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INDIAN POULTRY REVIEW

THE MAGAZINE OF INDIAN POULTRY INDUSTRY | JUNE 2024

COVER

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ARTICLE

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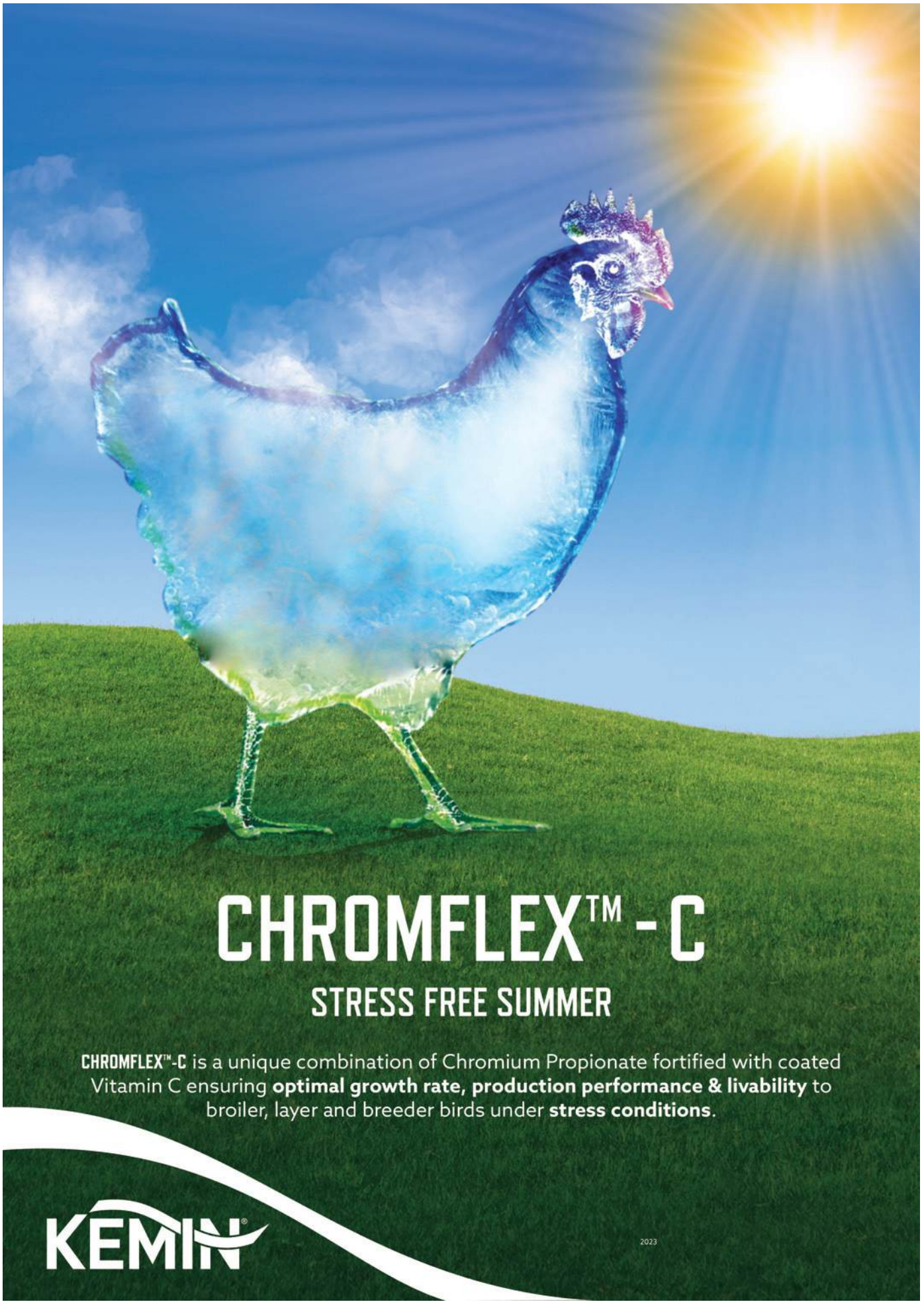
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The Edit

PREDICTABLE DOUBT

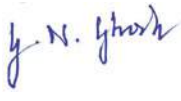
Using antibiotics in poultry, regardless of the dosage or duration, poses a risk of developing resistance, according to most poultry pathologists worldwide. Antibiotics function by eliminating bacteria in the animal's body. However, some bacteria survive and proliferate, potentially making future infections harder to treat or leading to transmission to humans through valuable food sources like eggs and poultry meat. This phenomenon, known as antimicrobial resistance, results in the mortality of numerous farm animals and poses a significant threat to human health each year.

While antibiotics are crucial for treating serious, life-threatening infections, they are often prescribed for less critical situations. This leads to the persistent question in the minds of poultry farmers: "Do I really need to use antibiotics?"

Dr. Bradley Langford, a pharmacist specialising in antimicrobial resistance at Public Health Ontario in Toronto, Canada, suggests that frequent use of antibiotics may not always be necessary. According to the Centers for Disease Control and Prevention (CDC) in the USA, at least 28% of antibiotics prescribed in medical settings are unnecessary.

In recent years, US animal health experts have advocated for more conservative use of antibiotics for common ailments. Research indicates that shorter courses of antibiotics are associated with a lower risk of resistance and are often as effective as longer treatments. Unfortunately, some providers still prescribe longer courses than needed. Therefore, it is essential to ensure that the shortest possible course is administered for any given situation on your farm or within your flock.

Additionally, the type of antibiotic used should be considered. Broad-spectrum antibiotics, which target a wide range of bacteria, are more likely to contribute to resistance compared to those that target a narrower spectrum.



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Managing Editor

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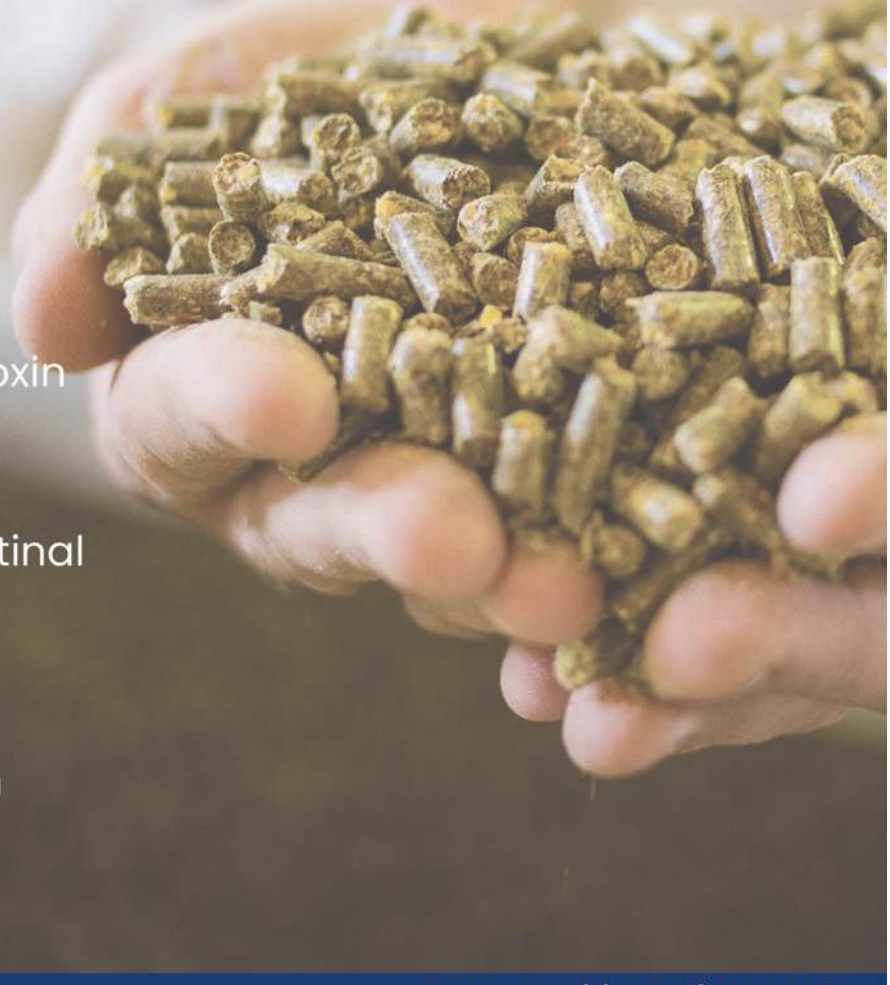
3-D approach for Mycotoxin Risk Management



THE BENEFITS

- Reduces mycotoxin bioavailability
- Modulates intestinal barrier function
- Reinforces the immune system

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Article

Holistic Approach to Address the Current Challenges Faced by Indian Poultry Industry

Dr. Shiva Kumar
Director – Technical
Trouw Nutrition South Asia

Poultry derived food products are the most important animal protein sources globally. India is the third-largest egg producer and the fourth-largest chicken producer in the world. Poultry meat and eggs are the most important animal protein sources available, and a significant increase is forecasted in demand.

But there is also a significant number of challenges facing the Indian poultry and allied industries with respect to sustainable production of poultry meat and eggs where market demands, and consumer needs will put more constraints on the production systems and methods. These challenges are dynamic and diverse, and solutions and opportunities will require development of appropriate technology, using and advancing our knowledge base.

Sustainable poultry 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.

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.

Feeding the Future is the essence of Trouw Nutrition (a Nutreco company), expressing the challenge to double food production while halving the carbon footprint. Our ambition is to contribute meeting the rising global demand with growing number of world population in a sustainable manner.

The Trouw Nutrition way focuses on innovation, quality, sustainability, and integrated solutions.

Our solutions are built on four solid pillars. Each one contributes to help our customers adding more value to their business in a sustainable and a safe way.

Trouw Nutrition is built on a strong commitment to transform science into actionable, practical nutrition and farm management solutions. We focus on our four innovation pillars that deliver sustainability benefits to animals, farms, and the environment:

Early Life Nutrition

Birds are confronted with various stressful events during their life, especially in critical transition periods such as hatch and transport. Provision of nutrition and water during the immediate post-hatch period and during transit from hatchery to farm has shown promising effects on broiler performance and health in the first days and weeks of life (*Bergoug et al., 2013; Published results, Trouw Nutrition 2016*). Early life interventions do not per se result in higher market weights or improved feed efficiency in each flock, but it will contribute to more stable and consistent performance and a reduced risk of birds developing health problems.

Health Life

Animal Nutrition is an important part of the solution to help to contain Antimicrobial Resistance (AMR). Adequate animal nutrition (well-balanced and well-formulated feed) combined with good hygiene practices on farms and proper housing are key in promoting animal health and welfare. A balanced diet of compound feed supported by specialty feed ingredients/additives meets the animal's physiological requirements and maintains the balance of the gut flora. Gut health is in fact a key factor in keeping birds healthy and resilient to stressors, such as heat or pathogens.

Trouw Nutrition Gut Health Solution, integrates Farm, Feed and Health approach.

- Feed – Premixes, Young Animal Feed (ChickCare, NutriOpt, feed formulation advice including Intellibond C, Feed safety: Fysal/Fylax/Toxo
- Farm - Advice on farm management and biosecurity, Selko pH (drinking water) with dosing systems
- Health - Selko pH (water) + Selacid (feed), Gut health evaluation

Water and feed acidification will contribute to maintaining a stable microbiota in poultry. The efficacy of organic and inorganic acids can be further enhanced by inclusion of medium chain fatty acids or other natural antimicrobial compounds that exert a broad-spectrum antimicrobial activity at relative neutral pH ranges.

Precision Nutrition

From an economic point of view, we need, in general, to meet nutrient requirements of the birds in the most efficient and economical way and assure that animals are in good health to exploit their potential.

Efficient use of resources e.g. feed ingredients will benefit environmentally sound production. In this respect, use and conversion of co-products from the food and biofuel industry to highly nutritious animal products is contributing to sustainable production as well. One of the challenges in our industry is to be flexible with our raw material usage to manage higher use of low-quality ingredients and anticipate on fluctuations in raw material prices, whilst at the same time we need to have grip on variation in raw material quality and assure that the feed delivers the same high performance.

Near infrared reflectance spectroscopy (NIRS) is a rapid technique to evaluate the nutrient profile of feed ingredients. A more advanced precision nutrition system such as NutriOpt from Trouw Nutrition has incorporated NIRS, with its extensive nutrient databases.

NutriOpt is an integrated nutritional precision-feeding tool from Trouw Nutrition, which enables the poultry farmer or grower or feed miller to optimise both feed costs and production results to maximise financial benefits in the value chain. It consists of several key elements that complement and support one another in optimising animal nutrition, performance and associated costs through precise real-time analysis, modelling and calculation.

To offer real-time feed analysis, Trouw Nutrition has introduced the NutriOpt On-site Adviser (NOA). This innovative solution reveals the real nutritional value of your feed ingredients and helps to improve performance and profitability. Poweredby our comprehensive NutriOpt database, the NutriOpt On-site Adviser provides with accurate analytical results to make better-informed choices.

The portable NIR scanner and the mobile app enable you to get analytical results of nutrients in raw materials and finished feed onsite. The mobile app connects the handheld scanner to the NutriOpt nutritional database and advice on the nutritional value of the scanned materials. The NutriOpt On-site can be even connected to your decision-making tools for a smooth optimisation process.

NOA can perform convenient analysis without samples leaving your farm, and the poultry farm owner can enjoy a greater control over their animal performance.

In relation to feed safety, mycotoxins are probably one of the most important risk factors that need to be controlled among the Indian poultry Industry. It is also encouraging to note, that rapid diagnostics are now more widespread globally adopted for quality control to take appropriate measures once mycotoxin contamination in raw materials is detected. It is an essential part of feed quality assurance and with the right measures the risks can be mitigated, which will prevent unexpected performance losses and health problems.

