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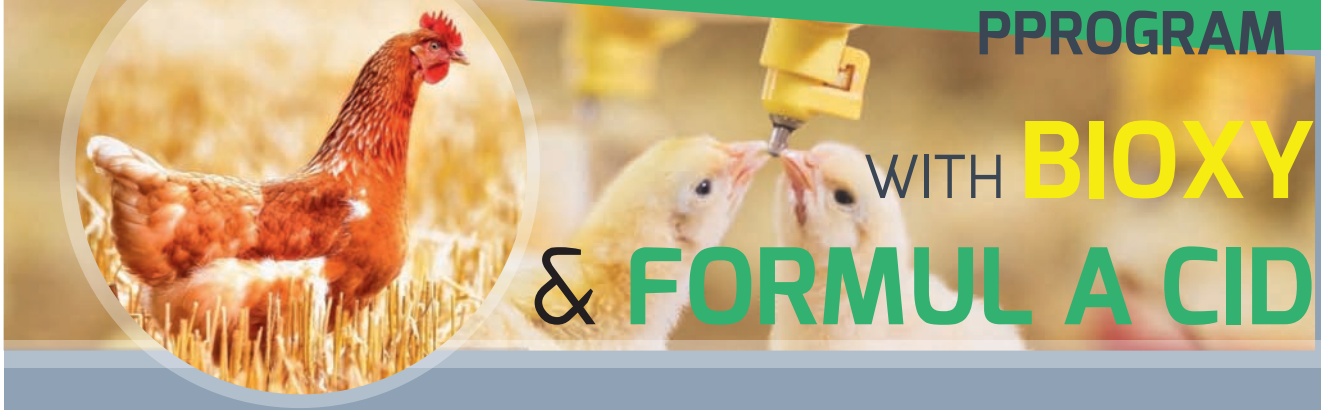

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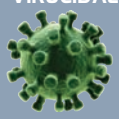

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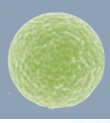

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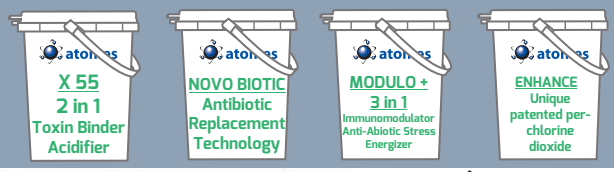

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Poultry Fortune

English Monthly Magazine
(Established in May 1991)
Volume 22 Number 5 December 2020

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Editorial & Business Office:
POULTRY FORTUNE
NRS Publications,
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Tel: 040 - 2330 3989, 70329 19554
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Website: www.poultryfortune.com

Annual Subscription
India : Rs. 800
Foreign Countries : US $ 100
or its equivalent.

Poultry Fortune will be sent to the subscribers in India by Book Post, and to foreign subscribers by AirMail.

Edited, printed, published and owned by M. A. Nazeer and published from BG-4, Venkataramana Apts., 11-4-634, A.C.Guards, Hyderabad - 500 004, India. Printed at Srinivasa Printers.
Registered with Registrar of Newspapers for India with Regn. No. 72452 / 99. Postal Regn.No. RNP/HD/1067/2018-2020.

NRS PUBLICATIONS
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Subscriptions for Poultry Fortune, English monthly, should be sent to:
The Circulation Department, Poultry Fortune, BG-4, Venkataramana Apartments, 11-4-634, A.C.Guards, Near Income Tax Towers, Hyderabad - 500 004, India. Email: info@poultryfortune.com

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Americans ate more chicken than any other protein during COVID-19 pandemic

Dear Readers,

The December 2020 issue of ***Poultry Fortune*** is in your hands.

In the News section you may find news about – A survey conducted by the National Chicken Council finds that half of Americans ate more chicken than any other protein during the COVID-19 pandemic. Throughout 2020 – as home kitchens took centre stage - Americans have been relying on chicken as a healthy and convenient protein that can be enjoyed by everyone. In fact, three-quarters (75 per cent) of Americans who eat any chicken say they prepare chicken at home at least once a week. During the past 9 months of COVID-19, retail chicken sales have increased $1.3B, up 19.5 per cent from the same period last year, according to IRI and 210 Analytics.

Stirring the 'egg debate' again, Madhya Pradesh Chief Minister Mr Shivraj Chouhan on 22 November 2020, announced that his government will be providing cow milk instead of eggs to severely malnourished children as part of the mid-day meal scheme. It would be better if stakeholders of poultry in Madhya Pradesh state ask the Chief Minister to give both Egg and Milk to the children, with which the school children will have double benefit.

A study from the University of Guelph in Canada proves that slow-growing chickens live under better welfare conditions than faster-growing breeds. The team, led by Tina Widowski, professor in the Department of Animal Bioscience, and Stephanie Torrey, adjunct faculty member in the same department, hope the results will benefit global poultry production by improving welfare standards and meat quality. Other studies show, though, that slower-growing broiler chickens are less efficient in terms of feed conversion, cost more for consumers, and create a larger overall environmental footprint.

Central Poultry Development Organisation & Training Institute, Hessarghatta, Bengaluru organized a 5 - day online Entrepreneurship in Poultry – Awareness Week (EPAW) from 23 – 27 November, 2020. The programme was planned to impart the knowledge for entrepreneurs focused on Business models in Indian Poultry, Commercial Poultry Farming and Rural Poultry Farming, Credit proposals for Bank, Government of India Schemes, and understanding of profitable poultry models, Nutrition, Disease Management and Medications etc.

In the Articles section – Article titled ***Management of Poultry During Winter*** written by Technical Team of Hy-Line International highlighted that in India, the winter season follows the rainy season and can be marked with cold weather. Winter season in India lasts between November to February. Northern India experiences the most severe cold season, where environment temperatures can drop below 15°C with night time temperatures as low as 5°C. Southern India usually experiences milder winter weather and low temperatures are not a major concern. Winter season brings unique challenges for brooding chicks. Cooler environmental temperatures can affect nutrition programs because of the bird's higher energy requirement to maintain body temperature.

Another article titled ***Raw Material Risk Management for Mycotoxins - the ever - more - challenge for Indian Poultry Producer*** written by Dr Susim Mukul Ray, Head – Technical & Promotion , Zydus AHL, highlighted that Amid concerns over a slowdown in the Indian economy during mid-Q3'19, worrying reports of economic distress from the poultry farm sector began hitting the headlines. During the period, the economic crisis in the sector owes largely to the hike of prices of raw materials viz., maize and rice bran, making upto 70-80% of feed formulation. The resulting hike in prices of poultry feed is speculated to be the highest in last 20 years.

Article titled ***Impact of Oxidative Stress*** written by Mr Kurt Van de Mierop and Dr Jesse Stoops, Nutrex NV, Belgium highlighted that Intensive livestock farming exposes animals to various stress factors throughout their life cycle such as heat stress, weaning stress, toxins, pathogens and an unbalanced diet. The process that plays a central role in all these situations is oxidative stress.

M.A.Nazeer
Editor & Publisher
Poultry Fortune

Poultry Fortune

Our Mission

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

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

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

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

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

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Japfa Comfeed's Hatchery extension project in Bali launches with second installation of Royal Pas Reform Smart™ technologies

PT Japfa Comfeed Indonesia Tbk, one of the country's leading integrated agri-food businesses, has further expanded production capacity at its hatchery in Tukadaya, Bali by installing a range of Smart™ technologies from Royal Pas Reform. The facility now has a total capacity of 32 million day old chicks per year.

The project was for 6x Smart Set Pro™- 6 setters, including Adaptive Metabolic Feedback™(AMF™) and Energy Saving Modules™ (ESM™). AMF™ fine-tunes incubation environments to the needs of growing embryos, and Energy Saving Modules™ (ESM™) reduce energy consumption.

In addition, the company has installed 6x Smart Hatch Pro™ hatchers, including Smart Watch™, Hatchery Automation and Climate Control. Smart Watch™ is a unique tool for hatch-window control, which creates ideal conditions for chicks to hatch – by optimizing the humidity and CO_2 inside the hatcher. It monitors and adjusts the hatching process automatically – from the day of transfer, through to the hatching of the last chicks – eliminating any need for human intervention.

Japfa Comfeed launched its Tukadaya operation in 2014, when it installed 12 Smart Set Pro™ setters, 12 Smart Hatch Pro™ hatchers and a full climate control system. A Smart Center™ hatchery information system was installed to monitor and record every incubation

SmartPro™ incubation technology from Royal Pas Reform, Japfa Comfeed Indonesia's Hatchery Manager Mr Mustiko Nur Setyo.

cycle. Royal Pas Reform also provided hatchery management training, together with ongoing service and technical support.

Mr Gusi Ketut Wirata, Japfa Comfeed Indonesia's east area hatchery lead, says: "We chose to extend our use of Royal Pas Reform's advanced Smart Pro™ single-stage incubation technologies to help us deliver premium quality broilers with high uniformity throughout the integration and achieve a superior retail product."

Hatchery manager Mr Mustiko Nur Setyo, has been a happy man since the installation of Pas Reform's SmartPro™ incubation technologies: "Results are superior and have exceeded our expectations in terms of hatchability percentage and chick quality", he says.

Japfa Comfeed Indonesia's core business activities include animal feed manufacturing, chicken breeding and poultry processing, as well as aquaculture farming. It already commands a significant share of the domestic poultry market and is the country's second largest integrated poultry company. It is a subsidiary of Singapore -based Japfa, which employs over 40,000 people across an integrated network of modern farming, processing and distribution facilities in Indonesia, China, Vietnam, India and Myanmar. It operates 78 poultry breeding farms, over 27 central hatcheries.

Bas Kanters, Royal Pas Reform's Sales Director, says: "We are delighted to have been involved in the Tukadaya hatchery extension project with Japfa Comfeed. It builds on the already successful business partnership we have enjoyed since we helped to launch it five years ago, and was a natural extension of the facility when the decision was made to expand its capacity. It speaks volumes to the long-term relationships we forge with our customers – based on providing the latest technologies and delivering exceptional service."

Japan's Kagawa prefecture to cull 850,000 chickens after bird flu outbreak

20 November 2020, TOKYO- Japan's Kagawa prefecture will cull 850,000 chickens at two poultry farms after the country detected a bird flu outbreak earlier this month, the local government said in a statement on 20 November, 2020.

These will be the sixth and seventh cases of the avian flu in western Kagawa prefecture and the biggest culling to be done at one time since the country's first bird flu outbreak in more than two years was found in the poultry this month, an official at the prefecture said.

Chickens at the two farms in Mitoyo city tested positive in a preliminary examination for avian influenza on 19 November 2020, after the farms had notified the prefectural government of an increase in the number of dead chickens.

The local government said it has confirmed the infection was a highly pathogenic strain of H5 bird flu from genetic tests on 20 November 2020.

The prefecture has already culled about 460,000 chickens for the past four cases, the official said.

Japan's last outbreak of bird flu occurred in January 2018, when 91,000 chickens at a farm in Sanuki city, also in Kagawa prefecture, were culled due to the H5N6 strain of bird flu, according to the agriculture ministry.

Courtesy: Reuters

Canadian researchers determine slow-growing chickens more humane

9 November 2020, Canada - A study from the University of Guelph in Canada proves that slow-growing chickens live under better welfare conditions than faster-growing breeds.

The team, led by Tina Widowski, professor in the Department of Animal Bioscience, and Stephanie Torrey, adjunct faculty member in the same department, hope the results will benefit global poultry production by improving welfare standards and meat quality. Other studies show, though, that slower-growing broiler chickens are less efficient in terms of feed conversion, cost more for consumers, and create a larger overall environmental footprint.

Fast-growing broiler chickens, which were developed over decades through selective breeding, reach a weight of about two kilograms in just 35 days. These faster-growing breeds, for the most part, have larger breast muscles and shorter legs. This has made it difficult for them to perform normal activities, and, as a result, raised concerns regarding animal welfare.

