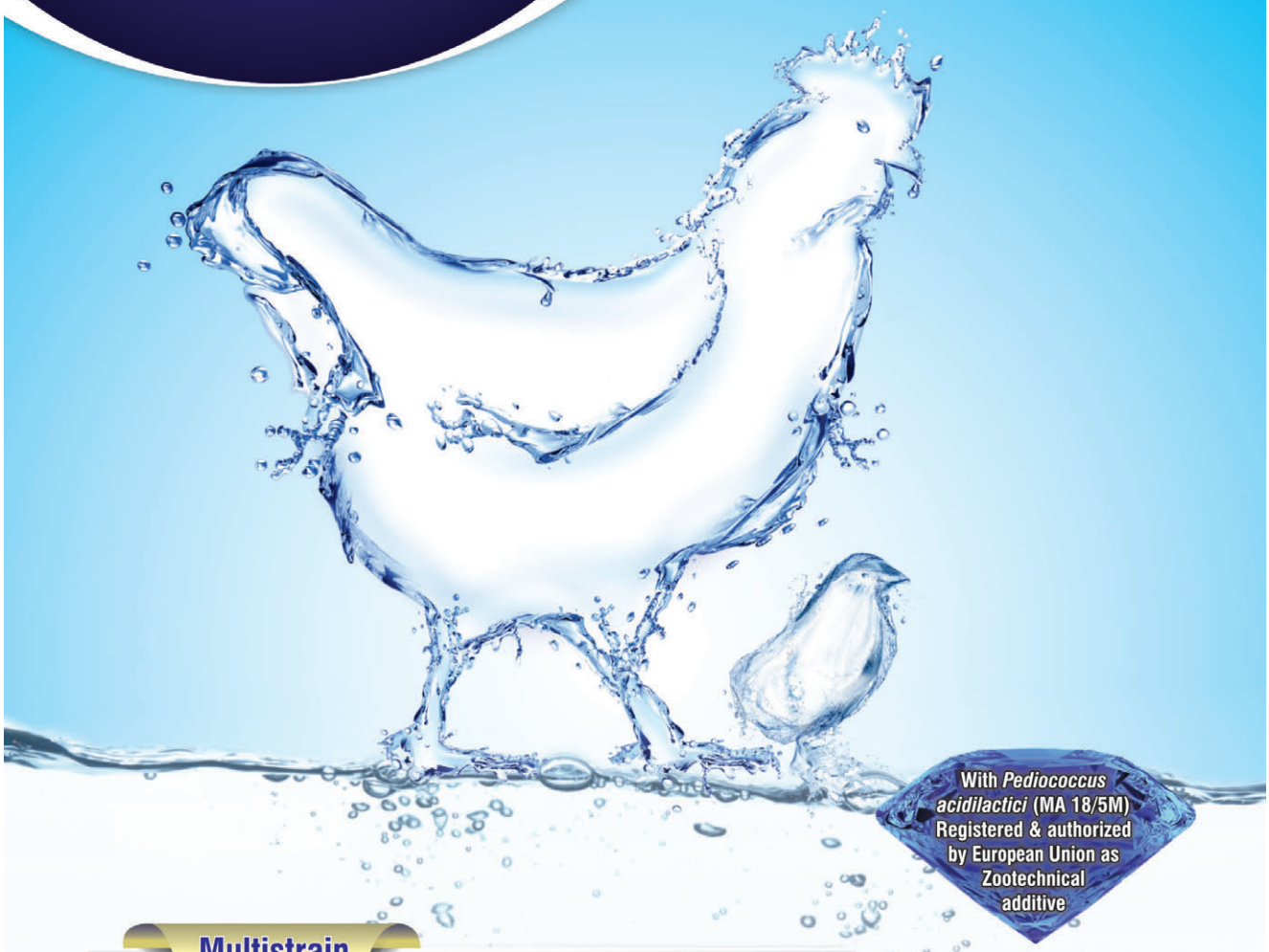

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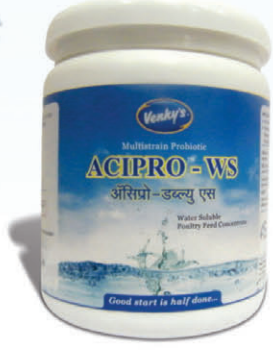

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Optima Life Sciences Celebrates 14th Foundation Day

Optima Life Sciences commemorated its 14th Foundation Day with a vibrant celebration at its Jejuri factory, showcasing its dedication to innovation, teamwork, and employee recognition. The event underscored the company's unwavering commitment to growth, sustainability, and fostering a collaborative culture.