Measuring mycotoxin levels in feed can be time-consuming and requires specialised and costly methodology. Trouw Nutrition offers "Mycomaster", a tool to analyse mycotoxins.

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.

Tackling the Challenges

The importance of using a holistic approach to enable successful conversion of feed into high quality poultry protein in a sustainable way is evident for the Indian poultry producers. These high producing birds must be able to consume, digest, absorb and convert sufficient nutrients to meet their genetic potential, and do this consistently from flock to flock. To do this successfully and achieve high consistent production with acceptable risk will require increased use of existing technology and expanding our knowledge and information network. At Trouw Nutrition, we have the tools to support the challenges faced by the poultry producers to make better choices to support the production chain.

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% Achievement	:	100%
Weeks Above 90%	:	50
Peak Weekly Production	:	96%
Feed Cost/Egg @Rs.26/KG	:	Rs.3.17

Mr. M A Mukheed

Samad Poultry Farm,
Mahabubnagar, TG

Achieved **277 HHE** in **64 weeks** with **105 g avg feed intake/day**

Cum Feed/Egg	:	119
% Achievement	:	99%
Weeks Above 90%	:	38
Peak Weekly Production	:	96%
Feed Cost/Egg @Rs.26/KG	:	Rs.3.09

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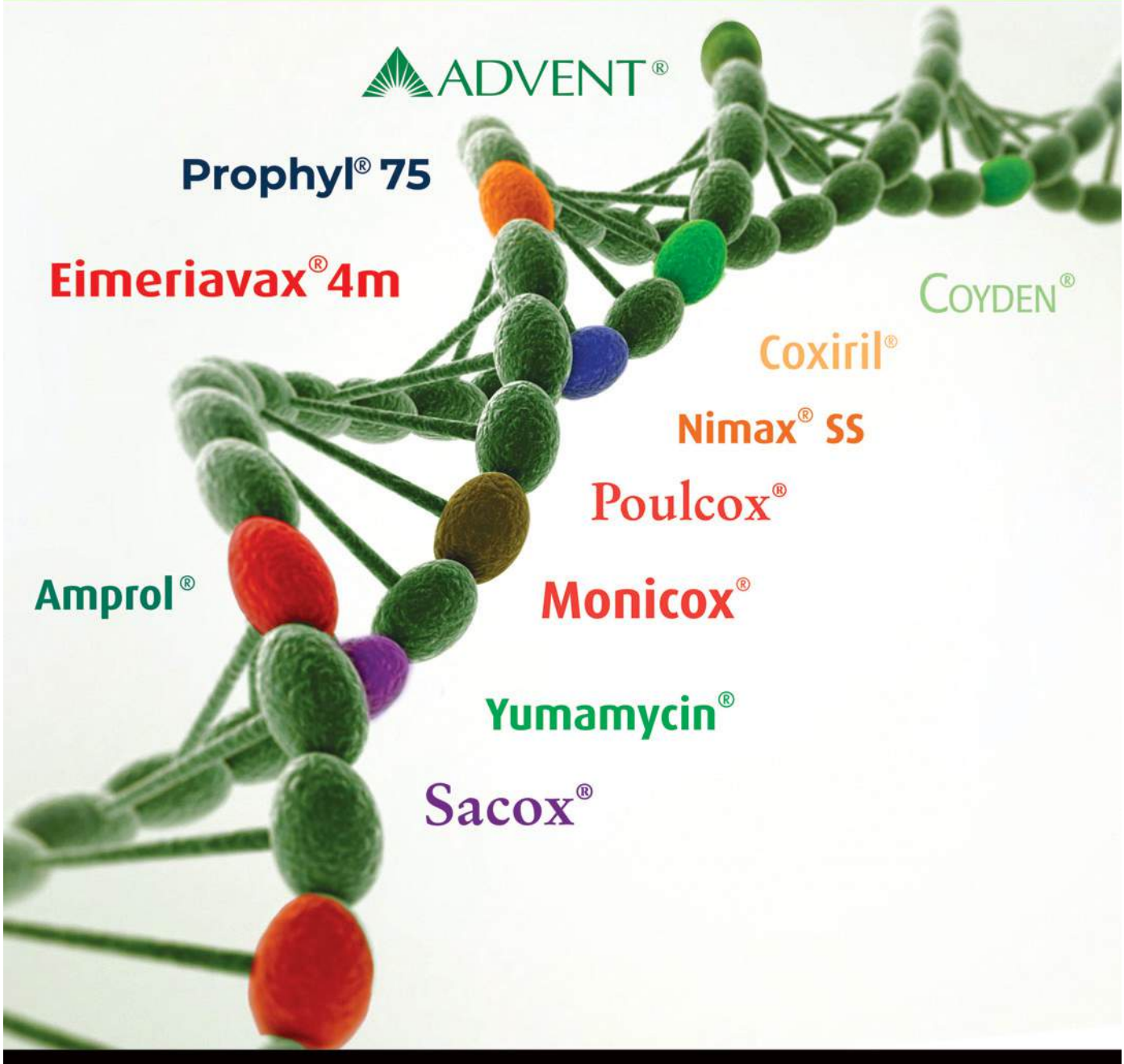

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Coccidiosis– The Hidden Profit Killer

Dr. Sachin Patil
DGM - Key Clients, Huvepharma SEA

Poultry coccidiosis is an intestinal infection caused by an intracellular parasitic protozoan of the genus Eimeria. Four species cause wide impact and economic losses in the broiler industry. Each species exhibits different pathogenic characteristics and targets a specific intestinal location and alters the function of the intestinal tract, generating deficiencies in the absorption of nutrients and lowering productive performance, leading to economic losses. Since long the disease has principally been controlled prophylactically by incorporating different anticoccidial drugs through feed. Nowadays vaccines are also added to control and restore the sensitivity against resistance oocysts. Management and control of coccidiosis with the feed coccidiostat is still widely used in the poultry industry.

EPIDEMIOLOGY

Most of the Eimeria spp. affects birds between 21-33 days of age

1) E. acervulina - Moderately Pathogenic
2) E. brunetti - Slightly Pathogenic
3) E. maxima - Moderately Pathogenic
4) E. tenella - Most Pathogenic


Eimeria tenella


Eimeria maxima


Eimeria aceruvilina

LIFE CYCLE

Coccidia has 2 stages in its life cycle of Eimeria species (7 days)

1. Asexual stage-Schizogony stage
2. Sexual stage Sporogony stage

CLINICAL SIGNS

Coccidiosis in chicken is characterised by bloody diarrhoea, enteritis, emaciation, drooping wings, poor growth, low production with high rate of mortality and morbidity in heavy infection.


Clinically cocci infested bird

Types of Coccidiostats and its level in the feed

Category	Anticoccidial Agent	Recommended Dose (ppm) - Broiler
Monovalent Ionophore	Monensin	100-120
	Narasin	60-80
	Salinomycin	44 -66
Monovalent Glyosidic	Maduramicin	5 - 6
	Semduralmicin	25
Divalent | Lasalocid 75-125		
Chemicals	Amprolium	125 - 250
	Halofuginone	3
	Clopidol	125
	Decoquinate	30
	Diclazuril	1
	Dinitomide (zoalene)	125
	Nicarbazin	125
	Robenidine	33
Mixed Synthetic with Ionophore	Salinomycin / Nicarbazin	50
	Narasin / Nicarbazin	54-90
	Monensin / Nicarbazin	40
	Maduramicin / Nicarbazin	0.75 - 40
	Semduralmicin / Nicarbazin*	15-40


Healthy intestinal villi

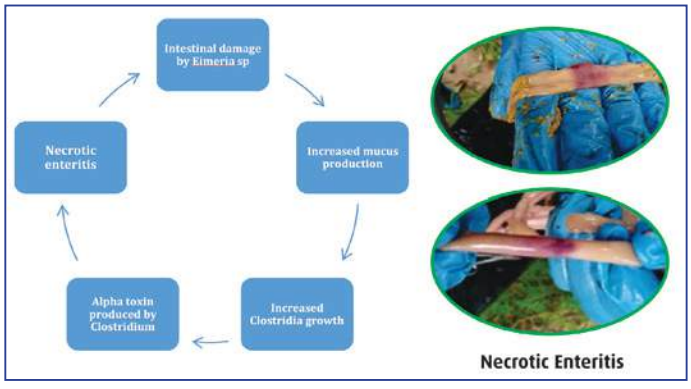

Damage & rupture intestinal villi

CHARACTERISTICS OF COCCIDIOSIS

1. Species-Specific (turkeys<=>chickens)
2. Tissue-Specific (intestinal mucosal cells)
3. Specific area in intestines per species
4. Pathogenicity is variable (E. mitis, E. necatrix)

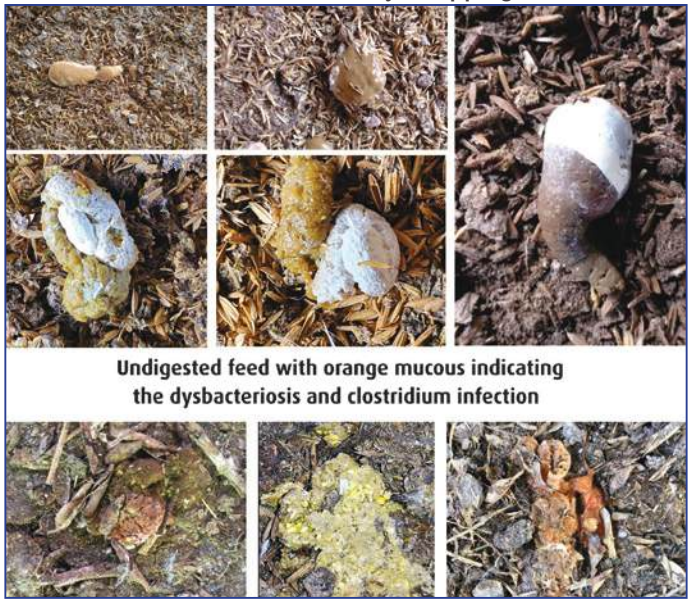
Coccidia does not come alone

Coccidiosis goes hand-in-hand with other gut diseases, because it damages the gut mucosa and allows bacteria to enter causing secondary infections.



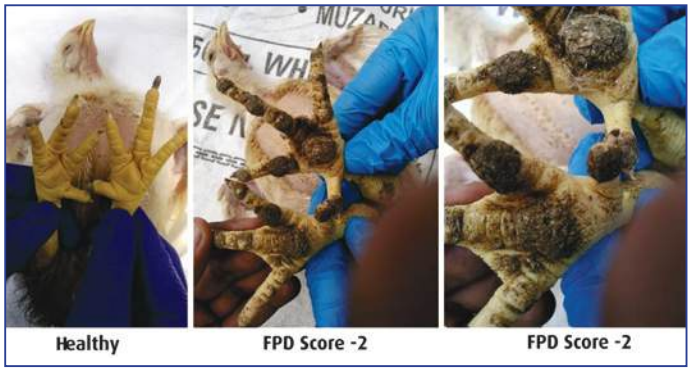
What Droppings Tell You?

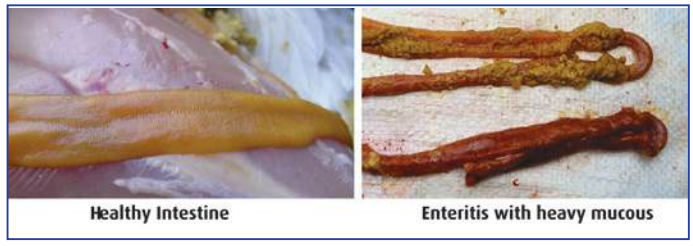
Caecal and Healthy Droppings

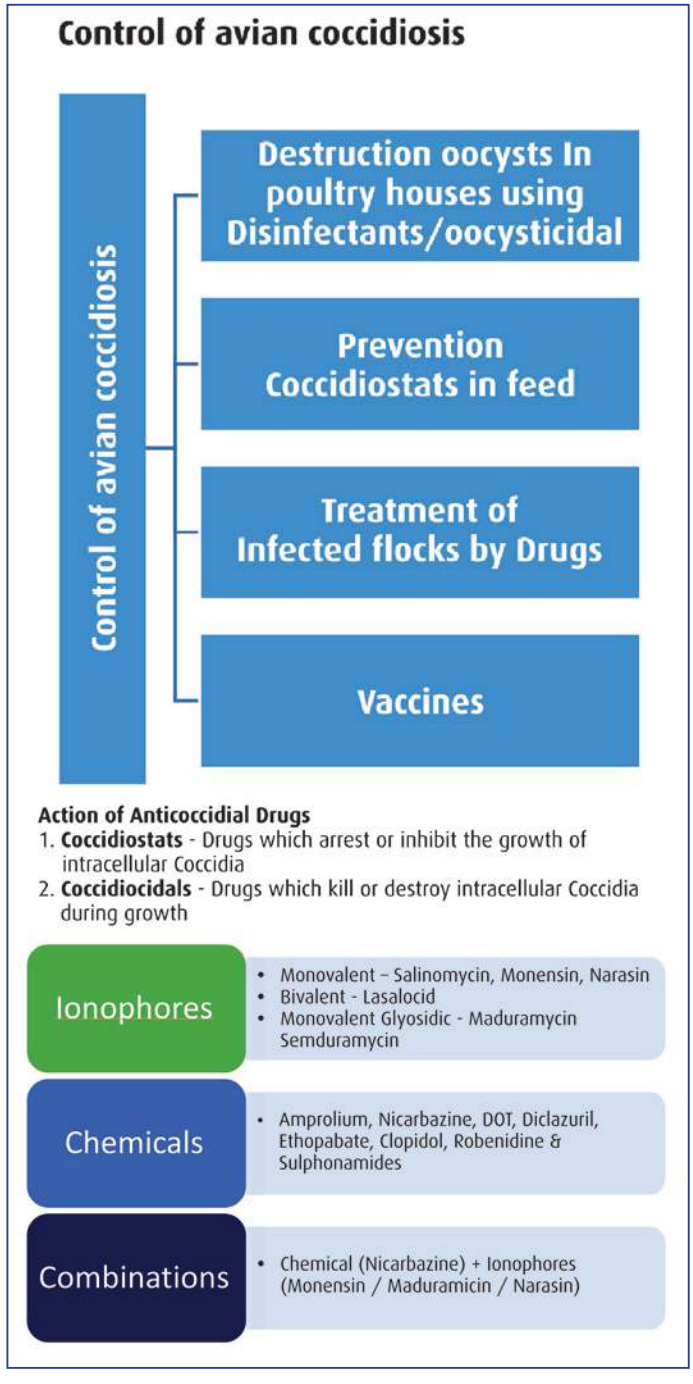


Undigested feed with orange mucous indicating the dysbacteriosis and clostridium infection

Indicator of Litter Quality - Foot Pad Dermatitis







These fall into three categories: the polyether Ionophore which includes Monovalent Ionophore Divalent Ionophore, Synthetic/ chemical & Combination of synthetic and chemicals such as Monensin& Nicarbazin.