In an effort to improve welfare, Widowski and Torrey evaluated more than 7,500 chickens of 16 genetic strains bred for four growth rates, as well as other traits. Thirteen of the strains were slower growing and they were compared to three standard North American breeds.

Using wearable devices like Fitbits, they monitored mobility and activity, and used an obstacle course to test leg strength. They also monitored birds for their use of enrichment items, and examined their feet for lesion. Finally, they evaluated the fully - grown birds for meat quality.

Chickens in experimental pen from study conducted by Widowski and Torrey

"We found that, overall, many indicators of welfare are directly related to rate of growth," said Widowski, pointing to overall behavior, levels of activity and mobility, and foot and leg health.

Faster - growing birds crossed the obstacles fewer times and saw higher prevalence of footpad lesions, added Torrey. Major health issues, including skeletal leg muscle problems and heart failure, no longer prevailed in the slower - growing strains.

"That means breeder selection to resolve those problems has worked, and we hope that results of our study will set the direction for the next phase of genetic changes leading to welfare improvements," said Widowski.

The Global Animal Partnership (GAP) provided funding for the project. Their hope is that the findings will help retailers attract customers who are looking for products raised under higher welfare standards.

Torrey and Widowski are not the only researchers to evaluate slower-growing broiler production. In Belgium, Dr Evelyne Delezie, a researcher at the Institute for Agricultural and Fisheries Research (ILVO), found that slower - growing broilers have different nutritional needs. Delezie compared two breeds, Ross and Sasso. The Ross breed reached its target weight of 2.5 kilos in 40 days, while the slower-growing breed Sasso took 62 days to reach the same weight.

Overall, Delezie found that the slower-growing Sasso breed consumed 40–50 per cent more than the Ross breed. Overall body weight of the Sasso breed was 50 per cent lower. When composition was compared, Delezie found that the slower-growing breed had a higher percentage of leg meat and less breast meat.

While she contended that the slower-growing breed lived under better welfare conditions, it was not a sustainable choice when considering overall production efficiency.

Tatijana Fisher, at the University of Kentucky, conducted similar research. She was concerned about the implications of switching to slower-growing breeds, particularly with regards to feed conversion and overall meat composition. She compared two breeds, Cornish Cross, a conventional breed, with Red Ranger, a slower-growing breed.

Fisher's findings showed that the Cornish Cross carcass produces 30 per cent breast meat, while the Red Ranger carcasses produces 20 per cent. Considering consumer demand for breast meat, Fisher said it would take 9 per cent more Red Ranger birds to produce the same amount of breast meat. On top of that, to account for longer rearing times, producers opting for the slower - growing breed would need 50 per cent more housing and 97 per cent more feed.

Feed conversion was also evaluated

"We have about a 1.9 feed conversion on the Cornish Cross, which was not the best you can get off them," said Fisher. "The Red Ranger had about a 2.2, which is downright awful on some level. Still it was better than some heritage breeds, which have a feed conversion rate of about 5.5."

Fisher's research did not look at welfare parameters. Anecdotally, though, she said she didn't notice any differences in terms of mortality or other welfare-related parameters.

Slow-growth production makes up about 90 per cent of the fresh market in The Netherlands, a move that is due, in part, to a 2012 campaign from animal welfare activist party Wakker Dier (Awoken Animal). The organization was the first to introduce the term 'plofkip', which

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means 'exploding chicken' in Dutch. In the wake of the campaign, Dutch retailers announced a move to 100 per cent slow-growth breeds by 2020.

Production cost and compromise

Despite its success in terms of animal welfare, Wageningen UR economic researcher Peter van Horne said the move comes with some compromises. While slow-growing breeds are less work for producers, overall production costs are higher. Heating, catching, litter and manure disposal costs are all higher. Only overall health costs were lower. Because farmers receive a higher price for slower-growing chicken, margins are the same.

Perhaps most concerning are his findings with regards to overall carbon footprint. Slow-growth production, said Van Horne, has a 20 per cent larger carbon footprint than its conventional cousin.

"That's the dilemma," he said. "Some people say the slow-growing bird is a welfare-friendly bird, but the fast-growing is an environmental bird."

"Then you have to make a choice," he said in conclusion.

Widowski and Torrey concede that the faster-growing breeds are more efficient, but they come with trade-offs as well.

"There are implications in terms of the welfare of the bird and its overall function in terms of ability to walk, cardiovascular function and those sorts of things," said Widowski.

On top of that, the breeds they studied came in a range of growth rates, which means they were able to get insight into the welfare implications at different growth rates.

Widowski and Torrey hope that the results of their study will help breeding companies select for traits that confer better welfare, even in the faster-growing strains. Ultimately, the goal is to raise the level of welfare for all broiler chickens.

Ms Tina Widowski, Professor and Ms Stephanie Torrey, Faculty, Department of Animal Bioscience.

DNA insights could aid small-scale poultry farmers

13 November, 2020 - New findings about viral regions in the DNA of chickens could aid productivity for smallholder farms in developing countries.

Disease could be better managed in small holder flocks, thanks to key discoveries about parts of the genetic code of chickens derived from viruses.

The findings aid understanding of these elements of the genome, which are remnants of historical Avian Leukosis Virus subgroup E (ALVE) infections.

These viral sections of the genome can give rise to harmful molecules, which hamper birds' growth and productivity, but their presence can also prevent related external viruses from causing infection.

In smallholder flocks, their contribution to disease prevention may outweigh their impact on productivity, according to the research.

International study

An international team of scientists led by the Roslin Institute searched for and analysed ALVEs in the genetic codes of more than 400 chickens from villages in Ethiopia, Nigeria and Iraq.

A diverse mix of ALVE types was found across the range of birds, in the first such study to focus on non-commercial chickens. Scientists found 850 previously unseen ALVE types, trebling the number documented to date.

The study could pave the way for further research to understand the role of each ALVE in immunity against external viruses.

Such insights could help manage breeding and improve the health of flocks in low- and middle-income countries.

The study, published in Genetics Selection Evolution, was funded by the Centre for Tropical Livestock Genetics and Health (CTLGH) through a Biotechnology and Biological Sciences Research Council (BBSRC) Impact Accelerator Award and involved researchers from the CTLGH, the International Livestock Research Institute, and partners in Africa and Iraq.

Genetic diversity

In a related study, researchers described the two ALVEs found in the standard reference genome for chickens – a dataset used by scientists for research.

The ALVEs in the reference genome, taken from one undomesticated ancestor to modern chickens, do not reflect the diverse mix of ALVEs in the DNA of chickens today, researchers found. For example, one of the ALVEs in the reference dataset has not been seen in any other chicken, according to the study.

The reference sequence remains vital for the research community, however, its comparison to the genomes of modern and pre-domesticated chickens should be considered when undertaking research, scientists say.

The study, in the journal Poultry Science, was carried out by researchers led by the Roslin Institute with their commercial partner Hy-Line International from Iowa, US.

Madhya Pradesh again Discontinues Eggs from Mid-day Meals; 'Will Give Cow's Milk': Says CM

22 November 2020, Madhya Pradesh: Stirring the 'egg debate' again, Madhya Pradesh Chief Minister Mr Shivraj Chouhan on 22 November 2020, announced that his government will be providing cow milk instead of eggs to severely malnourished children as part of the mid-day meal scheme.

Mr Chouhan, when in power from 2005-2018, had refused to follow the UPA government's direction to include eggs as part of the mid-day meal school programme. The Kamal Nath government had previously introduced eggs in the mid-day meal for children in Anganwadis in October 2019. The Comprehensive National Nutrition Survey (CNNS) released in 2019, shows 54 percent of kids in Madhya Pradesh in age group of one to four years are anaemic, while stunted growth is at 40%.

Shivraj Chouhan: 'Milk instead of egg'

There are around 7 lakh to 8 lakh stray cattle in Madhya Pradesh. The state government will construct around 2,000 new cow shelters. Not all of the cow shelters will be run by the govt but NGOs will also be operating them, said Chief Minister Shivraj Singh Chouhan.

Madhya Pradesh's egg history

In 2019, Congress had announced it will be serving eggs as part of the mid-day meal for children in Anganwadis and pregnant women in Anganwadis in a serious bid to check malnutrition, as per reports. Taking offence to it, BJP argued if eggs are served in the mid-day meal, "vegetarian children" will stay away from the food served in the Anganwadis and this will result in further escalation of malnutrition. The state's women and child development minister Imarti Devi had said, "We don't care about the opposition to this scheme. All we care about is that the children get the nutrition they need."

Since then, Imarti Devi - a Jyotiraditya Scindia loyalist

- switched to BJP. During her bypoll campaign she said that 'Eggs will be given in mid-day meals to children who want it while others will be given fruits to combat malnutrition at anganwadis'. She lost her seat to Congress' Suresh Raje. Eggs have been introduced and revoked in states as per the political rule at any given time.

Naidu suggests milk be made part of mid-day meal scheme

BJP and 'egg' in mid-day meal

Inspite of the Centre's recommendation in 2013, BJP governments across India have been reluctant to include eggs into the diet of school children as part of mid-day stating 'vegetarian' diets. As per the Right to Food Campaign (2015), 13 states across the country serve eggs as part of the meals. As per reports, states like Andhra Pradesh, Maharashtra, and West Bengal perform much better among the highly populated states as they provide eggs/ bananas to children twice a week.

Meanwhile, BJP-ruled states like Madhya Pradesh, Uttar Pradesh, Assam, Karnataka, Gujarat either serve no egg or just one egg to students per week, citing religious reasons. A few non-BJP states like Punjab, Mizoram and Delhi too do not serve eggs. With 195 million undernourished in India, the National Institute of Nutrition has stated that proteins derived from egg had comparatively higher protein bioavailability of 94%, compared to vegetable proteins like Bengal gram (76%) and soya bean (54%).

Courtesy: NECC

NCC survey finds that more Americans are eating chicken during the pandemic

A survey conducted by the National Chicken Council finds that half of Americans ate more chicken than any other protein during the COVID-19 pandemic.

19 November 2020, America - Throughout 2020 – as home kitchens took centre stage -- Americans have been relying on chicken as a healthy and convenient protein that can be enjoyed by everyone. In fact, three-quarters (75 percent) of Americans who eat any chicken say they prepare chicken at home at least once a week. During the past 9 months of COVID-19, retail chicken sales have increased $1.3B, up 19.5 percent from the same period last year, according to IRI and 210 Analytics.

The National Chicken Council (NCC) unveiled the findings of a new survey fielded with the goal of better understanding chicken consumption trends and preferences in the United States. Along with a host of interesting metrics, the survey includes insight into the impact of the pandemic on chicken consumption habits, showing that half (50 percent) of Americans who eat chicken say they have eaten it more than any other protein during COVID-19.

Chicken has been popular during COVID-19 because it's easy to prepare and great for meal prepping

A staple of many diverse meals, it is no question that chicken is a versatile protein. Nearly half (48 percent) of survey respondents say they increased the amount of chicken they prepared at home during the pandemic, while 39 percent said they increased the ways they prepare chicken. No matter how Americans prefer it, chicken is an easy meal to prepare and is perfect for meal prepping, especially when we are spending more time than ever at home.

Twitter users would agree, as "chicken" has also been the most Tweeted about food during the pandemic months.

> *"Americans have been relying on chicken as a healthy and convenient protein that can be enjoyed by everyone"*

Chicken could be the way to a happy holiday, with half of Americans agreeing they'd prefer chicken to other proteins during the holidays

With the pandemic shifting many holiday plans, people are finding innovative ways to reinvent their traditional celebratory meals. Half of Americans who eat chicken at all say they'd prefer chicken to ham (52 percent) or turkey (49 percent) at a holiday meal. And more than half would eat chicken wings as part of Thanksgiving (57 percent) or Christmas (61 percent) dinner.

The NCC survey also shows 56 percent of chicken eaters would be happy to get chicken as a holiday gift. We recommend keeping it out of the stockings (for obvious reasons).