Debraj Das, COO of Baramati Agro lit the ceremonial lamp. In his address, Mr. Das praised Optima's remarkable achievements in the animal feed additive and health sector saying, "Optima Life Sciences has carved a niche for itself in the animal feed additive and health sector. Its rapid growth is a testament to the vision, hard work, and dedication of its leadership and employees."

A highlight of the celebration was the presentation of Long Service Awards, honouring employees who have demonstrated exceptional loyalty and dedication.

The day also featured a dynamic leadership session titled "Identifying the Leader, Boss, and Manager Within You and Walking the Extra Mile Ahead" for Heads of Departments (HODs).

The much-anticipated Optima Premier League (OPL) Cricket Match added to the excitement of the day.

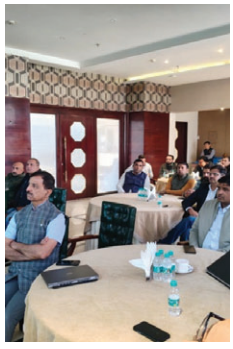
Venkateshwara B.V. Biocorp's Layer Farmer Meeting

On 20th December, Venkateshwara B.V. Biocorp Pvt. Ltd. organised a farmer meeting in Kurukshetra, Haryana, focusing on the "Concept and Importance of Organic Trace Minerals in Layer Nutrition and Gut Health Management." The event brought together numerous layer farmers to discuss advancements in poultry nutrition and health.

The session began with a welcome address by H.S. Padda, DGM for North India, who greeted the participants and set the tone for the technical discussions.

Dr. Sunil Jadhav from Venkateshwara B.V. Biocorp Pvt. Ltd. delivered an engaging presentation on the concept and significance of organic trace minerals (OTM). He explained the differences between inorganic and organic trace minerals, emphasising the benefits of chelation technology in enhancing mineral bioavailability. He highlighted the key role of bioavailable organic trace minerals in preventing issues such as eggshell breakage, dirty eggs, and poor egg quality. He also explained their importance in improving egg production, bone development, and eggshell mineralisation. Critical minerals like zinc (Zn), copper (Cu), and manganese (Mn) were identified as essential for achieving optimal performance in laying hens. Dr. Jadhav introduced OTMIN-CL, a bis-chelate MHA (methionine hydroxy analogue) organic trace mineral formulation tailored for modern laying hens. This product supports health and eggshell quality, especially during extended laying cycles.





Dr. C. B. Pande from Lallemand Animal Nutrition, France, presented on the importance of gut health management and the development of gut microbiota. He underscored the critical role of early gut health development and strategies to establish a robust digestive system in chicks. Dr. Pande explained that the gastrointestinal tract is sterile at hatching, and the growth of beneficial microflora is gradual. He introduced Bactosacc, a unique probiotic formulation designed to enhance gut health, reduce the percentage of dirty eggs, and improve breast muscle thickness during the rearing period. These factors are vital for achieving peak production and consistent laying performance.

The event concluded with a vote of thanks by Shashi Bhushan.

Technical Seminars by Venkateshwara B.V. Biocorp on Pumipro

Venkateshwara B. V. Biocorp Pvt. Ltd, organised a series of technical seminars in December 2024 across four cities—Nashik, Hyderabad, Kolkata, and Karnal—to highlight the benefits of Pumipro, a cutting-edge probiotic for commercial broilers.

The seminars brought together industry experts, technical consultants, and field specialists to discuss the importance of gut health in poultry and the unique benefits of Pumipro, which features the Bacillus pumilus strain. The seminars featured technical sessions by Dr. Ivan Rychlik and Dr. C. B. Pande, technical consultant from Lallemand Animal Nutrition, France. Dr. Sunil Nadgauda, Dr. Dutta Kulkarni and Dr. Sunil Jadhav presented field trial results of Pumipro at Nashik, Hyderabad and Karnal respectively.

The Kolkata seminar began with a warm welcome and an insightful opening speech by Deepak Khosla, General Manager – Marketing, Venworld, who addressed challenges in optimising poultry performance and combating antimicrobial resistance.

The series of seminars successfully demonstrated the unique benefits of Pumipro in enhancing gut health and performance in commercial broilers. The discussions underscored the growing importance of probiotics in the poultry industry as a sustainable alternative to antibiotics, contributing to better food safety and profitability.