This article gives a glimpse on the brief review on epidemiology, transmission, clinical signs, diagnosis, control and economic losses due to coccidiosis in poultry.

SHUTTLE AND ROTATION PROGRAMS

Ionophore combinations are typically applied to control coccidiosis during the rearing of broiler chickens in so-called "shuttle programs", in which different drugs are used in successive feeds given during the life of a single flock. Combinations may also be employed in "rotation" programs that involve the use of different drugs in successive flocks. The use of combination products in the first feed provided (starter & prestarter feed) and sometimes in subsequent finisher feeds has become a common practice.

CHEMICALS & MODE OF ACTION

Below are the chemical drugs and thier modes of action

- Amprolium- thiamine (Vit. B1) analog
- Clopidol- disrupts energy transfer in the mitochondria
- Decoquinate- Quinolone, disrupts electron transport
- Diclazuril- unknown, acts on sexual and asexual stages
- Nicarbazin- unknown, thought to be related to NAD metabolism
- Robenidine- unknown acts on sporozoite
- Ethopabate- monocyclic aromatic, PABA competitor
- Sulphonamide- second generation schizonts, folic acid synthesis

CONCLUSION

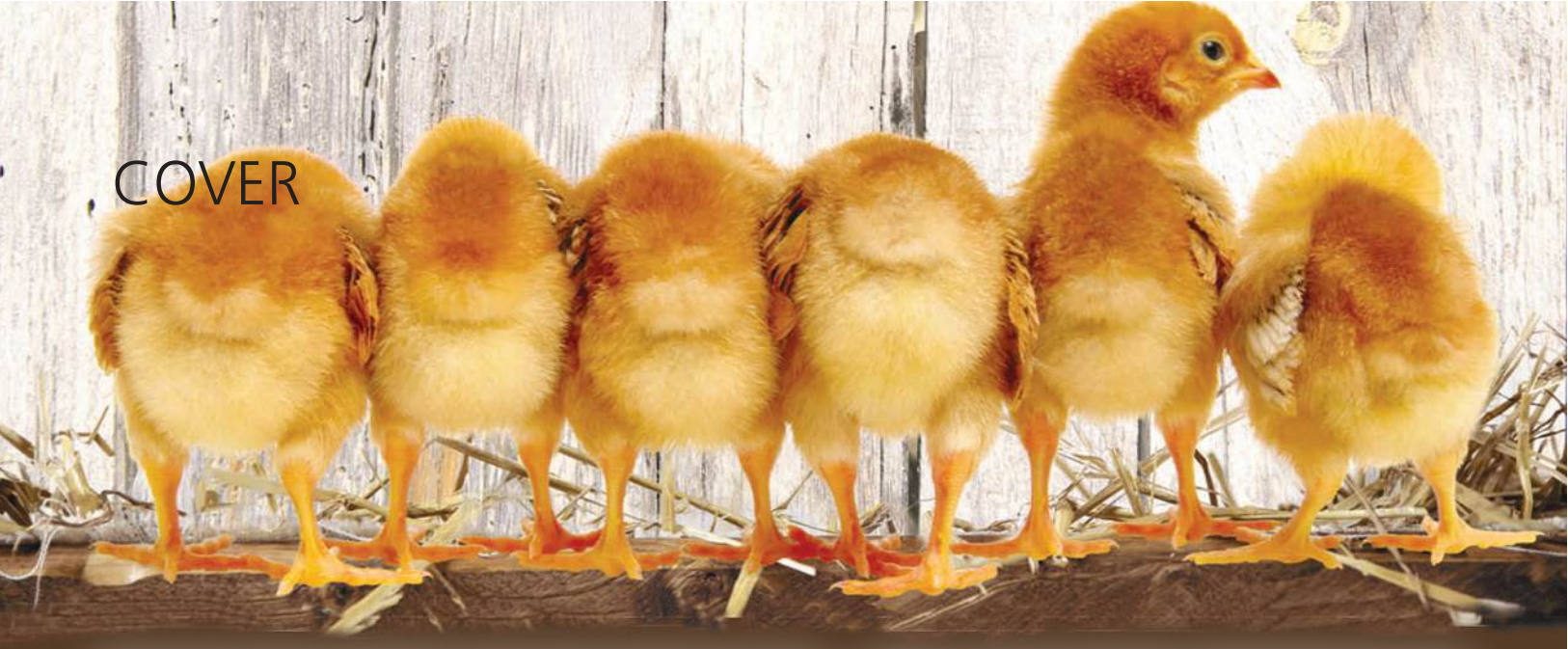
Coccidiosis is a globally occurring problem causing losses of Rs 16/- per bird in broilers. Coccidiosis is a multi-factorial disease so, hygiene, management, ventilation, feed quality and precise mixing of anticoccidial play a crucial role in management of coccidiosis. During the complete year clean-up programme is very important with the help of strong chemical molecule to lower the oocyst pressure in the farms.

Ionophore can be used for six months and later resting can be given after the use. Always try to use chemicals/combination molecules in prestarter and starter feed and Ionophore in the finisher feed it allows to leakage of immunity.

In conclusion, the prevention and control of coccidiosis will be dependent upon the use of anticoccidial drugs and vaccines integrated with a comprehensive program focusing on high standards of bird health, nutrition, and management of the production environment.

Huvepharma Complete Cocci Range

PARAMETERS	Poulcox®	Sacox®	Yumamycin®	Coxiril®	Coyden®	Monicox®	Nimax®
TYPE	Ionophore			Chemical		Combination	
ACTIVE	Monensin	Salinomycin	Maduramicin ammonium	Diclazuril	Clopidol	Monensin + Nicarbazin	Maduramicin + Nicarbazin
PPM	100 - 125	60 -70	5	0.8 - 1.2	125	40/40 - 50/50	40 - 3.75
WITHDRAWAL PERIOD	3 days	0 days	5 days	0 days	5 days	0 days	0 days



MAXIMISING POULTRY WASTE MANAGEMENT

Solid waste generation is an alarming issue worldwide due to the significant rise in population growth along with industrialisation and urbanisation which retains terrific pressure on the environment and public health. Poultry wastes have a great potential for value added application, hence their effective management, proper treatment and disposal has become one of the most significant thrust areas for the research community. IPR explores future management practices

Poultry farmers understand the importance of maximimising profits on one hand, while also maintaining sustainable farming practices. One crucial aspect of achieving this balance is proper waste management. There are several factors which result is strategising waste management. From the types of poultry waste, methods of poultry waste management, best practices, the role of technology in waste management, regulations and compliance to environmental impact of poultry waste, the economic benefits of proper waste management, case studies of successful poultry waste management and call to action for sustainable poultry farming, every little details need to be laid out.

Be it the slaughterhouse or poultry industry, it is possibly one of the fastest-growing sectors driven by the increasing demand of food availability. Subsequently, the wastes produced from the slaughterhouse and the poultry farms are in huge quantities, which could be promising resource for the recovery of value added products, and bioenergy production to minimise the dependence on fossil fuels. Furthermore, the wastes from the slaughterhouses and poultry alike are a hub of pathogens that are capable of infecting humans and animals. This demands the emerging need for an effective and safe disposal method to reduce the spread of diseases following animal slaughtering.

How is solid waste managed in slaughterhouses

Poultry farming is a profitable business, however, with the increase in production comes the issue of waste management. Poultry waste management is the process of collecting, treating and disposing of poultry waste. Proper waste management is essential for sustainable and profitable poultry farming.

In the light of that, the state of the production of poultry wastes is presented first, following this, the impact of solid waste exposure in terms of air, water and soil pollution and the associated health challenges due to improper solid waste management practices is presented to highlight the problem. Secondly, the potency of the solid wastes and the various waste-to-energy technologies that have been employed for effective management and resource utilisation of wastes generated from poultry are reviewed in details. Finally, the reviews also highlight the opportunities and challenges associated with effective solid waste management, future requirements for the development of effective technlogies for the recovery of value added products (like keratin, fibreboards) and biofuel production.

Global solid waste generation is estimated to be about 11.2 billion tons per year, which is projected to increase to 19 billion tons per year by 2025. Out of the solid wastes, global municipal solid waste (MSW) generation was found to be about 2.01 billion tons per year resultant from the global population of 7.8 billion. It is estimated that the global population is projected to increase to 9.9 billion by 2050 which is approximately 26.9% increase than the present population during which the MSW generation is estimated to increase approximately by 70%, i.e. 3.4 billion tons per year. Out of the 2.01 billion tons of MSW generated annually, it was reported that about 33% is not treated properly, and thus improper management of solid waste is quite common in many developing countries. Along with waste-handling issues, solid waste also contribute 3% of global greenhouse gas (GHG) emmissions. Among these solid wastes, animal byproducts are well-recognized drivers of GHG. It was also investigated from the life cycle assessment study that meatless meals showed a 40% reduction in environmental impacts while compared to the meat-containing meals in the assessed indicators like carbon footprint, resource consumption, water use and health impacts.

The management of these solid wastes is another worldwide problem because of the complexity associated with waste segregation, collection, transportation, treatment and disposal which greatly affect environmental sustainability. Furthermore, the improper disposal of solid wastes also creates several environmental (water, air and soil pollution) and health issues like waterborne diseases and respiratory illness resulting from the open burning of wastes.

It is reported that about one-third to one-half of the total weight of a slaughtered animal remains unutilised or partly utilised byproducts of livestock and poultry industry. In the poultry industry, huge quantities of wastes are generated in terms of solid wastes (bedding material, feathers, hatchery wastes, blood, offal, shells, poultry manure/litter etc.) and waste water. Though the poultry industry growing worldwide is providing huge employment opportunities and alleviates poverty, still abattoir wastes create a huge amount of environmental pollution by means of improper waste disposal or underutilisation of wastes' potency. However, similar to large animal slaughterhouses, poultry wastes also have great potential for value added applications.

There are essentially two types of poultry waste: Solid and Liquid. Solid waste includes feathers, bedding material and manure, while liquid waste includes urine and water. Understanding the types of poultry waste is crucial for effective waste management.

To effectively manage poultry waste, farmers must follow best practices. This includes proper storage and handling of waste, regular cleaning of poultry houses, and monitoring and record-keeping of waste management practices. Additionally, farmers should consider the use of biosecurity measures to reduce the risk of disease transmission.

In many of the developing countries, like India, almost 3/4th fund allocated to urban solid waste management is utilised for waste collection and transportation. This becomes a major constraint for the effective treatment of solid wastes. The main problem is the mixing of the segregated wastes like organic wastes from poultry houses, slaughterhouses or abattoir shops or from wholesale-centralised markets with inorganic waste fractions. Hence, the segregation of organic wastes from centralised wholesale complexes like poultry houses or horticultural markets is highly essential to designing a sustainable and effective waste management system. The wastes from poultry houses, slaughterhouses and abattoir shops have huge potential for energy recovery or product recoveries like protein hydrolysate synthesis, enzymes and lipids, however, they should be properly collected and treated in order to utilise their maximum potency. Hence,

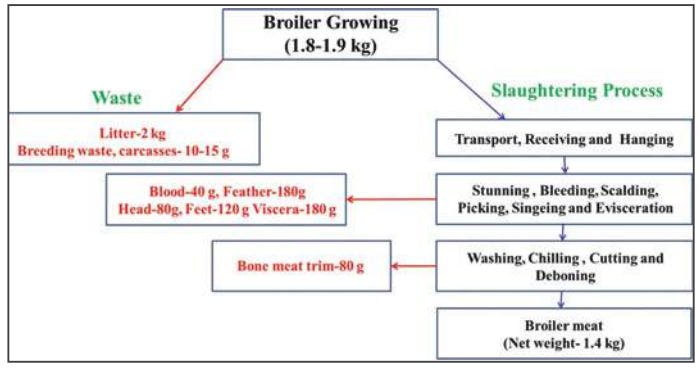
segregation of these bulk generators of organic wastes from Indian urban centres could prevent the inefficient use of the potency of this huge quantum of wastes. The suitable treatment options need to be explored to find their appropriateness based on each context. Thus effective management of slaughterhouses and poultry wastes and their proper treatment and disposal and the value addition of slaughterhouse and poultry wastes has become one of the most significant thrust areas for the research community.