Chicken is the preferred protein

Based on the survey, it is clear Americans prefer chicken. But when it comes to other chicken decisions, Americans are split. Approximately one half (52 percent) of Americans prefer grilled chicken while the other would opt for fried (48 percent). Americans also just barely prefer boneless wings (53 percent) over traditional bone-in wings. Plus, two in five Americans say that the breast is their favourite cut of chicken, but wing (20 percent), thigh (17 percent) and drumstick (14 percent) are also fierce competitors. Three-quarters (74 percent) of chicken eaters would prefer to eat real chicken over plant-based alternatives.

"With everyone adjusting to a new way of life this year, chicken has been a reliable source of nutritious protein in an unpredictable time," said Council spokesman Tom Super. "This research shows how the hard work of the entire chicken industry during this challenging time has supported many Americans who are looking for an easy-to-prepare, affordable, and healthy meal."

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CPDO & TI organises Entrepreneurs Day

26 November 2020, Hessarghatta/Bangalore: Central Poultry Development Organisation & Training Institute under Government of India, Ministry of Fisheries, Animal Husbandry & Dairying, a premier Institute located at Hessarghatta, Bengaluru organized a 5-day online **Entrepreneurship in Poultry – Awareness Week** (EPAW) from **23 – 27 November.**

Dr Mahesh P.S., Director, CPDO&TI

The programme was planned to impart the knowledge for entrepreneurs focused on Business models in Indian Poultry, Commercial Poultry Farming & Rural Poultry Farming, Credit proposals for Bank, Government of India Schemes, and understanding of profitable poultry models, Nutrition, Disease Management and Medications etc.

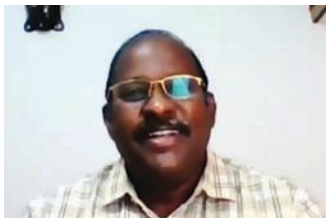
Shan Kadavil, CEO, Fresh to Home

EPAW was planned to create awareness among prospective entrepreneurs, Bankers, graduates and veterinarians across India. The schedule was very comprehensive covering all the aspects above mentioned. **Prof. P. K. Shukla, Former Joint Commissioner and Dean, DUVASU, Mathura** inaugurated the

S. Mahesha, Founder Director of My Chicken

programme on November 23 and narrated ample opportunities in poultry sector with perspective of Athmanirbhar Bharat and Vocal for Local initiatives given by Hon'ble Prime Minister.

Dr Mahesh P.S., Joint Commissioner, GoI and Director presented an overview of poultry sector



Suresh Babu, Bakhta Farms

and **Dr Krishnan** illustrated the basics and nuances of poultry farming on the first day.

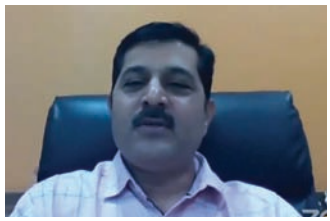
Dr Sonali Nanda and **Prof. B.S.V. Reddy,** former Dean of Veterinary College briefed the audience about management aspects and salient features of Poultry Nutrition. **Dr Baburaj,** DGM, Venkys India elaborated on common poultry diseases, medications and vaccinations followed by **Dr Lipi Sairiwal,** Assistant Commissioner GoI briefed on Government of India Schemes in poultry.

On 26 November, 2020 Entrepreneurs day was conceptualized for getting the first hand information from the hard working successful entrepreneurs in poultry sector. Concluding day on 27 November, 2020 **Dr Jeevan Sonawane,** Director, Novelvet presented on Incredible Eggs and Chicken – Facts and Myths. **Dr Mukund Kadam,** Head Poultry AICRP, Nagpur presented on

Dr Ravinder Reddy, Director, RR Foods and Feeds

various business models of Rural Poultry. **Dr Mahesh** presented on availing credit facilities in Nationalized Banks and various business models of poultry in detail as a final session.

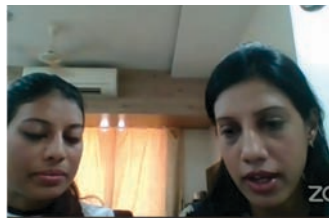
All these recordings are date wise posted on our Facebook page with the link https://www.facebook.com/cpdoti.bangalore . All are requested to browse any



Dr Ajay Deshpande, Director, Siddi Vinayaka Farms

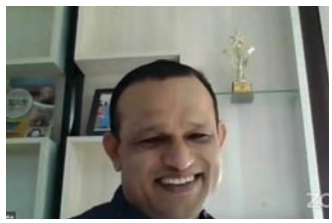
time at your convenience.

Entrepreneurs Day (26 November, 2020): The Entrepreneurs Day was inaugurated by **Mr Shan Kadavil,** CEO, Fresh to Home a Bangalore based New Age Marketing Company claims to be largest vertically integrated platform in online marketing of Meat



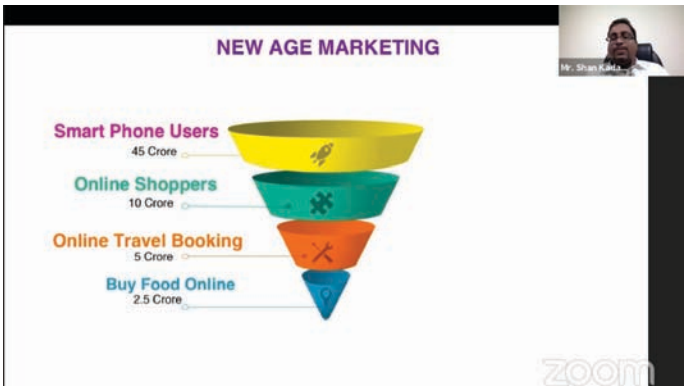
Lavita and Vanessa Dalgado, Premium Chick Feeds Ltd

and Fish in the world. **Mr Shan,** a multifunctional leader, former Indian head for Zinga (US company), Vice President, Support dot com (US) and Chairman of Debaux Technologies honored with "Best top 100 Tech Indians", Most promising Entrepreneur of 2019 and also honored with Champions of Change by Hon'ble Prime Minister of India. Shan participated in World Economic Forum.



Dr Harekrishna Deka, CEO, National Small Scale Poultry Development Trust

This inspirational leader presented in his inaugural address about opportunities of new age marketing with 2.5 crore online food buyers. He briefed for the future entrepreneurs to be optimistic, celebrate failures in shortest times come back with a differentiated game plan to achieve success. Further, he mentioned that poultry sector should focus on showcasing products beneficial to humankind with "Immunity" concept being built-in. He narrated



the nice innovative way of branding Haldi powder and Moringa by the US companies smartly marketing at abnormal prices.

Dr Ajay Deshpande, Director, Siddi Vinayaka Farms, Pune narrated his Entrepreneurship journey from being a former employee of a private company to the owner of his own company. He acknowledged the role in confidence building and unraveling potential of himself by his life partner to achieve the present status. "The success from any Entrepreneur involves hard work, listening to gut feeling, burning desire never give up attitude, listening to mentors and keeping anecdotes and quotes by the side during crisis for the path to success".

Dr Ravinder Reddy, Director RR Foods and Feeds, Hyderabad elaborated on diversification in his entrepreneurship journey of 3 decades being a owner of RR labs and consultancy, Contract research firm, medicine marketing and finally presently RR foods and feeds with broiler breeding farms and branded products under the brand name "Doctor Chicken". He cautioned the entrepreneurs that unplanned diversification can end up in failures. However, sticking to one plan is also not an option for the entrepreneur.

Mr Suresh Babu, Bakhta Farms, Bangalore being a mechanical engineer and owner of successful ventures of layer farming in Karnataka, elaborated in detail practical tips for a successful layer farm. This included Cardinal Thumb rules at Chick stage, Grower and layer stage and presented a hub model with a recommendation of single breed farm, quality control testing, manure management, data collection and analysis and motivated work force being part of his success. He acknowledged the contributions of Dr B.V. Rao and NECC for the growth of poultry sector in India.

Dr Harekrishna Deka, CEO of National Small Scale Poultry Development Trust, first of its kind organization built by tribal women force of about 20,000 women from Madhya Pradesh, Jharkhand, Maharashtra, Assam and Odisha. In his presentation he acknowledged the spirit of women force that too tribal women transforming from a wage earner to a

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owner or stakeholder of the trust. NSPDT presently is the largest broiler producers in Jharkhand and Madhya Pradesh and entering into other five states of India with a turnover of 500+ crores producing 30 lakh broilers per month. Their model involves smaller units of 500 broilers and 300 layers raised at a neighborhood of tribal villages with a three tier structure producer societies to cooperatives and to the federation. The NSPDT has won almost all the awards for the NGO and not for profit category in India. Dr Mahesh, Joint Commissioner GoI wished NSPDT under the leadership of Dr Deka to create "Amul" kind of revolution in poultry sector with the inspiration of Milk Maha Man, Dr Kurian.

Ms Lavita and **Ms Vanessa Dalgado** the next gen of the founders of Premium Chick Feeds Ltd., Pune narrated ample opportunities of leadership role for the women in poultry sector which was otherwise dominated by men. They mentioned that they are self motivated to join the organization established by their parents from grassroots to the level of 2000 crore business as on date. By their joining to the group they have motivated 25 women to join along with them in the company. The level of confidence and professionalism both the sisters expressed is nothing less than any male counterparts. They are committed in building the organization to the next level by product development, branding and quality chicken outlets across the country.

Mr S. Mahesha, founder director of My Chicken and More started his career in a poultry company and moved on to become an entrepreneur and established his own enterprise. His bold and courageous initiatives of establishing large format retailing shops similar to MRP shops are highly inspirational and thought provoking. In 2020 My chicken and more established largest 2500 sqft retail shop for chicken, fish and meat products along with culinary items in the shop. Dr Mahesh and other panelists expressed real surprise and appreciated his courage and confidence in his business. Dr Mahesh wished him to establish still bigger formats of retailing similar to Decathlon.

The entrepreneurs day programme has become a platform for showcasing entrepreneurs across the value chain in poultry sector. The programme is well received in both zoom and facebook with a viewership crossing 2000 for the day. **All presentations of the speakers can be viewed at our face book page posted on 26 November, 2020.**

Sri Anwar Basha, Senior faculty of CPDO&TI executed the job of admin of conducting EPAW very effectively. The other team members of CPDO&TI worked hard in making this programme successful.

The entire programme was live broadcasted on CPDO&TI facebook: www.facebook.com/cpdoti.bangalore. All the recordings of 5 days are uploaded on the same day as a ready reference for the facebook visitors.

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Covid-19 disrupts Bangladesh's Poultry sector

The Bangladesh Poultry Industries Central Council (BPICC) expects the supply and demand mismatch for poultry to continue for the remainder of 2020.

6 November 2020, Bangladesh - The BPICC saw a huge discrepancy in the early days of the Covid-19 pandemic with a 12 year low in prices which has so far only partly recovered. The current situation is seriously undermining the livelihoods of Bangladesh's millions of backyard poultry farmers and small traders.

More than 6 million people in Bangladesh are either directly or indirectly involved in poultry production. The commercial sector has expanded rapidly with commercial poultry farms growing at a rate of 15% a year, providing a significant pathway for the country's economic development and an increasingly important means of providing its people with nutrition. Poultry farming has also long provided a well-trodden path out of poverty for many.

Researchers at the One Health Poultry Hub Bangladesh work closely with chicken farmers and wanted to find out to what extent the sector has been affected by the Covid-19 crisis. The main focus was on how the pandemic and control measures were affecting the production, distribution and consumption of chickens and eggs. A group of 36 chicken farmers, traders, feed, medicine and chick suppliers, and others involved in Bangladesh's chicken production and distribution network were interviewed between early April and early May 2020. The research findings illustrate the very serious impact that Covid-19 has had on this important and growing sector.

Damaging rumours about livestock transmission

In Bangladesh, the first human case of SARS coronavirus-2 was detected on 8 March. By the time lockdown was announced on 26 March there were 39 reported cases. To prevent human-to-human transmission, preventive measures were quickly introduced, including social distancing and controls on people's movements, the closure of food outlets, factories and markets, and the reduction of domestic and international transport.