PFI's 35th Annual General Meeting

Poultry Federation of India (PFI) organised its Annual General Meeting in Gurgaon on 27th December. The event hosted over 700 delegates, including poultry farmers, breeders, feed and equipment manufacturers, industry leaders, policymakers, and experts.

PFI President, Ranpal Dhanda opened the event with a speech emphasising unity and innovation. Key updates were presented, including the annual reportand financial accounts.

The event featured technical sessions by renowned experts such as S. K. Malhotra, Dr. Ali Asgar, Dr. Rahul Sawarkar, Dr. B. C. Dutta, Dr. Susil Silva, Dr. Lipi Sairiwal, Dr. Javeed Mulani and Dr. N. K. Mahajan. A significant milestone was the signing of a Memorandum of Understanding (MoU) between PFI and The Energy and Resources Institute (TERI), symbolising a commitment to sustainable practices.

Suresh Chitturi conducted a focussed session on "Strategies to Grow the Demand of Eggs in India."

The new PFI leadership was announced at the AGM

President	Ranpal Dhanda
Vice President (HQ)	Sanjeev Gupta
Secretary	Ravinder Sandhu
Joint Secretary	Ricky Thaper
Treasurer	Rahul Khatri

Hon'ble Minister of State State for Animal Husbandry, Fisheries and Dairying, Prof. S P Singh Baghel addressed the audience, reaffirming government support for the sector and urging awareness campaigns to dispel misconceptions about eggs and chicken. He was honoured on stage by Uday Singh Bayas, President, IPEMA. The AGM concluded with a vote of thanks by Ricky Thaper.

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KPFBA and Uzbek Poultry Association Forge Strategic Partnership

The Karnataka Poultry Farmers and Breeders Association (KPFBA) and the Poultry Industry Association of Uzbekistan recently signed a Memorandum of Understanding (MoU) to promote knowledge sharing and collaboration between the poultry sectors of both nations.

As part of this initiative, a delegation of five senior officials from Uzbekistan visited Bangalore between 14th and 18th December to gain hands-on experience of India's advanced poultry farming techniques and integrated farming systems.

Highlights of the visit included field visits to integrated poultry farms operated by KPFBA members, knowledge exchange discussions and strengthening bilateral relations and underscoring a shared commitment to long-term collaboration.

Speaking on the MoU, Naveen Pasuparthy, President, KPFBA said, "MoU between KPFBA and Poultry Industry Association of Uzbekistan opens doors for exchange of delegations, ideas, information and business opportunities between members."

According to Akhmedov Ulugbek Shukhratovich, First Deputy Chairman of the Poultry Industry Association of Uzbekistan, "This collaboration with India offers a unique opportunity to learn and implement the best poultry integration practices, benefiting Uzbekistan and its people. We are excited to share the knowledge and growth opportunities that arise from this partnership."

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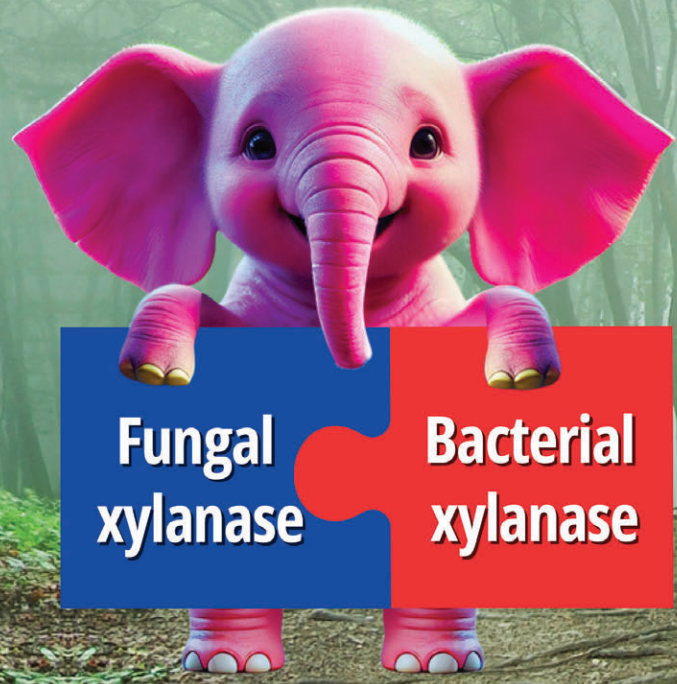

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