There are several methods of poultry waste management, including composting, anaerobic digestion and land appication. Composting is the process of breaking down organic material into a nutrient-rich soil amendment. Anaerobic digestion is the process of breaking down organic material in the absence of oxygen, producing biogas and a nutrient-rich liquid fertiliser. Land application involves directly applying poultry waste to agricultural land as a fertiliser.

Slaughterhouse and poultry wastes are the commercial waste of Municipal Solid Waste (MSW). The population growth increases the demand for meat products, livestock and poultry products. It is estimated that the total world meat production is 220 million tons and is mainly contributed by buffaloes (31%), cattle (31%), sheep (5%), goats (10%), pigs (10%) and poultry (11%). Generally, slaughterhouse/abattoir operations, poultry farms produce a considerable amount of organic waste with relatively high levels of suspended solid, liquid and fat (Table 1). It is estimated that about 50 -54% of each cow, 52% of each sheep or goat, 60-62% of each pig, 68-72% of each chicken and 78% of each turkey is utilised for meat and the remaining is disposed of as waste.

of drugs, pesticides, disinfection of chicken houses and abattoirs. It is further estimated that approximately a chicken produces 1 kg of fresh manure with variable water content for each kilogram of feed consumed, whereas a commercial layer produces about 20kg waste per year. These wastes comprise potential nutrients, which can be used for crop production; however, it requires crop nutrient requirement and soil testing. Moreover, poultry waste management and its potential application are mostly driven by the economic viability and environmental safety regulation of a country as well as the awareness of the public.

Fig. 1 : Poultry Waste Generation During Broiler Farming and Slaughtering Process



Animal by-products can be categorised as edible and inedible. For instance, organs like kidneys, heart and liver are examples of edible by-products whereas horns, hooves and hair are inedible by-products. The inedible parts of slaughtered animals vary for different categories, i.e. 49%, 47%, 44% and 34% for cattle, sheep and lambs, pigs and broilers respectively. However, part of these wastes are being processed by the rendering industry for conversion into animal feed, pet food, poultry meal and animal fats. Recently, slaughterhouse byproducts are being utilised in several applications such as anaerobic digestion, synthesis of a protein hydrolysate, lipids, enzymes, bioactive peptides and synthesis of protein-based adhesive formulations. The blood from the slaughterhouses is one of the major animal byproducts that are rich in protein (about 18%). The dry protein could be used for the production of yogurt, cakes and cheese due to the excellent gelling and emulsifying properties. The potential use of these huge quantum of slaughterhouse and poultry wastes would not only pave a way for sustainable waste management, but also would increase industrial development and employment opportunities. Hence, there is an alarming need to focus on sustainable waste management technologies for the treatment and effective ulitisation of slaughterhouse and poultry wastes.

Table 1 : Chararteristics of Slaughterhouse Wastes

Substrate	Moisture (%)	TS (%)	VS (%TS)	Protein (%)	Lipid (%)	Carbohydrates (%)	C/N
Poultry trimmings and bones	77.6	22.4	68.0	11.4	4.9	-	-
Poultry feathers	6.1	93.9	-	85.3	2.0	-	3.5
Cattle meat and fatty waste fractions	47.3	52.7	98.9	6.5	43.2	-	-
Cattle rumen content	88.3	11.7	93.0	0.8	1.8	-	-
Goat rumen content	82.9	17.1	87.7	3.0	2.6	7.6	12.6
Bovine slaughterhouse waste	46.8	53.2	98.8	3.5	46.1	-	-
Cattle manure	77.0	23.0	78.6	4.8	0.3	13.0	-
Solid cattle slaughterhouse waste	74.0	26.0	95.0	13.0	17.5	0.1	-
Poultry manure	39.7	60.3	-	-	-	-	3.8

Furthermore, the bovine slaughterhouse generates solid waste of 27.5% of the animal weight, i.e. 275 kg/ton of total live weight killed. In the case of goat and sheep slaughterhouse, the waste generation is 2.5kg/head that is equivalent to 17% of animal weight. Similarly during pig slaughtering, an average waste generation is 2.3 kg/head that is equvalent to 4% of animal weight. In abattoir shops, on an average, 32.5 – 37.0% of poultry waste is being generated while a chicken is slaughtered, with the waste composition consisting of 57.37% of feathers and skin; 20.35% of intestines; 14.8% of legs and others (<1%).

Poultry industry is growing rapidly which generates large amounts of solid and liquid wastes. The process of poultry slaughtering and the corresponding waste generation is shown in TABLE 2. It is estimated that globally, an excess of 90% of poultry waste is spread on land close to the poultry farms. These poultry solid wastes majorly comprise feathers, bedding material, excreta, feed, hatchery waste (empty shells, infertile eggs, dead embryos and late hatchings), dead birds and mortality waste. Liquid waste generation includes faeces, urine, saw dust, remnants

The consumption of broiler chicken meat production exceeds 22.85 billion chickens worldwide and the approximate waste from poultry is estimated as 32.5 to 37%. Although a huge quantum of organic solid wastes is being generated, still the recovery of value-added products from these wastes would benefit society in an eco-benign way. Hassan et al. experimented with the utilisation of food wastes for bio-hydrogen and bio-methane recovery whereas

Isarankura et al. evaluated the extraction of keratin protein from waste chicken feathers. The chicken feather waste is reported to contain approximately 91% keratin proteins. Likewise, the waste produced from citrus processing industries exceeds 40 million tons worldwide. However, these wastes are rich in carotenoids and flavonoids that provide a good source of provitamin A and antioxidants. These existing studies exhibit the potency of organic solid wastes as a valuable resource that needs to be utilised through suitable and efficient treatment options.

Advancements in technology have led to innovative poultry waste management solutions. These include the use of sensors to monitor waste levels and quality, automated cleaning systems, and the use of drones for mapping and monitoring waste disposal sites. Technology can help improve waste management efficiency and reduce environmental impact.

There are several technologies that exist for the treatment and disposal of organic solid wastes Fig. 2; furthermore, solid wastes are potential resources for valuable products. Thus, the description of solid waste treatment techniques and details of the recovery of valuable products, especially for slaughterhouse and poultry waste are given in Table 2.

Poultry farmers must comply with the state and local regulations regarding waste management. These regulations include proper storage and disposal of waste, record-keeping and monitoring of waste management practices. Failure to comply with regulations can result in fines and legal concequences.

Also improper poultry waste management can have severe environmental consequences. Poultry waste contains high levels of nitrogen and phosphorus, which can pollute water sources and harm aquatic life. Additionally, the ammonia released from poultry waste can cause repiratory problems and contribute to air pollution. The accumulation of poultry waste can also lead to the emmission of greenhouse gases, contributing to climate change.

Poultry wastes are rich in nutrients that are useful for improving the structural stability of the soil that in turn benefits the crop yield. In addition to nutrients, poultry manure contains several active enzymes produced by the digestive tract microorganisms.

Fig. 2 : Solid Waste Treatment and Disposal Techniques

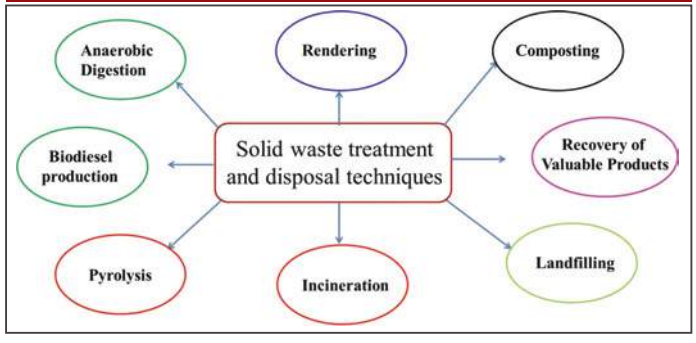


Table 2 : Product Yield from Poultry and Slaughterhouse Wastes under Different Treatment Technologies

Substrate	Operating Conditions	Product Yield
Mixed cow dung, waste fleshings, and leaf litter	Co-composting; hydrolysis of fleshing using Selenomonas ruminantium; square-shaped compost bioreactor (Size: 0.5m × 0.5 m × 0.5 m); composting time: 49 days	Germination index of 84% (cucumber), 86% (bottle guard) and 94% (tomato)
Poultry wastes	Batch AD tests; 1 L glass reactor bottles; substrate to inoculum ratio—0.25; temperature: 35 °C	262 mL CH4/g VS added
Bovine slaughterhouse wastes	Batch AD tests; 1 L glass reactor bottles; substrate to inoculum ratio—0.25; temperature: 35 °C	572 mL CH4/g VS added
Mixed cattle manure and food wastes	Batch AD tests; 1 L glass reactor bottles; temperature: 35°C; mixed food wastes (1 proportion) with cattle manure (2 proportion)	388 mL CH4/g VS added
Mixed slaughterhouse and food wastes	Semi-continuous AD tests; 5 L lab scale reactor; temperature: 35°C; helix type mechanical stirrer: 70 rpm; Retention time: 30 days	630 mL CH4/g VS added
Commercial feather meal	Biodiesel production; transesterification process; temperature: 70°C; process time: 1 h	7–11% biodiesel (on dry matter basis)
Poultry waste feathers	Keratin extraction; feather with reducing agent (1:20); reaction time: 6 h; temperature: 40°C	Keratin yield of 88% (with sodium sulphide) and 66% (with L-cysteine)
Chestnut Burrs (CB), Cow Manure (CM), Bovine Bone (BM)	Co-composting; waste shredding using mechanical shredder; 50 L compost bins; composting period: 38 days	Best compost yield with 15% BM; 55% CM to CB, Rich in macro and micronutrients; Relative seed germination (98.36%); Germination Index (104.21%); pH-6.02; C/N-18.32
Cattle manure with sewage sludge	Incineration; pilot-scale rotary kiln incinerator; Temperature: 750–850 °C and air ratio (0.9–1.4)	N_2O Emission factor = 1.9–6.0% g-N2O-N/g-N; CH_4 Emission factor = 0.0046–0.26 g-CH_4/g of burning object
Poultry litter	Fast pyrolysis; temperature: 530 °C; lab scale bubbling fluidized bed reactor; bedding material: Aluminium oxide	Bio-oil yield: 27%; Heating value: 32 MJ/kg
Meat and bone meal	Protein meal; plasticiser added: glycerol; bioplastic sheets synthesis; composition of meal: 4–7% moisture, 50% protein, 8–12% fat, and 35% ash	Bioplastic sheets; Tensile strength of sheet: 0.8 ± 0.1 MPa
Poultry waste feathers	Protein extraction; plasticiser added: glycerol; bioplastic sheets synthesis; 60 ml of keratin solution with varying glycerol concentration of (2, 5, 10 wt %)	Bioplastic sheets; SEM revealed good morphologies without cavity, holes and edge; Keratin with 2% of glycerol showed best thermal and mechanical properties
Slaughterhouse wastes	Protein extraction; operation conditions: pH: 9; reaction time: 1 h; temperature: 20–40°C	Protein yield of 75% (pork lungs); 64% (beef lungs); 83% (chicken meat)
Poultry waste feathers	Keratin extraction; dissolving of feathers (50 g feather + 2 L of sodium sulphide solution (0.5 M)); protein precipitation (feather filtrate solution and ammonium sulfate solution (1:1)) and protein extraction	Keratin yield of 53% (sodium sulphide as reducing agent)

In addition to nutrients and energy for soil microbial activities, the use of the compost resulting from the poultry manure could also enhance the enzymatic activity of soil which in turn improves the absorption capacity, buffering capacity and stress resistance of the soil. For a better composting of poultry and slaughterhouse wastes, the addition of carbon-rich materials like sawdust is widely suggested to provide better conditions during composting process. Qasim et al. carried out composting of chicken manure with an addition of carbon-rich materials and bulking agents, i.e., sawdust and wood shavings under forced aeration in a closed cylindrical composting reactor system. The results revealed the lowest ammonia and carbon dioxide emissions and high volatile solids (VS) reductions (from 81 to 61%) with GI of 84.5% during aeration of 0.25L/min/kg VS. The composting of cow dung with leather fleshing waste revealed complete mineralisation of the compost after 49 days of composting and, the relative seed germination study showed germination index (GI) of 84%, 86% and 94% in cucumber, bottle gourd and tomato respectively. The GI of >80% represents that the compost has attained maturity and is also free of phytotoxicity. Onyuka et al. carried out composting of bovine hair in thermophilic conditions at a temperature range of 40-50°C with a pH of 7, compost with humification degree of 73% and C/N ratio of 29. Composting of poultry/salughterhouse wastes demands the need for the addition of carbon-rich materials/bulking agents from improving the nutrient balance; however, it is a simple and effective option for the treatment and disposal of solid wastes. The resulting compost would be an alternative source of organic fertiliser to enhance the soil properties and plant growth.

Proper poultry waste management not only benefits the environment, but also aso has economic benefits for poultry farmers. By properly managing waste, farmers can reduce the risk of environmental fines and improve the health of their flock, leading to increased productivity and profitability. Additionally, properly treated poultry waste can be used as a valuable fertiliser, reducing the need for costly synthetic fertilisers.

Several poultry farms have implemented successful waste mangement practices. These farms have reduced environmental impact, improved animal health and increased profitability. By studying these case studies, farmers can learn and implement similar successful practices for their own productive farms.

A large part of the research is focused on eco-friendly and sustainable energy from waste biomass to replace fossil fuels. The slaughterhouse and poultry wastes are growing renewable energy resources and the resultant enhanced share in total energy supply would reduce carbon dioxide emissions. Furthermore, both these wastes are rich in protein content and hence could be ideal substrate for biofuel production. Biofuels are applied in all three states of matter, i.e. solid, liquid and gas. In solid form, they normally exist as charcoal, wood and chips, pellets etc., whereas in liquid form, biodiesel and bioethanol stand out. In gaseous form, biofuel exists as biogas, produced predminently by anaerobic fermentation, or by gasification during partial oxidation of wastes at high temepratures. Due to the energetic and biological characteristics of poultry and slaughterhouse wastes, their sustainable use as bioenergy can be produced through biochemical or themochemical routes, i.e., anaerobic digestion, pyrolysis and trans-esterification of poultry tallow. Most of the existing research on slaughterhouse and poultry wastes focused on biodiesel, biogas and bio-oil production as renewable biofuels and the potential of each technology in producing electricity, bio-oil, bio-diesel etc.