Rumours, particularly on social media, that the SARS coronavirus could be transmitted to people through livestock and livestock products, combined with the new lockdown measures, caused serious damage in the country's various poultry production and distribution networks. For example, poultry farmers stopped receiving necessary supplies, such as day-old chicks, poultry feed, vaccines and medicines, and the lack of consumer demand – caused by fears based on the unfounded rumours as well as people's reduced incomes and their inability to access markets – meant they could no longer sell their market-ready birds at the desired prices. One medium-sized broiler farmer we interviewed said: "Never in the last 10 years have I ever experienced this kind of critical situation. I cannot sell mature broilers to middlemen, even at BDT80-90/kg (US$ 0.95-1.06) while my production cost is more than BDT100/kg (US$ 1.20)."

With some help from NGO Dwip Unnayan Songstha (DUS), poultry farmer Reshma Begum made a good living from poultry. Covid-19 has put a severe strain on earnings in Bangladesh.

Farmers suffer economic losses

Farmers have suffered serious economic losses as a result. Preliminary research findings show that by the end of April approximately 70% of small to medium-sized broiler farms had temporarily stopped farming and trading. Although by June, half of these farms had restocked with day-old chicks, albeit on a smaller scale due to the uncertainty surrounding the likelihood of further losses.

The plight of farmers in turn significantly affected the business of poultry traders, large poultry companies, poultry feed companies and pharmaceutical companies. A follow-up study in June showed there had been a 30-45% reduction in day-old chick production, a 35-40% reduction in poultry feed production and a 40-50% reduction in the sale of medicines and other pharmaceutical products. In April one hatchery manager told the researchers: "The market price of day-old chicks has dropped below the production cost. Now, the selling price for day-old chicks is BDT4-5 (US$ 0.047-0.05), while it was around 35BDT (US$ 0.4) before Covid-19. Our production cost is around BDT30-32 (US$ 0.36-0.38). So, we had to reduce day-old chick production from 13 million a week to 7.5-8 million."

Price fluctuations for poultry meat and eggs a constraining factor

Since the pandemic, farm eggs have been selling at up to BDT4-5.5 (US$ 0.046-0.065) each at farm level in Bangladesh, against production costs of at least BDT6 (US$ 0.07). The average price of a farm egg was BDT7-8 (US$ 0.08-0.09) before the pandemic. The

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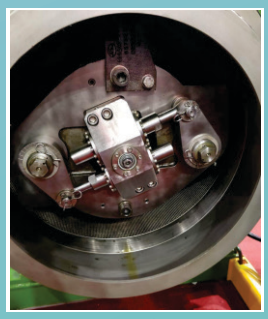

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production cost per kilo of broiler meat was BDT95-100 (US$ 1.17-1.18) while post-pandemic farmers had to sell wholesale for only BDT65-70 (US$ 0.77-0.80). Farmers who run their farms by taking credit from the feed dealers have fallen deeper into debt.

Local newspapers have reported that prices of both chicken eggs and meat hit a 12-year low in April. The Bangladesh Poultry Industries Central Council (BPICC) is expecting the supply and demand mismatch for poultry to continue for a minimum of 6 months.

In the 2nd week of May, the price of poultry meat and eggs increased as a result of supply disruptions and demand for the Eid al-Fitr (one of the biggest Muslim festivals) and, according to the state-run Trading Corporation of Bangladesh (TCB), chicken broiler prices increased by an average of 45% in the 4 days between 20-23 May as Bangladeshi poultry producers had stopped production in March and April due to low demand. All of which had worsened the situation. Such rapid price fluctuations for poultry meat and eggs are making it increasingly difficult for farmers and traders to cope with the crisis.

Livelihoods of backyard poultry farmers and small traders threatened

The current situation is seriously undermining the livelihoods of Bangladesh's millions of backyard poultry farmers and small traders. About 90 % of rural Bangladeshi households keep poultry, the practice being recognised as a major route out of poverty, particularly for poor, landless women. In April, BPICC anticipated that with no improvement in the Covid-19 situation, more than 2 million people in the poultry industry would become unemployed in the next couple of months.

The Bangladesh government has acted to support the country's farmers with measures during the period of the pandemic, including support from the Department of Livestock Services (DLS) and the Ministry of Livestock and Fisheries (MoLF) for the distribution and marketing of eggs and poultry, along with MoLF support for the early release of imported poultry feed materials and pharmaceutical products from the docks. The government has also announced a stimulus package of Tk 5,000 crore (US$ 595 million) to provide financial assistance to small and medium-sized farmers in rural areas to boost agricultural production further to the fallout caused by Covid-19.

However, government support alone will not be enough to repair the damage suffered by farmers, while there are also complexities linked to the implementation of the stimulus package. A simple but efficient way for farmers to benefit from the package needs to be put in place. Large poultry companies and UN organisations should also come forward. There are no quick solutions to the challenges faced by the poultry sector in Bangladesh during the Covid-19 pandemic. The One Health Poultry Hub Bangladesh believes that what the sector now needs is a short, medium and long-term plan to tackle the crisis, said Dr Rashed Mahmud, One Health Poultry Hub Bangladesh.

Chicken and egg sales likely to reach the pre - Covid levels by March

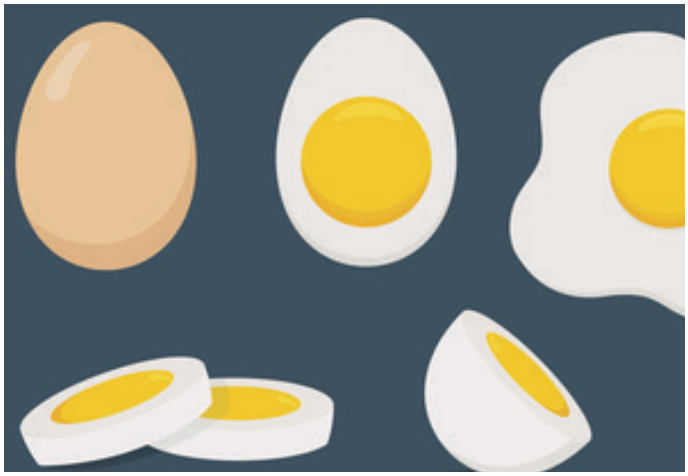
"Chicken sales and production are back to about 75%, eggs to 80% and by March we will reach the pre-Covid level," said Mr B.S. Yadav, MD, Godrej Agrovet, an animal feed company whose poultry arm, Godrej Tyson Foods, sells fresh and frozen chicken.

3 December 2020, New Delhi: Chicken and egg sales in the country have recovered significantly and are likely to reach the pre - Covid levels by March recovering from a battering the industry received on account of the pandemic and subsequent lockdowns that forced farmers to stop operations, industry executives said.

"Chicken sales and production are back to about 75%, eggs to 80% and by March we will reach the pre - Covid level," said Mr B.S. Yadav, Managing Director, Godrej Agrovet Pvt Ltd, an animal feed company whose poultry arm, Godrej Tyson Foods, sells fresh and frozen chicken.

The revival is driven by household demand while there is some improvement in sales to hotels and restaurants, Yadav said.

This has helped push up prices that had dived through the early phase of the pandemic, said Mr Surinder Kumar Bhutani, Chairman for Delhi zone of the National Egg Coordination Committee (NECC).



"There is a 30% increase in the egg prices in the last six months. We have come a long way from organising chicken festivals where were selling it at discounts and even free to the current prices of Rs 85 - 90 a kg. Prices will touch Rs 110 - 120 a kg by March. Looking at the good returns, even farmers have gradually

started opening the production of broiler and eggs," Bhutani said.

Low prices in March prompted many farmers, traders and manufacturers to stop operations.

Suguna Poultry Farms' chairman B Soundararajan said sales were up to 85% to 90% of the pre Covid levels. "There has been a good increase in home consumption which will further rise in the winter months," he said and added that stable prices of maize and soya bean meal too will help farmers to increase production.

Prices of maize have come down from a high of Rs 24 a kg last year to current prices of Rs 14 to Rs 17 per kg in different markets of Odisha and Bihar, said Mr Sunoor Kaul, Director, Origo Commodities, a trading company. "At Rs 14 - 15 a kg, maize is attractive for stocking for returns and margins," Kaul said, according to a report published in The Economic Times.

Singapore greenlights the sale of lab-grown chicken meat

Singapore has given the US start-up Eat Just its first regulatory approval to sell lab-grown chicken meat.

2 December 2020, Singapore: According to *Reuters*, Eat Just calls the lab-grown meat "clean meat" and stresses that it does not come from slaughtered animals. The meat, to be sold as nuggets, will be priced at premium chicken prices when it first launches in a restaurant in Singapore "in the very near term", co-founder and CEO Josh Tetrick said.

Demand for alternatives to regular meat is surging due to concerns about health, animal welfare and the environment. Plant-based substitutes, popularised by the likes of Beyond Meat, Impossible Foods and Quorn, increasingly feature on supermarket shelves and restaurant menus.

But so-called clean or cultured meat, which is grown from animal muscle cells in a lab, is still at a nascent stage given high production costs.

Singapore, a city state of 5.7 million, currently only produces about 10 percent of its food but has set out ambitious plans to raise that over the next decade by supporting high-tech farming and new means of food production.

Josh Tetrick said the San Francisco-based firm was also talking to US regulators but that Singapore was a "good bit" ahead of the United States.

"I would imagine what will happen is the US, Western Europe and others will see what Singapore has been able to do, the rigours of the framework that they put together. And I would imagine that they will try to use it as a template to put their own framework together," he said in an interview.

The Singapore Food Agency said it had reviewed data relating to process, manufacturing control and safety testing before granting approval.

Eat Just said it will manufacture the product in Singapore, where it also plans to start making a mung bean-based egg substitute it has been selling commercially in the United States.

Founded in 2011, Eat Just counts Hong Kong tycoon Li Ka-shing and Singapore state investor Temasek among its backers. It has raised more than $300 million since its inception, Tetrick said, and is valued at roughly $1.2 billion.

It is targeting profitability at an operating income level before the end of 2021 and hopes to go public soon after, he added.

Globally more than two dozen firms are testing lab-grown fish, beef and chicken, hoping to break into an unproven segment of the alternative meat market, which Barclays estimates could be worth $140 billion by 2029.

Competitors have also attracted some eye - catching investors.

U.S.-based Memphis Meats raised funds this year in a deal led by Japan's Soft Bank Group and Temasek, and also counts Bill Gates and Richard Branson among its backers.

Singapore's Shiok Meats, which aims to become the first company to sell lab-grown shrimp, is backed by Henry Soesanto of Philippines' Monde Nissin Corp, which also owns Quorn.

Courtesy: NECC

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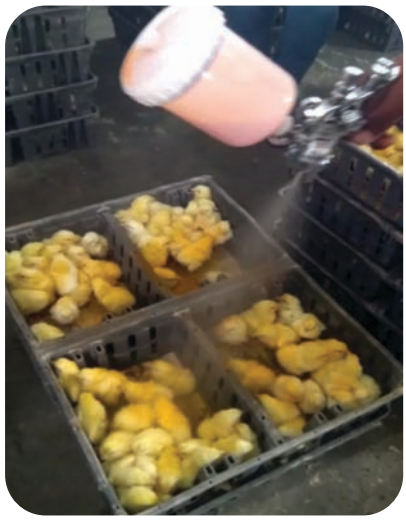

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Fly Management: Surveillance and Control

Technical Team of Hy - Line International

INTRODUCTION

Fly infestations pose a significant challenge for poultry operations. Whether concentrated in a pit system, holding shed, or on a litter floor, poultry manure is an ideal medium for fly reproduction. Large fly populations can cause discomfort, stress, and decreased production in egg-laying chickens, pullets, and breeders. Flies also serve as a vector of both bird and human diseases. In extreme cases, failure to control flies may result in poor community relations or even litigation. Fly control and prevention is essential for success in the rearing and production of egg - laying chickens.

Figure 1. Musca domestica.

FLY BIOLOGY AND ECOLOGY

A basic understanding of the life cycle of flies and their interaction with their environment is important for developing strategies to reduce their impact. The following is focused on the house fly (*musca domestica*), a major pest on poultry farms.