Overall, the fat extracted from poultry and slaghterhouse wastes can be a potential feedstock for producing a high-quality biodiesel subject to the availability of huge quantity and cost effectiveness. Mostly sulphuric acid, KOH and NaOH are used as catalysts during the trans-esterification process. Due to the presence of high free fatty acid content, a two-step trans-esterification process is usually applied. The FAME properties reveal that the biodiesel produced from poultry and slaughterhouse wastes does not fully comply with international standards, however, blending with commercial diesel is possible that in turn exhibit acceptable fuel characteristics which would enhance environmental sustainability and economy.

In addition to management practices and renewable energy production, the slaughterhouse and poultry byproducts and the wastes are potential resources for the generation of value added products (e.g., protein, protein hydrolysate) which could be valuable alternatives to commercial counterparts. The utilisation of slaughterhouse and poultry byproducts and wastes for recovery and fabrication of value added products are described below.

Keratin, an abundant polymer, is a fibrous protein found mainly in hair, nails, feathers, wool and horn of mammals, birds and reptiles. It has several applications in pharmaceutical, biomedical, food and cosmetic industries. The major constituent of feathers (>90%) is keratin, and hence poultry feather wastes have great potency to be utilized in various applications. Pourjavaheri et al. extracted the keratin from waste chicken feathers with the mass ratio of feathers to the reducing agent (sodium sulphide and L-cysteine) as 1:20 with a reaction time of 6 hours at a temperature of 40°C. The result revealed keratin yield of 88% and 66% while using sodium sulphide and L-cysteine respectively.

Recently research is being carried out for fabrication of natural insulation composite fibreboard samples from mixed waste poultry feathers and wood residues. Fibreboard samples were prepared by mixing feathers with wood shavings (course structure) or mixed wood residues (finer and denser structure) in different proportions. The properties of the produced fibreboard showed the highest bending strength with the mixed combinations (with 20% feather, 70% waste wood, 10% adhesives). Also, the thermal insulation properties and biodegradation were improved while increasing the share of feathers in the fibreboards.

Nowadays, synthetic plastics are gradually being replaced by bioplastic materials to tackle sustainability and environmental challenges. Slaughterhouse/ poultry wastes are one of the renewable sources of protein for the fabrication of bioplastic films. Lukubira and Ogale evaluated the effect of chemical modification (using calcium hydroxide) of plasticised meat and bone meal (with a composition of 4-7% moisture, 50% protein, 8-12% fat and 35% ash)on bioplastic sheets fabrication for potential geo-structural uses.

Proper poultry waste management is essential for sustainable and profitable poultry farming. By understanding the environmental impact of waste, the economic benefits of proper management, and the different methods available, farmers can implement effective waste management practices. By following best practices, utilising technology and complying with regulations, farmers can reduce their environmental impact and improve their bottom line. It is our responsibilty to priortise sustainable waste management practices and contribute to a cleaner and healthier planet.

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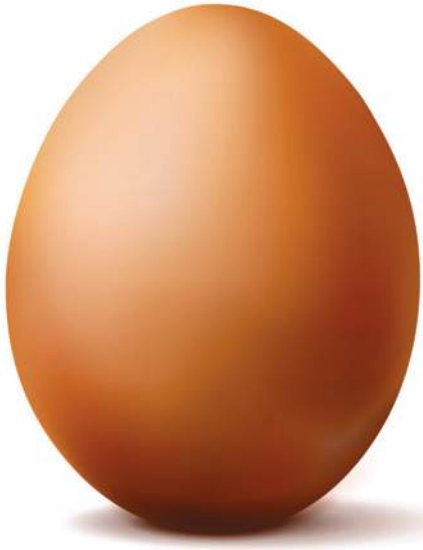

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Cobb

Article

To Meat or Not To Meat

SHRIDHAR speaks

Tarun Shridhar
Former Secretary, Ministry of Fisheries, Animal Husbandry and Dairying, Govt. of India

Not eating meat is a decision, eating meat is an instinct, Denis Leary, American actor and comedian.

What population of India is non-vegetarian? Several figures float around ranging from 40 to 85%. Then there are regional and state wise figures drawing contrasts in dietary habits. How credible and authentic are these figures; and how honest and reliable are the surveys stated to form the basis of this data? More than a pinch of salt should be taken while accepting any of these. The conclusions drawn are sweeping generalisations based upon highly suspect data. However, moving ahead with the extreme assumption of more than 80% of the population as non-vegetarian we ask ourselves a pertinent question: is meat an essential part of their regular and daily diets? The answer would be a decisive negative for an overwhelming number within this percentage. Decoding non-vegetarianism in India is quite a challenge for both the investors in the food business and policy makers alike. Against this background of a data poor situation, I am quoting only such figures as have gained wider acceptability besides getting reaffirmed through anecdotal evidence. The disclaimer though remains: keep a pinch of salt handy.

It is curious that despite being the most populous nation and one of the fastest growing economies in the world, we stand at the bottom of the ladder in consumption of meat at a per capita of a paltry around 3 kilograms per year, marginally behind our neighbour Bangladesh which stands at 3.4 kilograms. We may not be the last when it comes to egg consumption but then we are also not amongst the top even though we rank number three in the world in egg production having produced a whopping 138.38 billion last year. In meat production we figure in the top ten producers of the world. And let us not forget, buffalo meat is one of our biggest exports of agriculture and livestock commodities. What a supreme irony that the best of producers is the poorest of consumers! What would explain this paradox?

We are home to the largest population of vegetarians in the world. Even amongst a large number of meat consuming persons a regular diet is generally plant based with some meat partaken occasionally. A couple of days in a week, depending upon specific religious beliefs, are considered so auspicious as to prohibit consumption of meat. We have a unique breed called eggetarians; consume eggs but not meat. In fact, the word eggetarian, like quite a few others, is our contribution to the English lexicon. Some of us have no reservation to eating fish, considering it as sponge gourd of the water, jal tori, but any other animal meat is a strict taboo. The urban lifestyle is pushing some towards poultry away from red meat. While pork is a strict prohibition all across the Islamic world, for the Hindus beef is sacrilege. We have a humongous population of both religions. And then even diehard non-vegetarians have among them those who would be loath to cook and consume meat at home while devouring it outside.

The way you cut your meat reflects the way you live, thus summarises the great Chinese philosopher the blending of food and community.

The factors governing dietary habits and choices are several, however, religion and culture have become the most predominant in our context. Milk and honey, both animal products, are not only consumed widely but are considered elixirs of the gods. On the other hand, meat and eggs tend to evoke strong opposition amongst a large and powerful section. I recollect a minister getting visibly perturbed when deputed to preside over the World Egg Day; in a departure from the norm he requested that no publicity of the function be made as his constituents may not like his presence in an event which celebrates the egg. Another one held the view that consumption of meat resulted in genetic distortion, hence strongly advocated against it. Alas! He happened to be in charge of animal husbandry, dairy and fisheries. If this is not bizarre enough, another minister voiced strong opposition, successfully, to the introduction of milk in the mid-day meal programme for school children with a diktat that cow or buffalo milk is not for human consumption. When driven by beliefs and passion, choice ceases to be informed; therefore, the entire debate of vegetarianism versus non-vegetarianism is not about food and nutrition but about religious and cultural beliefs. Politics too has jumped into the ring.

I have known many meat eaters to be far more nonviolent than vegetarians, so said Mahatma Gandhi.

India is a complex and diverse multicultural nation. Unity in diversity may be a cliched motto, however, therein lies our strength as a nation of peaceful co-existence. Adding food to some of the already existing friction points is both irrational and dangerous. We have before us a buffet containing a lavish spread of delectable vegetarian and non-vegetarian dishes, so why not each one of us savour what he likes the most. Why attempt to impose choice upon something as personal as food. Not only such an attempt would cause disharmony, it would also be detrimental

to our fast growing economy in which the animal husbandry and fisheries sector are making significant contributions. Indian cuisine rules the roost in many parts of the world. The array of our vegetarian dishes and the diverse aromas they carry boggles the western mind and palate both; chicken tikka masala also finds a place on the same plate.

Milk is believed, and rightly so, to be a complete food as it contains all essential nutrients required by the human body. And it is tasty by itself; what to say about the innumerable products it offers, from curd to ice cream, paneer to chocolate, each one a class in itself. While celebrating this wonder food, why should we ignore other foods sourced from animals which too give us nutrition and taste.

Being nutrient-dense Animal Source Foods provide energy and many other essential nutrients such as proteins, fatty-acids and micronutrients. Malnutrition remains a persistent global issue; and worryingly for all, the problem is on a rise. It manifests in many different forms, including hunger, micronutrient deficiencies and ironically over-nutrition resulting in overweight and obesity. It has emerged as the single largest contributor to disease in the world, affecting one in three people, and responsible for 22% of premature deaths among adults worldwide. Milk, meat, fish and eggs could be the key to addressing this burning issue.

The ten countries at the bottom of the list of the least meat consuming countries in the world make for a rather intriguing reading. They are either developing or poor countries. But the bottom most i.e. India is not only huge but also one of the fastest growing economies and an emerging global super power. The reasons in the other nine, as in several others, are primarily, if not only, economical. People there are by and large non-vegetarians but do not have the financial muscle to purchase meat. Bangladesh, right above us on the ladder, is home to about 17.50 crore people; it is a Muslim majority nation, yet just 3.4 kg of meat per capita is the consumption. It is poverty that explains it. Although beef is highly sought after, it comprises just under 0.9 kg per capita because most people cannot afford it. Despite one of the largest livestock populations on the African continent and no restrictions, Ethiopia, next up, has a very low rate of meat consumption, with just under 4.6 kg per capita. A high incidence of poverty has made affordability a significant problem in the country, and access to quality foods like meat is a struggle for many. So would be the explanation for Nigeria, the most populous of African nations, which is grappling with poverty despite being a developing economy. There is Haiti too in the bottom ten struggling with extreme poverty making it impossible for most to afford meat. Pakistan, an Islamic republic is also at the bottom of the pyramid, though above us when it comes to meat consumption for no other reason except poverty.

Being nutrient-dense Animal Source Foods provide energy and many other essential nutrients such as proteins, fatty-acids and micronutrients. Malnutrition remains a persistent global issue; and worryingly for all, the problem is on a rise. It manifests in many different forms, including hunger, micronutrient deficiencies and ironically over-nutrition resulting in overweight and obesity

We indeed are unique as poverty and affordability are only one of the factors, and certainly not the dominant ones, resulting in low meat consumption, in fact the lowest in the world. Religion and culture are the most significant influences in our choice of foods. All the more reason for us to respect each other's choice and recognise the nutrition and taste, or even lack of it, in each item of cuisine amidst the countless dishes on the buffet table, be it plant or meat.

"The poor man must walk to get meat for his stomach, the rich man to get a stomach to his meat", highlights Benjamin Franklin the struggles for food faced by the poor and the rich.

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Company in Focus

BAADER

Deboning. *Picture Courtesy: Baader*

With over 100 years of innovation, BAADER is a global leader in advanced food processing solutions. Beyond fish and poultry, the company focuses on optimising processing performance through digitalisation and data analytics. IPR profiles the dynamic journey of a family run conglomerate thriving on innovation with a vision of advancement in technology

Achieving the most efficient use of the animal protein being processed is of growing industry interest and consumer demand. In the business of meat and poultry processing, capturing as much high-granted meat and minimising rejects is a way to make the most of the meat being processed. It offers as much economic as sustainable benefits.

THE BUSINESS

BAADER is a family-owned global partner for food processing solutions, boasting over a century of experience. Founded by Rudolph Baader in Germany in 1919, the company initially focused on developing and manufacturing fish processing equipment. Across three generations, it has evolved into a global presence, branching out into other meat processing industries and digital solutions. Today, alongside its fish processing division, the poultry processing sector serves as a vital pillar of its success.

Headquartered in Lübeck, Germany, the very city where the Baader family initiated and continues to operate their global business, their processing plants are strategically established worldwide to effectively serve diverse markets. In addition to the production facility in Lübeck, innovation and manufacturing are also managed in Norway, Iceland, Denmark, the Netherlands and the USA. Proximity to customers is paramount for BAADER, hence a comprehensive sales and after-sales structure is dispersed across the globe. Today, BAADER employs over 1600 professionals across 100 countries worldwide, with the ongoing establishment of new local offices.

Notably, a new office in Mexico was inaugurated recently, while the company's primary Asian offices in Singapore and China have been reallocated to accommodate escalating demand. Both fish and poultry processing industries are witnessing global growth, providing nutritious protein to an expanding population and BAADER follows closely the local industries and communities.

VISION

The key to the century-long success of the company lies in their unwavering commitment to innovate and optimise the entire food processing value chain. Through close collaboration with customers and partners worldwide, the group is dedicated to crafting dependable and efficient processing solutions tailored to meet local demands. It takes pride in offering a diverse portfolio of solutions that cater to processors of all scales, ensuring suitability for both large-scale enterprises and smaller operations.

As custodians of valuable and finite raw materials, BAADER is committed to ethical processing and maximising the efficient utilisation of resources. Their process equipment is meticulously crafted to balance gentleness with efficiency when handling live

animals, with hygiene measures consistently prioritised in their development process. The company takes pride in engineering solutions that optimise the value of the intake material no matter the size of the processing plant or the line speed. The group emphasises the importance of data analytics and that it is indispensable in safeguarding animal welfare, hygiene, quality and overall utilisation rates.

The experience developed over a century of food processing forms the bedrock of the business. They view their customers as partners and prioritise long-term relationships, extending from initial solution design to ongoing service and maintenance support. Through the robust global partnerships, the company remains at the forefront of emerging food processing trends, integrating these insights into both hardware and software developments.

In BAADER they think generations. When they mention the 'BAADER family', it encompasses more than just the family-owned business status; it extends to their employees and the enduring relationships they cultivate with customers over the long term. The group aspires to remain a dependable provider of food processing solutions for many years to come, which entails anticipating future needs and delivering tailored solutions to meet the evolving demands of their global clientele. Achieving this goal demands local presence, foresight, and continuous investment in research and product development.

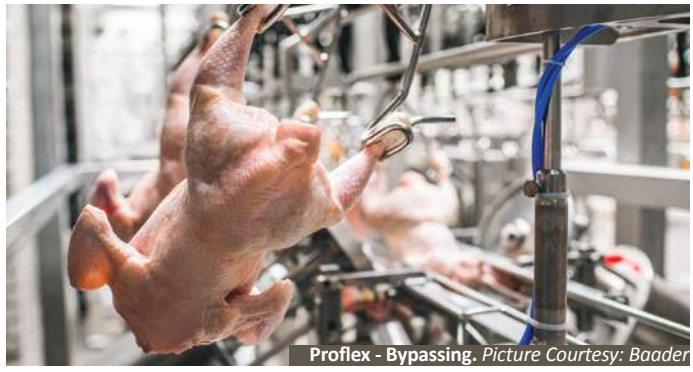
Bird in Drawer. *Picture Courtesy: Baader*

THE USP

Given the dynamic nature of the food processing industry and evolving consumer preferences, BAADER adapt their offerings accordingly. As lifestyles shift towards convenience, they assist their customers in producing ready-to-cook meals and tailored cuts suitable for the thriving fast food sector, all tailored to meet local eating habits.

Additionally, they facilitate close monitoring of the trend towards increased automation, from simple processing tasks to intricate operations like deboning. Continuously exploring innovative technologies, the company develops tools that can precisely measure products during deboning, allowing them to optimise top adjustments to replicate the efficiency of manual processes, thereby maximising yield performance.

By fostering a culture of knowledge and data sharing, the group can collectively achieve long-term optimisation of the food value chain. Hence, BAADER recently acquired a majority stake in the software development firm Emydex Technology, known for delivering real-time, precise reporting on production processes. This acquisition empowers customers to enhance efficiencies, increase yields, lower costs and boost profitability. By integrating Emydex's capabilities with BAADER's digital and equipment advancements, the company can now provide comprehensive solutions to the poultry processing industry, offering software to streamline production management, report on flock levels, and analyse processing operations.



Proflex - Bypassing. *Picture Courtesy: Baader*

With a focus on harnessing the significant benefits of data analysis and reporting for the group's global customers, BAADER has prioritised the development of precise and rapid data capture equipment. A prime example is the recently launched ClassifEYE vision camera, which utilises Artificial Intelligence to identify quality issues along the processing line. Traditionally, vision cameras have been employed for sorting purposes; assigning whole birds for optimal downstream processing based on quality, weight and count metrics. However, AI introduces entirely new functionalities, such as monitoring picking performance or evisceration line efficiency. The key to the technology's accuracy lies in a self-learning process, wherein the system analyses images and develops an understanding of the relevant classifications specific to the location on the processing line.

THE STAMP OF INNOVATION

Automation is the key to addressing several challenges in food supply and processing. The increasing demand for healthy proteins and the convenience required by busy lifestyles necessitate higher processing speeds, further processing, and reduced manual labour. BAADER, with its long-standing tradition of innovating efficient filleting technologies for both the fish and poultry industries, exemplifies this with its latest innovation: the automatic Breast Cap Deboner 660A. This advanced machine automates labour intensive filleting processes while meeting stringent quality and yield performance standards.

The automatic Breast Cap Deboner 660A offers the same production versatility as manual deboning, facilitating a wide range of fillet products, including single and double fillets, with or without the tender attached. Additionally, the fully automatic machine ensures the efficient harvesting of rest meat and keel bone (yagen), maximizing the extraction of every gram of valuable product. This automation not only enhances efficiency but also maintains the highest standards of product quality and yield, demonstrating BAADER's commitment to innovation in food processing.

The Breast Cap Deboner 660A prioritises control and monitoring, featuring a Human Machine Interface (HMI) control panel conveniently situated on the plant floor. This user-friendly interface empowers operators to oversee and adjust deboning process parameters with efficiency, ensuring optimal performance and yield.

With intuitive navigation and four pre-set recipes accessible on the screen, production setup becomes swift and straightforward, particularly during shifts. Operators can efficiently select the precise machine settings needed for any desired product by utilizing these recipes. Furthermore, these recipes are easy to configure and can be promptly modified as required.

Machine data serves as a vital link in the information chain, significantly enhancing the accuracy and efficiency of decision-making. In line with our commitment to empowering our customers with insights into plant floor operations, the Breast Cap Deboner 660A is equipped to share data with Manufacturing Execution Systems (MES) seamlessly.

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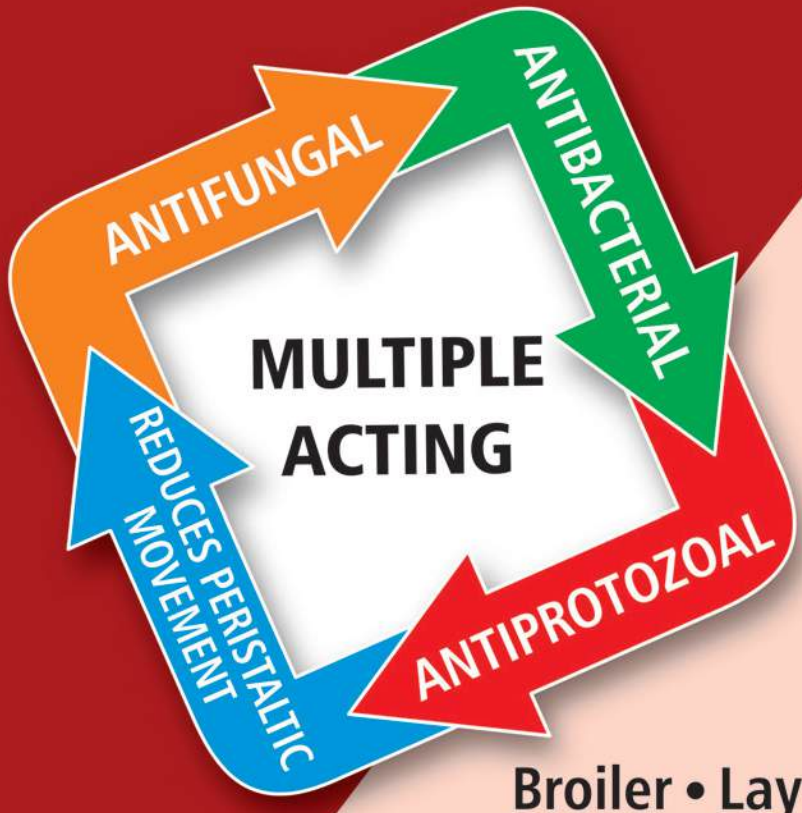

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IPR Espresso

INTERNATIONAL

Rabobank Presents Short & Long Term Outlook at International Poultry Council

In the presence of a record crowd, Nan-Dirk Mulder, senior global specialist animal protein at Rabobank, spoke recently at the IPC Global Poultry Conference in Buenos Aires, Argentina about the short and long term outlook for global poultry markets.

Mulder said the short term conditions are quite strong with many markets now operating in profitable conditions.

"We expect most global markets to stay relatively strong in 2024 and 2025. The poultry industry currently has a strong competitive position in times of price driven consumer behaviour," he said. "Input costs are now lower but still at historically high levels and there is price support from stronger prices for competitive proteins like pork and beef, while the poultry supply in most markets is relatively tight. Avian influenza and the El Niño impact in the Southern Hemisphere is having a significant impact on production in Southern Asia and Africa."

Trade will also stay strong but will be impacted by distribution challenges due to turmoil in the Middle East, Mulder added.

In the longer term, the outlook will remain strong with an expected 26% growth for poultry production in the next decade. 90% of the growth will be in emerging markets, especially Asia, Latin America and Africa, according to Mulder.

"Geopolitical tensions will have a big impact on global investment flows whereby food and resource security will become a global higher priority. In this context, we expect a further shift from global to local focus with faster growth in local poultry production then in export platforms like Brazil, the US or Thailand. This will accelerate globalisation of the industry as companies need to invest near their sales markets to access growth." he noted. "It will mean a further shift to more modern value chains with a higher emphasis on smart production systems and higher emphasis on sustainability requirements," he pointed out.

NATIONAL

Less Demand May Put the Maize Producer in Crisis this Year

Bihar is one of the main maize producers in the country. According to the state agriculture department, this year there is bumper production of maize due to the sufficient seasonal rain last year.

Unfortunately, there is a slump in maize market due to drop in demand. Maize (corn) is a major ingredient in animal feed, particularly in poultry feed production. Two-third of maize crop used to be purchased by the poultry industry.

Bihar used to supply maize to neighbouring states, including West Bengal, as well export, a good quantum to Bangladesh. But this year demand is low from the poultry producers of Bengal and Bangladesh.

Ratan Prasad a maize producer of Bihar, lamented, that this year inspite of bumper maize production, they are in crisis due to less demand. "This year, many of the poultry producers have closed their operation and about 25% of poultry have diverted their operation. Moreover, West Bengal, and as well as Bangladesh two major purchasers, are inclined to local producers of maize", Prasad added.

While the minimum support price (MSP) of has been fixed to Rs. 2090 per quintal, there is a little chance for maize procurement by government agencies, Prasad informed.

He also said that entry into the aquafeed sector using the latest extruder technology will revolutionize the industry just as it did with poultry feed 25 years ago.

Bengal Poultry Industry Stakeholders Encouraged with a Proposal to Export Chicken Products to Japan

A meeting was held in Kolkata recently between a group of West Bengal poultry industry stakeholders and a Japanese delegation to explore the avenues of export of poultry products to Japan.

In addition to West Bengal Poultry Federation General Secretary, Madan Mohan Maity, Sameer Agarwal of Shalimar Group and Radheshyam Roy of Hitech Group attended the meeting.

After extensive discussions, it was concluded that an initial monthly export of 300 metric tons of chicken skin would be feasible. This agreement represents a significant advancement in trade relations between West Bengal and Japan.

A spokesperson for the West Bengal poultry industry commented, "The successful implementation of this export initiative is expected to significantly bolster the poultry sector in West Bengal, potentially fostering further economic growth and development in the region."

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Unleash the Power of Enzymes and Probiotics with EnziProb: Your Key to Optimal Poultry Health



Dr. Ramdas Kambale
CEO & Board Member

Dr. Ravikumar Meshram
Techno Commercial & Marketing Manager

Glocrest Pharmaceuticals

Enzymes and probiotics are both commonly used in poultry farming to optimize health and productivity of the birds.

Enzymes are proteins that catalyse (speed up) chemical reactions. In poultry diets, they are used to break down complex nutrients into simpler forms that can be more easily absorbed by the birds. For example, enzymes like protease, amylase, and lipase can break down proteins, carbohydrates, and fats, respectively. This can improve the nutritional value of feed, reduce feed costs, and reduce the environmental impact of poultry farming by decreasing the amount of undigested feed that ends up in manure.

Probiotics are live microorganisms (such as certain types of bacteria and yeasts) that provide health benefits when consumed. In poultry, probiotics are used to promote a healthy gut microbiota, which can improve digestion and nutrient absorption, boost the immune system, and help protect against harmful pathogens.

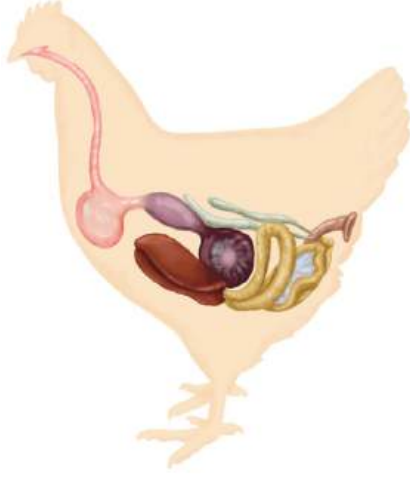
When used in combination, enzymes and probiotics can potentially work together to further enhance these benefits. For instance, enzymes can break down feed into simpler nutrients, making it easier for probiotic bacteria to thrive. Meanwhile, probiotics can create a healthier gut environment that enhances the activity of enzymes.

For broilers (chickens raised for meat), these benefits can lead to improved growth rates and feed conversion ratios (the amount of feed needed to gain a certain amount of weight), which can increase profitability.

For layers (chickens raised for egg production), these benefits can lead to improved egg production and egg quality.

For breeders, these benefits can enhance reproductive performance and the health and productivity of their offspring.

However, it's important to note that the specific benefits can vary depending on many factors, including the types of enzymes and probiotics used, the composition of the feed, the health status



of the birds, and their living conditions. Also, while many studies have shown positive effects, more research is needed to fully understand the best ways to use enzymes and probiotics in combination in poultry diets.

In the rapidly evolving world of poultry farming, we understand the ever-present need for superior quality feed supplements that not only enhance the health and productivity of your birds, but also drive down costs and maximize profits. This is where GLOCREST steps in, delivering top-notch, scientifically backed solutions to keep your poultry flock thriving. We proudly introduce our flagship product: Enziprob.