Health Risks of Flies

Flies are known to be vectors for many diseases of both humans and livestock, and are considered a sign of unsanitary conditions. Flies may transmit disease by carrying viruses, bacteria, parasites, and fungi on their bodies, or through their mouth- parts after contacting or ingesting infectious materials. Chickens may eat flies at any life stage, and can become infected by ingesting the insects or by direct contact. Fly populations may also create a reservoir for disease on poultry farms, making disease treatment and elimination more difficult.

Disease	Health Risk?	
	Chicken	Human
Avian Influenza	Yes	Yes
Botulism	Yes	Yes
Coccidiosis	Yes	No
E. Coli	Yes	Yes
Newcastle Disease	Yes	Yes
Roundworms	Yes	Yes
Salmonellosis	Yes	Yes
Tapeworms	Yes	Yes

Figure 2. Diseases of risk associated with flies.

Figure 2 outlines several major diseases of concern for poultry that flies may carry, though there are many more[2, 3, 5, 6, 8, 9].

Life Cycle

Flies pass through four distinct life cycle stages: egg, larva (maggot), pupa, and adult fly. The lifespan of flies from egg to adult is usually 2–3 weeks, but can vary depending on environmental factors including temperature, and be as long as 3 months under cool conditions. Figures 3 and 4 give an overview of these life stages[9].

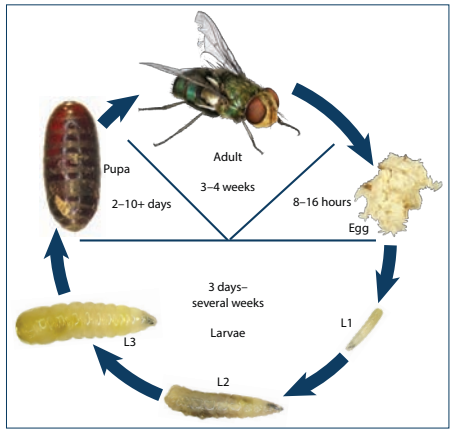

Figure 3. Life cycle of the fly.

Life Cycle Stage	Life Span	Key Features
Egg	8–16 hours[1]	• White, shiny, and difficult to see with the human eye • Laid in damp organic material (e.g. manure, garbage)
Larva	3 days– several weeks	• Account for 80–90% total fly population in most infestations. • Progress through 3 different phases ("Instars") as they eat and grow.
Pupa	2–10+ days	• Encased in reddish-brown exoskeleton. • Adult fly emerges within days depending on environmental conditions. • May remain dormant in soil/substrate under extreme weather conditions for extended periods of time.
Adult Fly	3–4 weeks	• Grey-black, winged insect, 6–9 mm long • Rest on horizontal surfaces when not eating or reproducing. • Females may lay 700+ eggs during life.

Figure 4. Life stages of the fly.

Breeding Sites

Flies reproduce and lay their eggs in rotting, decayed, or fermenting organic matter (e.g. garbage, manure, etc.) with moisture content between 50–85%. Fresh poultry manure has approximately 75–80% moisture content, making it highly desirable as a medium for development of fly populations[5].

Diet

Fly larvae have chewing mouth-parts, and consume any rotting organic material in their environment. Adult flies have sucking mouth-parts (proboscis), and must consume food that is already in a liquid state, or can be dissolved by their acidic saliva. Eggs and pupae stage flies do not eat, and survive entirely on stored energy[9].

Figure 5. Flies breeding.

Behavior and Distribution

As with diet, the behavior and distribution of flies varies by life-stage. Eggs are laid in organic material with 50–85% moisture content. Larvae remain in this environment, burrowing into the material. They must remain near the surface where conditions are moist, and they have access to oxygen. Their only activities are feeding and hiding. As the larvae mature they seek out drier material, and dig deeper beneath the surface (1–3 cm)[9].

After the adult fly emerges it is mainly active during daylight hours when it breeds and eats. Adult fly populations may have an activity range of 0.8–3.2 km (0.5–2.0 miles). They can travel much further by "hitching a ride" in a travelling car or truck. At night and any time when they are not eating or breeding, adults are considered at rest, or "roosting." Adults roost on any stable surface they can find (floors, walls, ceilings, furniture, plants, fences, garbage cans, etc.), preferring locations close to breeding or feeding sites. They may also adapt their activity somewhat to artificial lighting schedules5, [9].

Adult flies are most active at temperatures between 20–25°C (68–77°F) with low humidity. At higher temperatures (greater than 95°F/35°C), they will spend more time resting, and may prefer to be outdoors. At temperatures below 10°C (50°F), adult flies and pupae may remain alive, but dormant9

MONITORING

Systematic monitoring of fly populations helps in decision making about when and where to deploy insecticides. It also can provide for a legal record in the event of a public health or nuisance complaints relating to flies originating from the farm. A consistent and reliable fly surveillance method provides a more accurate reference point for fly numbers than simple observation of adult flies.

Figure 6. Examples of fly speck cards from a manure pit. Date, location, and number of spots are marked on card fronts.

Sticky fly tape is inexpensive and may help with identification of fly species. Hanging of tape in the aisles of chicken houses must be done strategically in areas where flies are more likely to circulate (such as near manure belts, or water lines), or fly numbers may appear lower than they really are.

Additionally, tape may become clogged with dust making them ineffective within just a few days. An alternative use of is to take a moving tape count;

walking a routine area of likely fly activity in each house (304 m/1,000 ft), while holding tape and counting the number of flies caught.

Figure 7. An egg with many fly spots indicates a fly problem.

Fly speck cards are another inexpensive means of fly monitoring (Figure 6). White index cards (8x12 cm/3x5 in) can be hung from the ceiling or rafters of the manure pit and other fly resting areas. Fly specks (brown spots left when flies land on the cards) are counted weekly.

Figure 8. Flies are attracted to feed. This reduces feed efficiency for the flock and increases the risk of contamination.

Fifty spots/card per week is a standard beyond which fly treatment with bait and residual adulticides is called for. 100 spots / card per week or more indicates use of a contact adulticide. Cards should be checked and changed at least once a week, but may need to be screened and changed more often if fly numbers are high. Cards should always be strategically positioned in the same location. Cards are easily dated and filed for record - keeping purposes.

Fly traps can be hung from wire or placed on the floor of manure pit. Traps should be checked and bait replaced at least once a week. Traps are more costly to set up and change than speck cards, but they kill flies and allow for identification of fly species.

Screening for larvae in the manure pit is as important as monitoring for adult flies. The manure pit should be walked daily to screen for wet spots or areas where flies are visibly concentrated. Manure can be dug up to look for eggs and larva just below the surface. This provides an opportunity for precise application of larvicide and manure drying chemicals. Daily manure production covers treated areas, necessitating regular inspection of the pit[6, 9].

FLY CONTROL STRATEGIES

Developing an effective fly control program is important for the success of any poultry operation. The most successful programs combine multiple control methods with diligent monitoring to minimize the economic and health threats posed by flies.

Sanitation

Manure management is the single most important aspect of fly control in poultry operations. Drying manure to less than 50% moisture content makes it a poor environment for fly reproduction. The manure pit must be walked daily to screen for fly blooms and wet spots. When wet spots are found the source of excess moisture needs to be identified and corrected. Common sources include leaking water lines,

condensation from faulty insulation, improper ventilation (drying failure), and leaks from outside. Ventilation of the manure area with exhaust fans and air-circulating fans in the manure pit is important to aid in manure drying. Both indoor and outdoor manure and feed spills should be minimized and cleared as soon as they are noticed.

Dead birds, as well as cracked, dirty, and floor eggs should be disposed of quickly and securely as far from the chicken house as possible.

Maintain clean office, entry, and break areas. Clearing grass, weeds, and clippings near the facility's perimeter or in nearby features like drainage ditches eliminates potential outdoor fly resting areas[5, 6, 9].

Structural Defenses

Maintenance of biosecurity barriers prevents outdoor flies and other pests from entering bird areas. Look for and seal cracks and breaches in the barn and connected structures such as feed bins and manure load out sheds. Doors should be opened only when absolutely necessary.

Generally, enough force is produced by exhaust fans in the chicken house or manure pit to prevent flies entering against active airflow.

However, when fans are not running they provide an ideal access portal for flies to enter the building. Fan louvers should always be closed to prevent flies entering the building when fans are off. If exhaust fan louvers, or any other area, must remain open for passive air- flow, the opening should be screened with a fine, securely installed mesh.

Physical fly traps placed near major access points can attract flies away from breeding areas. Baited traps can be made from jugs, cans or buckets and placed near portals or hung from the rafters of the pit. Sticky fly tape is less expensive and may serve the same purpose.

Both of these traps also can be used for fly monitoring, but must be regularly checked and replaced to remain effective. Electro cuter light traps ("bug zappers") are effective, but costly, and are therefore of greater value in human working (offices, egg sorting rooms, etc.) and egg storage and transfer areas[6, 9].

Biological Defenses

Maintaining populations of other organisms that compete with or prey on flies can help to compliment other elements of a fly control program. Special attention must be paid in selecting which species to use for fly-control so as not to introduce a new pest. For example, hister beetles are well-known predators of fly eggs, and dump flies can successfully outcompete house flies, but both of these species can still carry and transfer poultry diseases. Certain mites thrive in poultry manure (*Macrocheles muscae domesticate and Fuscurooda vegetans*) and feed on fly eggs and larvae, but care must be taken not to confuse them with other mite species that are parasitic to chickens. Parasitic wasps can be purchased commercially, and introduced near fly breeding areas. When they emerge, they will seek out fly pupae and lay eggs inside them, killing the fly at this life stage. Large fly populations can quickly overwhelm biological control methods, so they should always be used in conjunction with other strategies2, 3, 8. In integrating parasitic wasps into a control strategy, it is important to be aware that many knockdown adulticides will also kill the wasps.

In addition to insects, microorganisms that harm flies may be introduced into the farm system. The bacterium Bacillus thuringiensis causes disease in flies, but not chicken or people. Where available, it may be spread on chicken manure directly, or fed through the chicken as a feed additive[7].

Chemical Control

There are four basic types of chemical insecticide fly control: larvicides, residual adulticides, baits, and contact adulticides.

Larvicides include contact larvicides and insect growth regulators (IGRs). They may be sprayed onto maggot infested areas directly, or, when manure is very wet, may be applied as a dry granule.

Residual adulticides are sprayed on surfaces where newly emerged flies are likely to rest. Residues may last from

TABLE A: LARVICIDES FOR FLY CONTROL

Class	Active Ingredient	Example Brands
Insect Growth Regulator (IGR)	Cyromazine	Flynexx, Larvadexx, Neporex

TABLE B: INSECTICIDES USED FOR RESIDUAL TREATMENT IN FLY CONTROL

Class	Example Brands
Organophosphates	Durashield, Rabon
Pyrehtroids	Lambda, Optashield, Stanguard, Tempo
Permethrin	Permacap
Imidacloprid	Credo, Exile

TABLE C: INSECTICIDES USED IN TOXIC BAITS FOR FLY CONTROL

Class	Compounds	Example Brands
Neonicotinoid	Imidiacloprid	Quickbayt
	Nithiazine	Quik Strike
	Thiamethoxam	Agita
Carbamate	Methomyl	Golden Malrin
Ryanoid	Cyantraniliprole	Zyrox

TABLE D: KNOCKDOWN INSECTICIDES FOR FLY CONTROL

Class	Example Brands
Permethrin	Permectin, Pyranna
Pyrethrin	BP-100, BP-36, Riptide, Microcare

days to months depending on the product, and the surface it is applied to (porous surfaces like wood may absorb the chemical rapidly).

Examples of residual adulticides by class are outlined in Table B. **Follow local regulations regarding the use of fly control products in poultry facilities.**

Baits will attract flies and can be used in traps or as spot-on treatments indoors and outdoors. Some neonicotinoid, ryanoid, and carbamate class baits are outlined in Table C.