Each kg contains:	
Xylanase	9000000 Units
Alpha Amylase	2000000 Units
Cellulase	2000000 Units
Protease	2000000 Units
Mananase	1600000 Units
Lipase	500000 Units
Phytase	300000 Units
Lactobacillus acidophilus	2 X 10^{11} CFU
Sachharomyces boulardi	1 X 10^{11} CFU
Bacillus subtilis	1 X 10^{11} CFU
Bacillus licheniformis	1 X 10^{11} CFU
Bacillus megaterium	1 X 10^{11} CFU
Bacillus polymyxa	1 X 10^{11} CFU

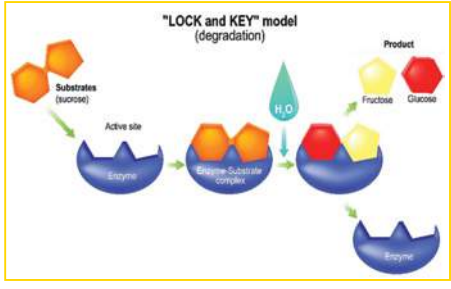
Enziprob is an innovative, unique blend of potent enzymes and robust probiotics, designed specifically for commercial poultry birds. This proprietary blend is tailored to boost the digestive efficiency of your flock, enhance nutrient absorption, and bolster overall health and vitality.

At the heart of Enziprob are seven powerful enzymes: Xylanase, Alpha Amylase, Cellulase, Protease, Mananase, Lipase, and Phytase. These enzymes work synergistically to break down complex dietary components such as cellulose, proteins, and fats, making it easier for the birds to absorb vital nutrients. The result? Improved feed efficiency, weight gain, and productivity of your flock.

Xylanase: This enzyme breaks down xylans, complex carbohydrates found in plant cell walls, into simpler sugars that are easily absorbed by the birds. This aids in unlocking the nutritional potential of feed, leading to better weight gain and growth rates.

Alpha Amylase: It targets the breakdown of starch, a common component in poultry feed, into smaller, absorbable sugars, thus helping in energy extraction and reducing feed costs.

Cellulase: This enzyme degrades cellulose, a fibrous carbohydrate found in plant cell walls that are generally



indigestible by poultry. With cellulase, the nutritional value of feed is increased, and the amount of undigested feed in manure is decreased.

Protease: Protease catalyses the breakdown of proteins into simpler amino acids, essential for muscle development, feather growth, and egg production.

Mananase: This enzyme helps in breaking down mannans, complex carbohydrates that can interfere with nutrient absorption. By doing so, mananase aids in improving gut health and the overall performance of the birds.

Lipase: Lipase is vital in breaking down fats into fatty acids and glycerol, providing the birds with essential sources of energy and aiding in the absorption of fat-soluble vitamins.

Phytase: This enzyme breaks down phytic acid, a form of phosphorus found in grains and oilseeds that is not readily available to poultry. Phytase aids in better phosphorus utilisation, reducing the need for inorganic phosphorus supplements and decreasing the environmental impact of poultry farming.

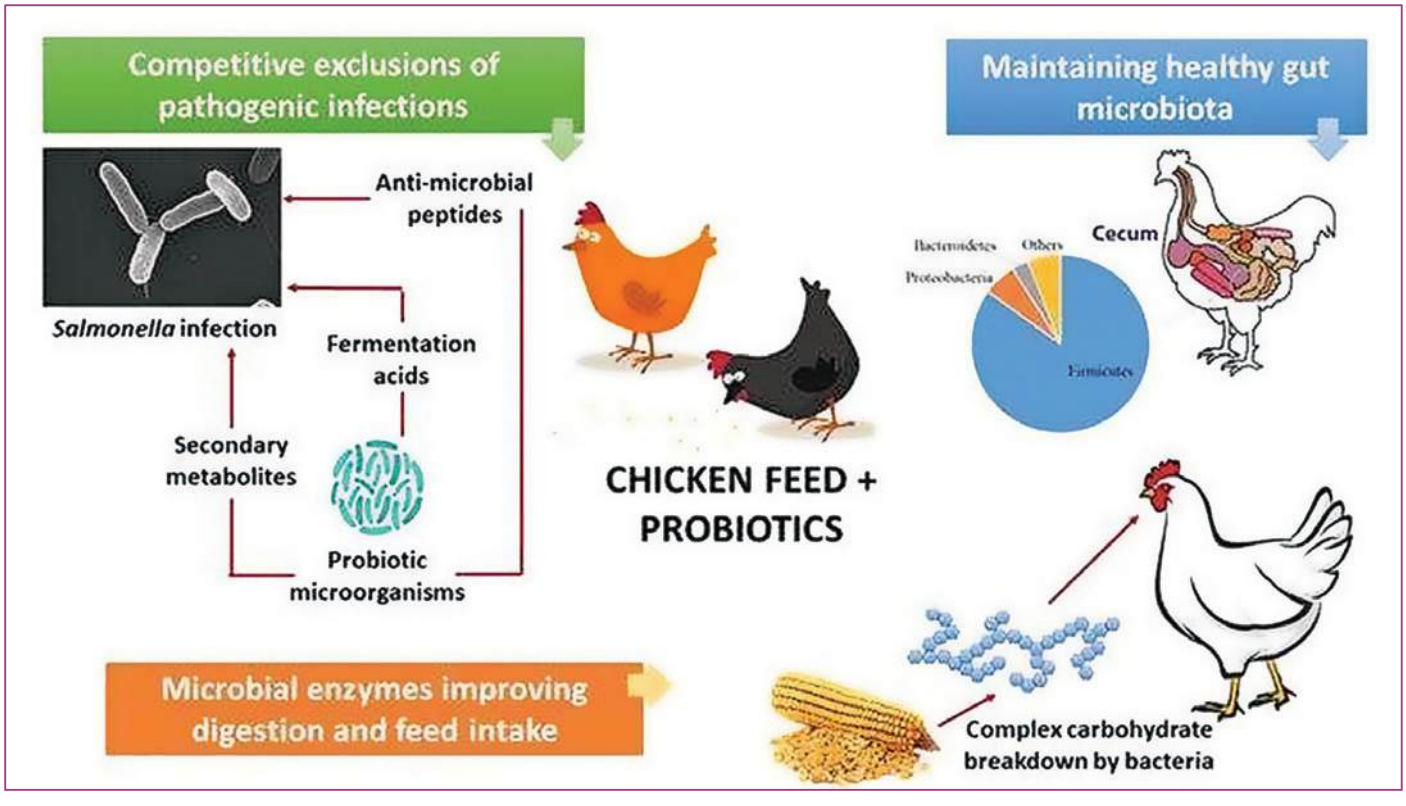
But the magic of Enziprob doesn't stop at enzymes. The product also contains five strains of probiotics: Lactobacillus acidophilus, Sachharomyces boulardi, Bacillus subtilis, Bacillus licheniformis, Bacillus megaterium, and Bacillus polymyxa. These beneficial bacteria bolster the gut microbiome, improving gut health and immunity, while outcompeting harmful pathogens. They also enhance nutrient absorption, giving your birds that much-needed edge for peak performance.

Sachharomyces boulardi: This yeast probiotic supports the immune system, helps in nutrient absorption, and can help maintain the balance of the gut microbiota, especially during periods of stress or disease.

Lactobacillus acidophilus: A beneficial bacterium that aids in nutrient absorption, promotes a healthy gut environment, and competes with harmful bacteria, maintaining a balanced gut flora.

Bacillus subtilis, Bacillus licheniformis, Bacillus megaterium, and Bacillus polymyxa: These Bacillus species are hardy probiotics known for their ability to form protective spores, ensuring their survival until they reach the gut. Once in the gut, they can promote a healthy gut environment, support the immune system, and outcompete harmful pathogens.

At GLOCREST, we don't just offer a product, we offer a promise - a promise of quality, reliability, and sustainable growth. Our commitment to research and development ensures that every batch of Enziprob delivers consistent results, helping you meet and exceed your production goals. Invest in Enziprob today and witness a remarkable transformation in your poultry's health and productivity. Experience the unparalleled benefits of this unique enzyme-probiotic blend and watch as your business reaches new heights.



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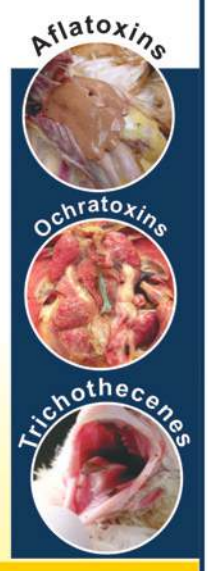

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Glamac Hosts Seminar on Enhancing Bird Performance and Combatting AMR

Glamac International organised a seminar on 7th June at Raipur titled, "Optimising Bird Performance to Sustain in the Industry & Overcoming Antimicrobial Resistance". Attendees included poultry farmers, distributors, poultry consultants, feed manufacturers and other key industry stakeholders.

The subject matter expert at the seminar was Prof. D. Chandrasekaran, retired professor of the Department of Animal Nutrition, TANUVAS. He shared his extensive expertise on the challenges and strategies for enhancing bird performance and combating antimicrobial resistance–critical issues facing the poultry industry today.

The event was expertly managed by Dr. Sumon Nag Chowdhury, AGM Technical and Marketing who commented, "Due to enormous population growth over the last few decades there has been an increasing need for economical and secure supply of protein sources. The major, most affordable and quality animal

protein sources are eggs and chicken and sustainable chicken farming has become very important."

The seminar commenced with a comprehensive introduction by Founder and Managing Director, Abir Mukherjee, who emphasized Glamac International's commitment to innovation, quality, and industry leadership, setting an optimistic tone for the event.

Dr. Chandrasekaran delivered an in-depth presentation on advanced strategies and best practices for improving bird performance. His talk covered a spectrum of topics, including nutritional advancements and management practices aimed at reducing antibiotic dependency and promoting sustainable growth.

An interactive question-and-answer session, moderated by Product Manager Dr. Rahul Mogale, provided attendees the opportunity to engage directly with Dr. Chandrasekaran.

Highlighting Glamac's dedication to innovation and research, Mr. Mukherjee introduced two ground breaking products: CYNKA HBR, an antidiarrheal and antimicrobial agent that can replace AGP or Halquinol to pave the way for antibiotic-free chicken and egg production in India, and Panbonis, a global brand from Herbonis Switzerland, featuring Vitamin D3 metabolites, a new natural element in animal nutrition.

The event concluded with a vote of thanks by Vinod Mishra, AGM Sales for North and South, who expressed gratitude to all participants for their active involvement and acknowledged the collective efforts of the team, particularly Upendra Dwivedi, Area Sales Manager for MP and Chhattisgarh, in organising the seminar.

Venky's Seminars ar Raipur and Karnal

Venky's India Limited organised technical seminars at Raipur and Karnal on 24th and 27th April respectively. Focusing on "Managing Multiple Toxicities in Feed and Mitigation Strategies," the seminars featured Dr. Josep Garcia, Technical Manager at Special Nutrient, USA as the keynote speaker.

Dr. Garcia commenced his presentation on "Toxins in Poultry" by showcasing photographs of post-mortem lesions caused by mycotoxins in poultry. These images provided a clear understanding of how different mycotoxins impact various organs. He also discussed the prevalence of toxins in poultry feed and highlighted the role of Biobantox and Biobantox Plus in preventing and managing these toxicities.

In the next segment, Dr. Garcia elaborated on the significance of endotoxins in poultry production. Endotoxins, also known as lipopolysaccharides (LPS), are components of the outer membrane of gram-negative bacteria like E. coli, Salmonella, Shigella, and Pseudomonas. These bacteria are part of the poultry microbiota, and under normal conditions, the intestinal cells of poultry are less responsive to LPS. However, when antibiotics are used against these bacteria, endotoxins are released into the bloodstream, which can adversely affect poultry health and reproduction. Dr. Garcia shared in vitro and in vivo study results showing the binding efficiency of Biobantox Plus against endotoxins. He explained that endotoxins, pesticides, and mycotoxins negatively impact the immune system and overall performance of the birds. Dr. Garcia concluded that Biobantox Plus effectively binds to endotoxins, mycotoxins, and pesticides, ensuring better health and performance for poultry.

Dr. Garcia also touched on the immunosuppressive effects of mycotoxins and the consequent vaccine failures. He emphasised the importance of selecting a suitable toxin binder, cautioning against using agents like activated charcoal, which can bind essential nutrients from the feed. He recommended Biobantox Plus for its comprehensive efficacy against mycotoxins, endotoxins, and pesticides, ensuring optimal bird health and performance.

The Raipur seminar was well-attended by field veterinarians, broiler breeders, integrators, and layer farmers. The event began with an introductory speech by K.G. Anand, GM of VHPL, and was coordinated by Dr. Vishwas Sagajkar, DGM, and Dr. Hemanth Murade, DGM. The ceremonial lamp lighting was conducted by Mr. Anand, Dr. Bhindwale (GM, Phoenix Group), Govind Chandrakar, and Sanjay Bramhankar. Manish Pottdar (ZM) delivered the vote of thanks.

At Karnal, the seminar also drew veterinarians, consultants, layer farmers, broiler breeders, and integrators. Shashi Bhushan welcomed the guests, and the lamp lighting was performed by Dr. Danveer (GM, Production), Mr. Bisla, and Dr. Vishwas Sagajkar.

The seminars concluded with Dr.Sagajkar expressing gratitude to all attendees and highlighting the positive results and excellent return on investment by using Biobantox and Biobantox Plus in poultry feed.

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First Nepal-India Poultry Expo

In a recent press communiqué, Indian Poultry Equipment Manufacturer's Association (IPEMA) announced the successful conclusion of the Nepal-India Poultry International Expo-2024.