Contact adulticides can be fogged, misted, or sprayed as a last resort when other control measures fall short. These are generally pyrethrin or permethrin class products. Refer to Table D for example contact adulticides[2, 4, 5, 6, 8, 9].

Resistance and Rotation

Unfortunately, overuse of popular insecticide products over the years has led to the development of resistant fly populations. Rotation of the product used can help reduce the likelihood of resistance emerging. When rotating products changes should be made on the basis of chemical class (e.g. organophosphate or pyrethroid) rather than the brand.

Precise use of insecticides can help to reduce the development of resistance, as well as reduce the cost of treatment. Overuse of insecticides in manure areas may kill helpful biological defenders against flies. An effective monitoring program can guide decisions about precise and prudent insecticide applications[1, 2, 8].

Human Health Risks

Always read and follow the manufacturer's instructions for safe handling and personal protection whenever handling insecticides. Have appropriate gloves, goggles, clothing, footwear, respiratory protection, and any other personal protective equipment (PPE) indicated by the chemical's safety labeling. When in doubt, request an SDS (safety data sheet) from your vendor or supervisor.

In addition to direct human and animal health cautions, insecticides and cleaning chemicals may contaminate birds or eggs, rendering them unfit for consumption. For example, the chemical fipronil, present in some insecticides, can be passed into eggs if ingested by or applied on chickens. Be certain to use only products labeled for use around chickens in areas where bird contact is possible.

FLIES OF THE WORLD

House flies tend to predominate in poultry regions of the United States, but other species like the ones below may be more common in other areas of the world.

Figure 9. Blow fly.

Figure 10. Garbage fly.

Figure 11. Lesser house fly.

Figure 12. Soldier fly.

Figure 13. Stable fly.

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SAMPLE FLY CONTROL PROGRAM

The following is a generalized program for a deep pit layer house, but should be adapted to the unique regional and structural component of a layer or layer breeder operation. Always follow all local regulations for chemical application and handling in bird areas8.

1. A farm culture of biosecurity, sanitary maintenance of the premises, and regular inspection and maintenance of manure holding areas should be instituted and practiced by all farm personnel and support staff.
2. Fly speck cards are placed throughout the house, work areas, and egg holding area. Check at least once/week. If there are 50 fly specks/card or more proceed treat with a residual adulticide. If there are 100 fly specks/card or more, deploy a contact adulticide.
3. Spot treat all areas where maggots are present in litter piles (e.g. wet spots) with a selected larvicide every 1–3 weeks during peak fly season.
4. Apply fly bait or place baited traps every 3 m (9 ft) in the manure pit at the start of the peak season or during cleanout. Replace bait weekly as needed.
5. Apply a selected residual adulticide to vertical surfaces in the pit areas. Do NOT apply directly to litter piles. Repeat every 2–4 weeks during fly season. Repeat every 6–8 weeks during colder months.
6. Apply the same residual adulticide as in (5) to all outdoor surfaces where flies are observed resting. Repeat every 2–4 weeks.
7. In cases of large adult fly blooms, or if fly numbers are at 100 fly specks/card/week or more, A fogged pyrethroid contact adulticide should be used.
8. Rotate class of adulticide used between each flock, OR if fly numbers have not declined after application of a contact adulticide as in (7).

CONCLUSION

Fly control is a daily activity in egg layer facilities. Depending on season, fly numbers can reach critical levels in a matter of days if adequate measures are not taken for prevention. Flies are a major irritant to chickens, as well as those working with them. They also harbor and carry diseases that impact both birds and people. Reducing fly numbers enhances bird performance and improves food safety.

Management of Poultry During Winter

Technical Team of Hy - Line International

In India, the winter season follows the rainy season and can be marked with cold weather. Winter season in India lasts between November to February. Northern India experiences the most severe cold season, where environment temperatures can drop below 15°C with night time temperatures as low as 5°C. Southern India usually experiences milder winter weather and low temperatures are not a major concern. Winter season brings unique challenges for brooding chicks. Cooler environmental temperatures can affect nutrition programs because of the bird's higher energy requirement to maintain body temperature. The effects of decreasing photoperiod and light intensity during the winter can affect sexual maturity, resulting in delays in egg production. Poor air quality can occur as farmers close curtains to maintain house temperature. Cool air slows down the drying of manure, leading to increased ammonia levels within the shed and can increase the fly menace. Poor air quality and cooler temperatures can increase the disease threat during the winter season.

Table 1. Weather Conditions in Different Regions of India during Winter

December Month Average	North India (New Delhi)	Central India (Mumbai)	South India (Hyderabad)
Maximum temperature °C	23°C	32°C	28°C
Minimum temperature °C	9°C	19°C	15°C
Average humidity %	62%	58%	57%
Average hours of sunshine per day	7 hours	8 hours	8.5 hours
Management attention	High priority	Medium priority	Low priority

Source:https://www.currentresults.com/Weather/India/temperature-december.php

The following intervention strategies should be considered during winter season:

Brooding and Growing Management:

1. Chick brooding requires special attention during winter. Brooding shed arrangements should be ready before 48 hours of chick placement. This is important because it will take a longer time to preheat the chick's environment during the winter season. Ensure the shed and equipment is heated to 35°C environmental temperature. Relative humidity should be maintained between 40–60%.
2. Be aware of low night time temperatures during the winter season. Cold stress usually occurs during the night and early morning. Maintaining proper chick brooding temperatures throughout the night can be challenging in the winter season. This is especially difficult for farmers using charcoal heaters or other sources of heat without thermostatic control. Thermostatic control of brooding shed temperatures is highly recommended to avoid cold stress during the nighttime. Low nighttime temperatures can chill chicks, which can impair their growth and organ development. Cold stressed chicks are more susceptible to infectious diseases. Use a thermometer that is capable of recording nighttime temperatures in the brooding shed.

Figure 1. Brooding management.

3. Frequently observe the activity of chicks and adjust temperatures to the comfort of the chicks. Chicks should be distributed evenly inside the cage. Under cold stress the chicks are huddled in groups, not eating and drinking and with less activity. For more information on W-80 brooding management, refer to the "Growing Management of Commercial Pullets" technical update at www.hyline.com.

Figure 2. Monitoring chick temperature using an infant ear thermometer.

4. An infant ear thermometer can be used to measure the vent temperature of chicks. This gives a good indication of the comfort of the chicks and correlates well with the chick's core body temperature. The normal vent temperature in chicks should be 39.4–40.5°C.
5. During the brooding period, place starter crumble feed on the cage paper for first 3 days to encourage feed consumption. Cage paper blocks cold drafts of air. For infrared beak treated (IRBT) chicks, place starter crumble on the cage paper for first 7 days. Checking chicks for the presence of feed in the crop helps understand feed consumption. The presence of feed in the crop is a good indication of a proper chick start (see Figure 3).

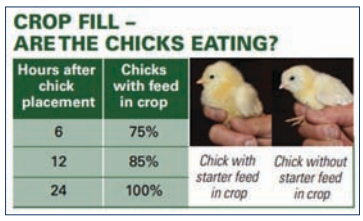

Figure 3. Desired crop fill percentages.

6. During peak winter where environment temperature drops below 10°C, the drinking water temperature drops close to freezing. Drinking water temperature has a direct effect on the bird's feed and water consumption and slows body weight gains in growing chicks. Poor water consumption can also increase mortality related to dehydration and gout. The ideal water temperature to maintain good feed intake is 18–21°C.
7. The shortest day length of the year falls on December 21st. The shortest day length in India ranges from 10 – 11 hours, with North India having the shortest among all regions (see Table 1). The ideal hours of light during the rearing period for the W-80 is 11 – 12 hours. Rearing lighting hours need to be maintained at recommended levels for pullets in order to achieve ideal body weight

gain and sexual maturity. This will be done by following the Hy-Line International / Srinivasa Farms Lighting Program Generator. This is an Excel tool which creates lighting programs appropriate for the farm location and shed style (open or EC shed). These customized lighting programs can be provided to commercial customers with their chick placements. For further information, see https://www.hyline.com/ViewFile?id=d14081e1-8af8-49f1-a752-71720d4b5680 or contact Srinivasa Farms' technical service team or Hy-Line India's technical service team.

8. Provide adequate ventilation in brooding house for 24 hours in the winter. Do not close the brooding area too tightly while maintaining brooding temperatures during the winter. Always provide a continuous supply of fresh air to the birds by maintaining some opening of the curtains. The minimum ventilation rate during the winter must be sufficient to remove moisture and prevent the build-up of noxious gases in the brooding area. Ammonia greater than 25 ppm is harmful to chicks and can promote respiratory disease outbreaks. Coal heaters are commonly used in India as a heat source in brooding sheds and they produce large amounts of carbon dioxide (CO_2), carbon monoxide (CO), and other undesirable gases inside the house. It is recommended to have a minimum opening (one foot) at the top level of the curtains to provide minimum ventilation even during nighttime. During the middle of the day, the side curtains can be adjusted according to temperature and chick comfort.
9. Allowable levels of gases at the bird level in the shed are: ammonia (NH_3) <25 ppm; carbon dioxide (CO_2) <5000 ppm; carbon monoxide (CO) <50 ppm.
10. Bird transfers from brooding to rearing sheds and rearing laying sheds should be completed no later than 7 weeks and 16 weeks, respectively. Timely transfers give the birds enough space to continue proper growth and development and enough time to adjust to the new environment. During the peak winter season, schedule transfers to occur during mid-day when the temperature is more comfortable for the birds.

Layer Management:

1. Feed intake is generally higher in winter months as a result of increased demand for energy to maintain body temperature. Protein and amino acids should be balanced based on the actual flock feed consumption. Overconsumption of energy, protein and amino acids beyond the recommended level can lead to deposition of extra fat which predisposes bird to fatty liver / hemorrhagic syndrome (FLHS), as well as increases egg weight. Energy requirements tend to be slightly higher during winter, so it is important not to decrease the energy levels at the same proportion of the feed intake increase. See the W-80 flock book provided by Srinivasa Farms for the nutritional recommendations of the W-80.
2. Increased feed intakes during winter could lead to increased egg weights. Overconsumption of energy, methionine + cystine, other digestible amino acids, linoleic acid, and total fat can directly increase egg size. Egg weights should be monitored every week during winter and appropriate adjustments to the diet made to control egg weight.
3. Stone grit management may help in controlling feed intake and maintains eggshell quality if egg weights increase. Vitamin D supplementation during winter may be needed due to poor brightness of sunlight. Follow the W-80 recommended levels of vitamin D3 (3,300,000 IU per ton of feed – Rearing and laying phases).
4. Decreasing the feed particle size of less than 700 microns and including fibrous ingredients to the feed formulation is the best way to control feed intake.
5. In addition to shorter day length, foggy conditions with lower light intensity are common in winter. Average hours of sunshine are less during winter months (November to February). North India records the lowest hours of sunshine compared to other regions (see Table 1). Increased use of curtains during the winter to protect birds from cold stress blocks sunlight and further reduces the light intensity inside the shed. With lower brightness inside the shed, it is good practice to use the house lights to maintain recommended light intensity (30 lux) inside the layer shed.
6. Keep light intensity optimum by cleaning dirty bulbs and replacing faulty bulbs. This work should be done before the arrival of winter.

Figure 4. Lowering the curtain at the top creates better ventilation.

7. Adult laying birds are also susceptible to cold stress. In open-sided laying houses, it is recommended to use side curtains to protect birds from direct exposure to cold stress. The side curtains are managed in such a way to protect birds from cold stress as well as to provide minimum ventilation to remove excess ammonia buildup. Curtains should be allowed minimum opening (one feet) at the top level of the shed even during nighttime, and during the middle of the day, partial opening at the side can be practiced based on bird comfort (see Figure 4).
8. Decreasing day length during the winter may delay pullets from coming into egg production. Timely shifting of the flock to the laying shed and on-time light stimulation at the correct body weight (1100g with 85% uniformity) prevents a delayed start of egg production. A timely transition from the developer or pre- lay diets to the peaking diet ensures that egg production begins properly, avoiding egg production delays.
9. Cold air slows down the drying of manure and removal of moisture from the shed. This can cause excess ammonia gas build-up in laying sheds in the winter. High ammonia is also caused by nipple leakage and lack of ventilation

due to closed side curtains. This problem will be more pronounced in farms where the height of the manure is close to bird level. Remove manure and replace faulty nipples prior onset of winter to avoid conditions of high ammonia.