This first of its kind event between India and Nepal represents a significant milestone for the poultry industries of both countries. This event is another step in IPEMA's efforts to explore global business opportunities.

Held from 31st May to 2nd June at the Chitwan Expo Centre in Bharatpur, Nepal, the expo attracted over 75 companies and more than 6,800 visitors from across the region. The event was graced by the presence of Renu Dahal, Mayor of Bharatpur Metropolitan City.

The expo featured pioneering advancements in poultry production, with diverse representations from the feed, food, pharmaceuticals, equipment, and breeding sectors. IPEMA members proudly showcased their "Made in India" products to a global audience, highlighting the quality and innovation driving the industry.

The expo also saw participation from notable international brands from Italy, Belgium, and China, enhancing the event's global appeal.

A standout feature was the 'Poultry Pathshala,' a series of knowledge-sharing sessions that spanned three days, targeting various segments of the poultry industry. Day one catered to poultry veterinarians, academicians, scientists, nutritionists, extension officers, consultants, and farm managers. Day two focused on poultry field technicians, farmers, farm supervisors/ workers, students, early and mid-career professionals, suppliers, traders, and allied sectors. Day three continued to support these groups, addressing additional critical topics.

The date for the next Nepal-India Poultry International Expo will be determined by consensus among the Executive Advisory Committee members established for the event.

Glocrest's AGM

GLOCREST Pharmaceutical Pvt. Ltd. held its Annual General Meeting (AGM) on 17th and 18th April at Thane.

The AGM commenced with a welcome address from Dr. Ramdas Kambale, CEO & Board Member of GLOCREST. The morning session featured an inspiring training session by Dr. Richa Bhargawa from Dr. Richa's Success Solutions, offering valuable insights and strategies for personal and professional growth.

In the second part of the day, attendees participated in an engaging Spoor Training led by Tejasvi and the Spoor Team. This session focused on innovative approaches and technologies within the industry. The afternoon continued with an in-depth product training session conducted by Dr. Ramdas Kambale and Dr. Ravikumar Meshram, which provided valuable knowledge and updates on Glocrest's product offerings, highlighting their unique benefits and applications.

The second day began with a crucial session on sales review and budget planning for the fiscal year 2024-2025, led by Dr. Kambale. The zonal presentation session allowed different regional teams to showcase their achievements, challenges, and plans for the coming year.

One of the highlights of the AGM was the Award Ceremony, where outstanding performers were recognized for their exceptional contributions.

- Best Zonal Manager: Soumen Malakar from Kolkata
- Best Individual Sales Manager: Ashantu Raj from Patna
- Best Area Manager: Sugumaran Venkatasalam from Coimbatore

The awards were presented by company leaders, including Chairman, Rajesh Babu, and Board Members Nishank Kaparthy, and Dr. Ramdas Kambale.

The event concluded with a Q&A session, individual team meetings with management, and a wrap-up session.

Huvepharma Commemorates World Milk Day 2024

World Milk Day is a celebration that highlights the dairy industry's significant role in enhancing global food security, nutrition, and sustainable development. On this special day, the Huvepharma team donated fresh milk to the Maher Orphanage Home and provided dry fruit milk to everyone present. Witnessing the happiness on the children's faces was a heart-warming experience for all. The donation was a powerful reminder of the essential role milk plays in our diet.

Milk is crucial for our body's growth and development, as it is packed with essential nutrients such as calcium, protein, fats, carbohydrates, and vitamins A and D. It aids in strengthening bones and teeth while providing energy. It is hoped that this small gesture will help raise awareness about the importance of milk consumption in our community.

Heartfelt gratitude is due to India's dairy farmers for their unwavering commitment and perseverance. These unsung heroes have played a vital role in making India the world's largest milk producer. Despite facing challenging conditions, their dedication has ensured a consistent supply of milk and dairy products across the nation. Their hard work and contributions deserve applause and recognition.

8th Asia Agri-Tech Expo and Forum

The 8th "Asia Agri-tech Expo and Forum" (AAT), "Taiwan Livestock", and "Taiwan Aquaculture" was organised at the Tainan International Convention Center (ICC Tainan) from 19th to 21st June.

The opening ceremony was kicked off by the Deputy Minister of Ministry of Agriculture Hu Zhong-yi, Tainan City Mayor Huang Wei-che, and Informa Markets Senior Vice President Chris Eve.

The AAT, has entered its 8th edition since its launch in 2017. In 2024, the exhibition is moving from Taipei to Tainan for the first time, becoming Tainan's first international professional exhibition in agriculture, aquaculture, and livestock.

Tainan is located at the center of the important agricultural, aquaculture and livestock production regions in central and southern Taiwan. Over 80% of the livestock producers are situated in central and southern Taiwan, and the total agricultural output value accounts for around 2/3rd of the national total. By moving the exhibition to Tainan, it brings the exhibitors closer to the producers in the regions, making it more convenient for the central and southern professional buyers to visit and make procurement.

This year, the exhibition had 200 companies from 13 countries, exhibiting a total of over 400 booths. The new exhibitors were mostly from the agricultural and aquaculture sectors, showcasing many new products and equipment, such as lobster artificial feed, fish and shrimp sex control technology, smart drones for aquaculture, electric agriculture machinery, pineapple and banana harvesting fiber extract machines, cattle facial recognition and management systems, and automatic milking robots.

This year also marks the 400th anniversary of the founding of the Tainan ancient city, with various celebration activities held throughout the year.

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ILDEX Vietnam Attracts Global Audience

The 9th International Exhibition on Poultry, Meat Processing, Livestock, Dairy, and Aquaculture, ILDEX Vietnam was held at the Saigon Exhibition & Convention Centre in Ho Chi Minh City from 29th to 31st May.

The expo showcased over 230 exhibitors presenting technologies, machinery, and equipment for nutrition, animal health, and the slaughtering and processing of livestock and aquatic products. Participants came from more than 32 countries and territories, with international brands occupying 85 percent of the space and local innovators accounting for 15 percent. The event attracted 18,000 trade visitors from over 45 countries during its three-day run. Additionally, the conference sessions were highly successful, with over 1,600 delegates attending to explore the latest industry trends and innovations. The top visitor countries/regions included China, the Philippines, Thailand, India, and South Korea, besides Vietnam.

The three-day Business to Business (B2B) exhibition was bustling with activity as business friends and colleagues from the poultry and livestock industries worldwide met and networked. The latest innovations in agriculture and livestock technologies were on display, garnering a positive response from delegates in terms of business orders and inquiries. The Indian delegation was particularly pleased to participate in this dynamic gathering and looks forward to ongoing collaboration and growth within the industry.

Celebrating a Decade of Collaboration: Aviagen India and IB Group

Aviagen India and IB Group mark a significant milestone in their relationship with the latter's remarkable achievement of acquiring 100,000 Ross 308 AP Grand Parent stock in a single financial year. This catapults IB group to among the top five high-volume GP stock customers in Asia.

IB Group has been a partner of Aviagen since 2014 and has been receiving Parent Stock and Grandparent Stock chickens. Starting with a supply of 40,000 Ross 308 GPs, the collaboration has expanded to serve 22 states across India. With the 2015 introduction of Ross 308 AP GP birds, IB Group has grown into one of the country's leading poultry integrators, ensuring a steady supply of high-quality, nutritious, and affordable protein for Indian families. Ross 308 AP birds are known for their exceptional adaptability to diverse climatic conditions.

Over the past decade, Aviagen's customer service teams in India and Asia have worked closely with IB Group, leading to continuous improvements in the performance and welfare of Ross 308 AP birds across all breeding stages. The partnership has flourished through collaborative efforts, overcoming varied weather conditions to deliver outstanding results.

"Aviagen remains dedicated to the success of IB Group and our customers across the continent. Our India, Asia and global support teams have enjoyed working side-by-side with them over the years. We extend our warmest congratulations on this significant achievement and look forward to supporting their future expansion and accomplishments in the coming decade," commented Dr. Ramakrishna Balasubramian, Business Manager Aviagen India.

Dr. Mahendra Deshpande Joins VEGA Group

As part of its global expansion strategy, VEGA Group, China recently announced the appointment of Dr. Mahendra Deshpande as Sales Director for the Indian subcontinent. Dr. Deshpande will spearhead VEGA's business development and growth initiatives in the region, supporting the animal health and feed industry in achieving safe and sustainable production across sectors such as poultry, dairy, and aquaculture.

VEGA Group, a high-tech enterprise based in Zhejiang, China, specialises in the development, production, and marketing of functional feed additives, pharmaceuticals, food ingredients, animal health products, vitamins, premixes, disinfectants, and medical equipment. With nine production sites and plans to open 1-2 new facilities annually, VEGA boasts substantial production capacity. These facilities are certified by GMP, GMP+, ISO, FAMI-QS, KOSHER, and HALAL standards.

With core competencies in functional feed additives, pharmaceuticals, and food and animal health, VEGA has established a robust business network spanning over 80 countries. The company is dedicated to continuous innovation in technology and product development to sustain its position as a competitive global supplier.

Dr. Mahendra Deshpande holds a Master's degree in Veterinary Sciences & Animal Health from MAFSU, India, and is a certified DVM. With over 20 years of experience in operations management, sales, marketing, and various techno-commercial roles within the animal health and nutrition sector, Dr. Deshpande brings extensive technical knowledge and strategic expertise. He is known for enhancing organizational performance and unlocking new business opportunities through strategic alliances with key decision-makers.

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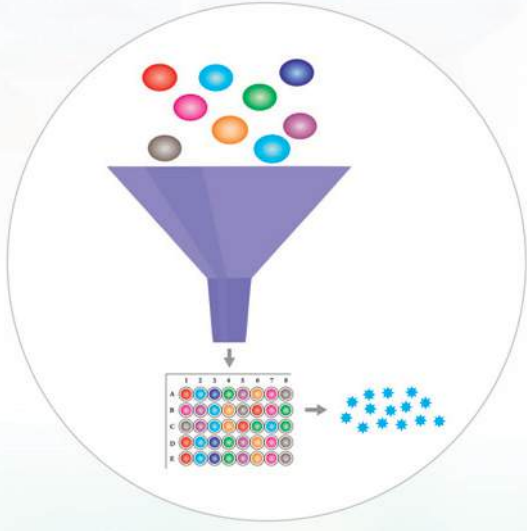

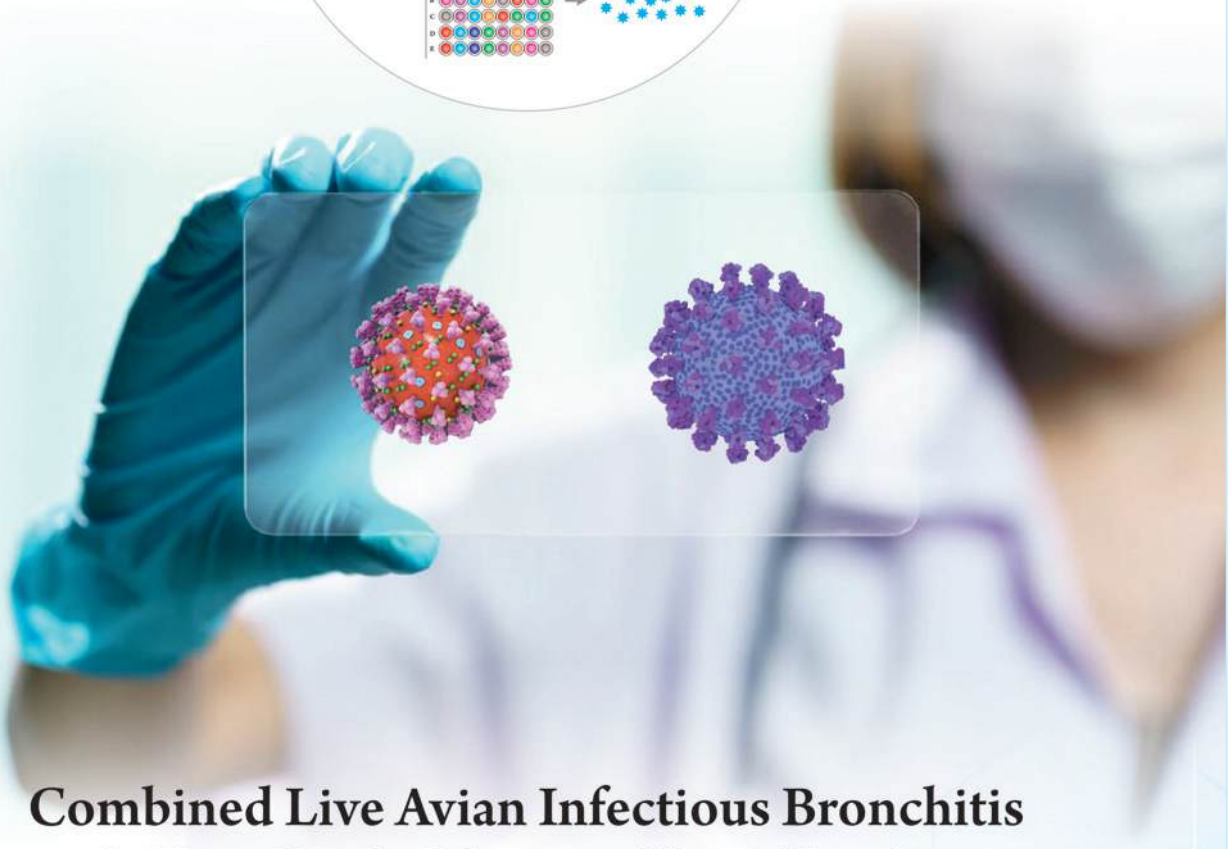

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