10. Cold weather and reduced air quality favors multiplication of pathogens, especially respiratory pathogens. Incidences of avian influenza, Newcastle disease, Gumboro (IBD), fowl pox, colibacillosis (E. coli), infectious coryza, gangrenous dermatitis, salmonellosis, and coccidiosis are more common in winter. Following good winter management with good biosecurity and timely vaccinations to control disease outbreaks.
11. Vaccinations should be carried out in the daytime during peak winter (December and January) when the temperature is ideal. In case of water vaccination, water holding time before vaccination should be increased from 30 minutes to 1 hour since water consumption is normally lower during winter. Water volume used for water vaccination should be matched with actual water consumption.

Management Chart:

Management Practices	North India Farms	Central India Farms	South India Farms
Brooding management	High attention	Medium attention	Medium attention
Water management	High attention	Medium attention	Low attention
Feed management	High attention	Medium attention	Medium attention
Lighting program	High attention	Medium attention	Low attention
Ventilation	High attention	Medium attention	Low attention
Manure management	High attention	Medium attention	Medium attention
Disease control	High attention	High attention	High attention
Bird transfer	High attention	Medium attention	Medium attention

Raw Material Risk Management for Mycotoxins - the ever - more - challenge for Indian Poultry Producer

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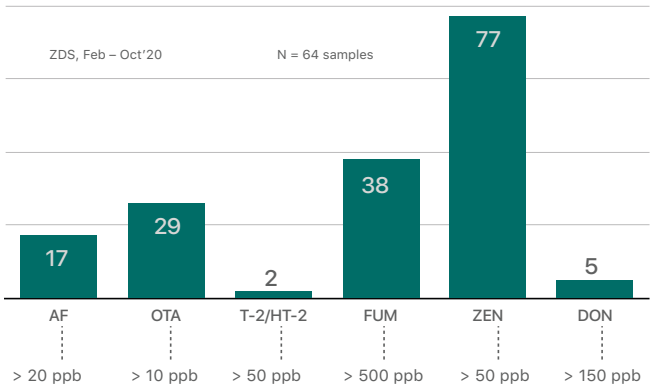
Amid concerns over a slowdown in the Indian economy during mid-Q3'19, worrying reports of economic distress from the poultry farm sector began hitting the headlines. During the period, the economic crisis in the sector owes largely to the hike of prices of raw materials viz., maize and rice bran, making upto 70-80% of feed formulation. The resulting hike in prices of poultry feed is speculated to be the highest in last 20 years. Short rainfall in preceding year affecting agriculture production is thought to be pivotal in precipitating the crisis. The odyssey of economic crisis was worsened by COVID 19 pandemic, until Q3'20, the reeling sector began spurting back to life with drastic reduction of maize and rice bran price –– heaved a sigh of relief!

The economic growth in sector usurped the crisis apparently, while looming challenges of mycotoxicosis inflicted serious headaches to the farming community. Raw materials, especially the new strain of maize, registered higher mycotoxin levels as compared to previous year leading to various unprecedented complications in field –– poultry productivity.

At Zydus AHL, our team of experts continuously strive to identify these stressors, analyse, and find right solution for the farming community. In next section, the retrospective analysis of mycotoxin levels in raw materials and finished feed studied by our laboratory is presented.

Fig 1. Contamination % of raw materials with various levels of mycotoxins in feed samples



AF = Aflatoxin, OTA = Ochratoxin A, T-2/HT-2 = Type A Trichothecenes, FUM = Fumonisin, ZEN = Zearalenone, DON = Dioxynivalenol

Fig 2a. ZEN level in feed samples

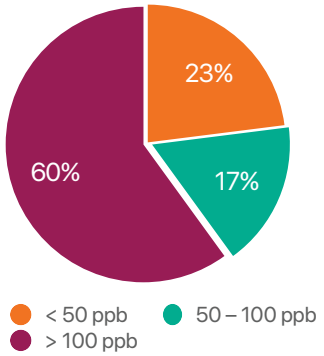
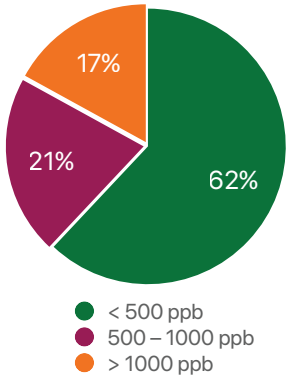
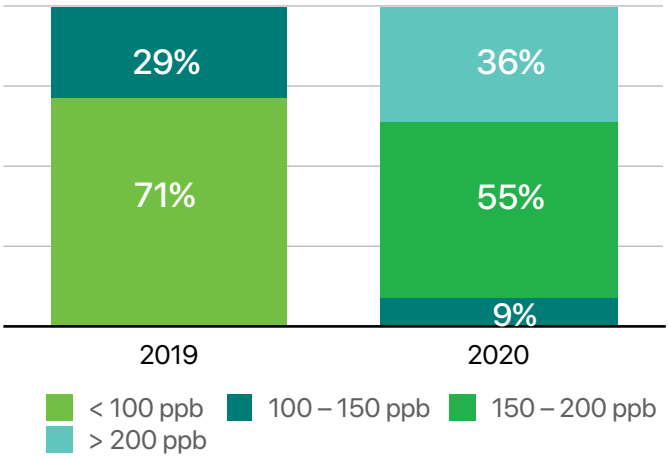


Fig 2b. FUM level in feed samples



Total 64 feed samples were analysed during Feb – Oct'20 and showed very high levels of ZEN and FUM (Fig 1). 77% feed samples had registered ZEN level > 50 ppb, while 38% feed samples had FUM level > 500 ppb (Fig 2a & 2b).

Fig 3. Comparison of ZEN level in maize (2019 vs. 2020)



N = 50 maize samples in 2019 and 2020

A comparison of 50 maize samples for ZEN level in 2019 and 2020, respectively clearly highlights significantly higher contamination in 2020. In 2019, only 29% maize samples had registered ZEN level > 100 ppb, while all maize samples (100%) had ZEN level > 100 ppb in 2020 (Fig 3). Such higher ZEN level in association with FUM had visible implications on poultry productivity, as will be discussed in forthcoming sections.

Besides higher ZEN level in maize/finished feed, the co-occurrence of more than one mycotoxin – multiple mycotoxicosis had far reaching detrimental effects primarily because of the synergism existing across different mycotoxins. It means that mycotoxins exert ill-effects at significantly lower concentration than alone resulting in lowering of their threshold limits in feed e.g. ZEN level upto 500 ppb can be tolerated by broiler breeder hens while chronic consumption of AF + ZEN or ZEN + DON at 20-&-50 ppb or 50-&-150 ppb, respectively may have deleterious effect on hatchability and egg shell quality.

% Co-contamination of different mycotoxins in feed samples > 20 ppb (Fig 4a) and > 50 ppb (Fig 4b)

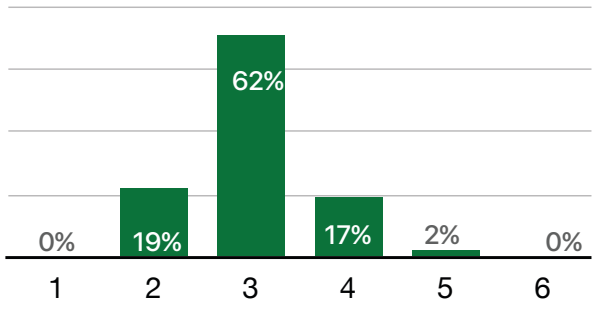


Fig 4a

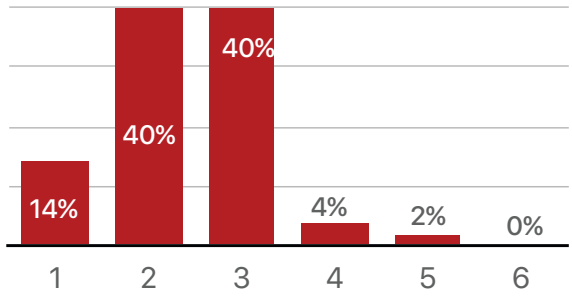


Fig 4b

N=64 Samples; ZDS, Feb - Oct'20

In 2020, our laboratory data on mycotoxin analysis showed that 46% and 81% feed samples were co-contaminated with 3 or more mycotoxins >20 ppb and >50 ppb, respectively (Fig 4a & 4b).

Zearalenone (ZEN), one of the most prevalent estrogenic mycotoxins, is mainly produced by *Fusarium* fungi and has been proven to affect the reproductive capacity of poultry. Exposure of poultry to ZEN is a global public health concern because of its toxicity and wide distribution in poultry feeds, carry over effect in egg and meat, and being stable/unaffected by feed/food processing conditions (150 °C for 44 h). Biotransformation of ZEN carried out by poultry liver leads to the formation of two metabolites: α-zearalenol and β-zearalenol. All ZEN forms are estrogenic, with the α-zearalenol being the highest. It has synergistic effect with Aflatoxin (AF) and Dioxynivalenol (DON), while additive effects with Fumonisin (FUM).

In 2020, higher levels of ZEN along with other mycotoxins (AF, FUM, DON, and OTA) in maize/finished feed samples were correlated with poultry production trend and following were our observations.

Egg laying hens (Breeder/ Commercial layer)	Commercial broiler
Reduced egg egg production (3 - 8%)	Inflammation of bursa –– bursitis (Feb – Jun'20) - Fig 6a & 6b
Fluctuation in egg production	Increased incidence of Gumboro disease (July – Oct'20)
Poor eggshell strength	
Watery albumin	
Reduced egg size –– Fig 5	

Fig 5. Reduced egg size (right egg); normal size egg (left); Zearalenone and Fumonisin level in layer feed was 220 ppb and 540 ppb, respectively; condition reversed with broad spectrum toxin binder (AntaFerm® MT80 @ 1 kg per MT feed)

Fig 6a & 6b. Inflammation of bursa in commercial broiler flock at day 26. Flock registered mean 4500 (IDEXX) IBD titer suggesting seroconversion against vaccination only. The Zearalenone and Fumonisin level in starter feed was 260 ppb and 640 ppb, respectively.

Controlling multiple mycotoxicosis, especially ZEN, FUM and DON, is challenging for poultry producer as they are pre-harvest mycotoxins and are extremely stable in feed processing conditions. Moreover, they are produced by same genera of fungi viz, Fusarium spp., and presence of one mycotoxin e.g. ZEN potentially increase the contamination risk of other mycotoxins e.g. FUM and DON. Therefore, two way approach in checking the menace of multiple mycotoxicosis is recommended.

- First, eliminating the growth of Fusarium fungi by mould inhibitors. Combination of buffered organic acids (SCFAs) and formaldehyde (ZanitizerTM) is very effective and ensures feed sanitisation before consumption by poultry.
- Secondly, pre-formed mycotoxins should be adsorbed completely by combination of inorganic and organic adsorbents before they are absorbed by chicken GI tract. Mycotoxin adsorbents (Bentonite, β-glucans, MOS, Diatomaceous earth, etc.) ensure that the mycotoxins are not bioavailable in systemic circulation after consumption by chicken. In this context, the right choice of mycotoxin adsorbents is critical. Mycotoxin like ZEN is non-polar in nature and require organic adsorbent (e.g. β-glucans) for effective binding in chicken GI tract, while AF (polar) requires inorganic adsorbent (e.g. Bentonite). Furthermore, the prevalence of mycotoxins vary widely, spatially and temporally (as we have shown for ZEN level in 2019 vs 2020), and therefore, ideal mycotoxin binders for poultry use should incorporate adsorbents dedicated for both polar and non-polar mycotoxins for optimum protection.

In conclusion, multiple mycotoxicosis is a serious threat to poultry producers. These mycotoxins exert synergistic and additive action in combination and, in most part, work in significantly lower concentration in combination capable of causing deleterious effect on poultry production and significant financial losses.

Impact of Oxidative Stress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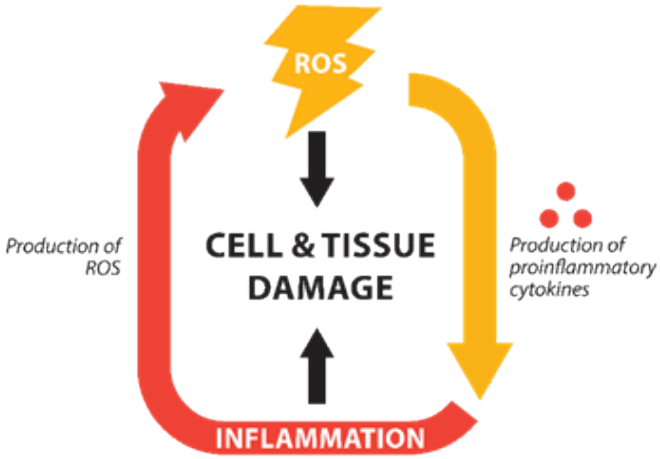
Intensive livestock farming exposes animals to various stress factors throughout their life cycle such as heat stress, weaning stress, toxins, pathogens and an unbalanced diet. The process that plays a central role in all these situations is oxidative stress. Oxidative stress is caused by reactive oxygen species (ROS), which can find their origin in exogenous and endogenous sources. ROS are highly reactive molecules capable of damaging macromolecules such as lipids, proteins and DNA. The oxidation of these components damages the cells to the extent that it leads to cell death and ultimately to tissue damage.

Inflammation



Reactive oxygen species initiate an intracellular signaling pathway inducing inflammation and the production of pro -inflammatory cytokines. Depending on the concentration of ROS the inflammation is either regulated or exaggerated. On the other hand, ROS are part of the inflammation process to combat infectious pathogens and contribute to the normal immune defense of the animal. Indeed, at the site of injury and inflammation, immune cells produce and liberate a high amount of ROS to destroy the pathogen, ultimately leading to oxidative stress. Thus, inflammation and oxidative stress are pathophysiological events that are tightly linked with one another. One of them may appear before or after the other, but when one of them appears the other one is most likely to follow and further aggravates the first. Both processes induce cell and tissue damage and take part in the pathogenesis of many chronic diseases.

Reduced gut health

Despite the protective barrier provided by the mucosa, the gastrointestinal tract remains prone to ROS attack as it harbors many potential sources of ROS. Reactive oxygen species can compromise the gut barrier by disrupting the tight junction proteins resulting in an increased intestinal permeability and facilitating the translocation of toxins (endotoxins, mycotoxins …) and pathogens. In addition, animals experiencing oxidative stress exhibit reduced villus height and crypt depth, decreasing the nutrient absorption surface.

Liver and kidney injury

The liver and kidney are organs that are highly vulnerable to damage caused by ROS. Like the gut, the liver and kidneys have tight junctions forming barriers that are compromised during oxidative stress. A variety of liver cells are highly susceptible to oxidative stress, leading to altered hepatic cellular function, inflammation and fibrosis. Oxidative stress not only triggers hepatic cell damage by inducing irretrievable alteration to lipids, proteins and DNA but more importantly, modulates pathways such as gene transcription, protein expression, cell apoptosis and liver cell recovery. These pathways regulate important processes in the liver and control normal biological functions. With regard to the kidneys, ROS invade the renal tissue and degrade key structures in the kidney involved in the excretion of a variety of waste products produced by cellular metabolism into the urine.

Decrease in performance

Oxidative stress influences animal performance significantly. The induced inflammation, together with the repair of damaged tissues requires energy and redirects nutrients away from production processes, resulting in economic losses for farmers. Moreover, pro -inflammatory cytokines suppress appetite resulting in a reduced nutrient uptake for production purposes.

Managing Fully Beaked Flocks

Due to changes in customer sentiment, restrictions on beak treatment practices have been introduced in some countries and are being considered by many others. Full (untreated) beaks are obligatory in European Union organic flocks, and this practice is being voluntarily extended to more barn and free range flocks on a customer by customer basis.

Management of fully beaked flocks requires more consideration and input relative to beak-treated flocks. The following document outlines areas which should be considered by farm managers, nutritionists, and health professionals.

There are key factors to consider in managing fully beaked flocks.

- Pullet quality
- Lighting
- Ventilation
- Environment
- Feeding system management
- Nutrition and diet nutrient specifications

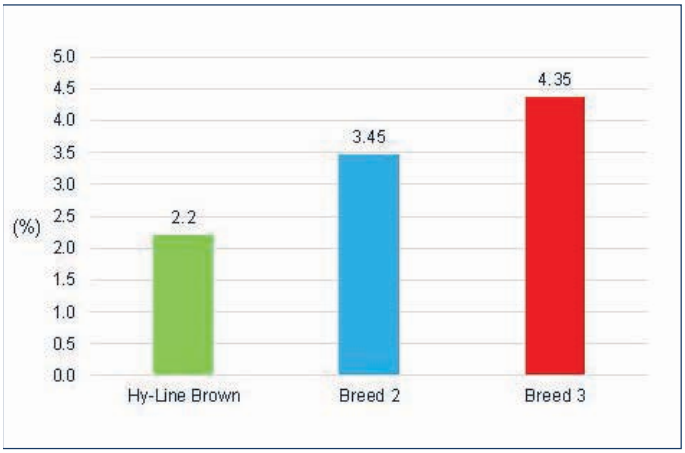


Figure 1. Mortality (%): Average of two fully beaked flocks (50.4 weeks in lay).

PULLET QUALITY

The goal for rearing flocks with full beaks is to transfer the hens with excellent feather cover, good behavioral attributes, good body weight, and high body weight uniformity with good overall body condition. The better overall condition a pullet flock is going into transfer, the better its behavior and feather condition will be throughout the lay period.

While management is a critical component of success for fully beaked flocks, genetics also plays a role. Hy-Line varieties have been bred to be particularly calm, sociable, and tend not to express aggressive behavior during stress events. In a recent set of both internal and university studies[1,2] assessing the performance of non-beak-treated flocks, Hy-Line Brown resulted in significantly lower mortality relative to other breeds (Figure 1).

Rearing can have a significant impact on the behavior of the birds later in life. Sociable birds in rear tend to stay sociable in the laying period, while those flocks that exhibit anti-social behavior in rear tend to maintain this behavior in lay.

Factors contributing to good flock behavior:

- Uniformity: Good uniformity will correspond with better flock cohesion and behavior.
- Feather cover: A poorly feathered bird at point of lay is more prone to stress during the laying period. Factors that contribute to feather quality include proper growth, nutrition, disease, management, overall stress, and uniformity. Pullets undergo three molts to transition from chick down to adult feather cover. To achieve the best feathering, the pullets must be healthy and free of stress for the duration of feather growth.
- Environmental conditioning: Hens that are less excitable due to external stimuli will be less stressed and more sociable.

Rearing Recommendations:

- Ensure there is adequate provision of litter at all times through rear. An inadequate amount of litter in rear can result in feather pecking behavior later in lay.
- Condition pullets in rear to audio and visual stimuli. Mechanical noises such as initiating the feeding system is a good way to condition the bird to spontaneous noise. Use of a radio in the rearing house will familiarize birds to sounds. Flock managers should walk frequently inside the house among the birds to accustom them to human contact. Changing the color of clothes and footwear frequently will also help condition birds to visual stimuli.
- Adapt rearing birds to the equipment and furniture used in the laying house. Provide adequate perches/slats in the rearing house and use the same feeding system as that used in the laying house. Chain feeding systems are often used in free range and aviary systems as they are associated with less feed selection and wastage, so introduction of this system in the rearing house aids familiarization.
- Enrich the bird's environment with perches, elevated platforms with feed and water, foraging material, pecking blocks and dust baths. These enrichments can prevent feather pecking and should be introduced at an early age (Figure 2).

Figure 2. Use of an elevated platform in a rearing house

- Stock birds at recommended rates to provide sufficient feeder, drinker, and floor space to minimize social stress.
- Achieve optimal body weight, conditioning, and uniformity by the end of the rearing period. Body weights should ideally be 100–150 g above the breed recommendation at 18 weeks with 85% uniformity.

LIGHTING

The pullet lighting program is essential in supporting overall body weight and feather growth in rear. There are three main components toany lighting program: the initial step-down, the constant period, and the stimulation.

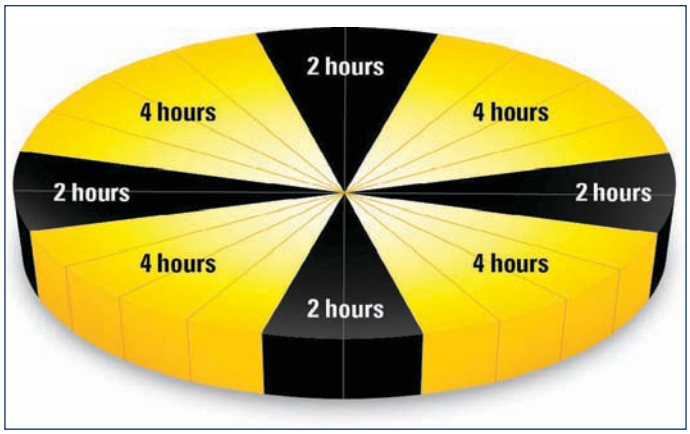


Figure 3. Intermittent lighting program for chicks.

Intermittent Lighting and Step-Down

An intermittent lighting program for chicks should be used from 0–2 weeks of age. This program provides (Figure 3) cycling of light and dark periods, which provides the chicks periods of rest throughout each 24-hour period. The resting and activity behaviors of the flock are synchronized.

As chicks have not yet developed a circadian (24-hour) rhythm, the intermittent program can be modified to fit the farm's work schedule. The recommendation is to provide between 3 and 6 dark periods, ranging from 1 to 2 hours each, which can be adapted for flocks exposed to natural light during the day.

Light intensity from 0–3 days of age should be 40–50 lux, reduced to 25 lux by the end of the intermittent lighting program. Reduce intensity to 10–15 lux no later than 4 weeks of age and continue until up to 2 weeks prior to stimulation.

Lighting must be LED and flicker-free to minimize stress:

- 3000–5000 Kelvins in rear
- 2700–3000 Kelvins in lay

After the conclusion of the intermittent lighting, provide 18 hours of constant light with 6 hours of dark and start the step-down portion of the lighting program. Utilize a slow step-down program to reach 10–12 hours day length by 10 to 12 weeks of age.

Constant Lighting Period

- **Day length:** Consistent day length starting at 10 or 12 weeks until stimulation. The duration of consistent day length is predicated on the history of the farm, season, and the time of natural light that will be present by 16 weeks of age. A longer consistent day length will allow for more feeding opportunities and will enhance growth if needed for warm weather or challenging conditions. The body weight goal for fully beaked flocks is at least 5% above standard. If birds are not 5% above target by 8 weeks of age, adjust the lighting program to allow for a longer consistent day length. Ensure the period of consistent day length is a minimum of 3 weeks after the step-down is complete.
- **Lighting type and intensity:** To limit the stress at transfer, match the lighting programs (duration and intensity) and type of lighting (e.g. LED) in both rear and lay houses. Maintain the same light intensity for the first 3–4 days after transfer to allow the birds time to adapt to the new environment. After this period, implement the laying lighting program. Exposure to some natural lighting in the rearing house can help to customize birds to natural lighting if this is stipulated in the laying house (Figure 4.)

Stimulation and Lay House

- Stimulate hens based on achieving the target body weight. The Hy-Line Brown should be stimulated no lighter than 1350 g and no earlier than 15 weeks of age. Delaying light stimulation until 1500 g may help increase average egg weights. Use a 1 or 2-hour initial stimulation. The goal is to reach 15 to 16 hours of total light by 24 weeks of age.
- Adapt light intensity to the behavior of the hens, although interior light intensity may be controlled by local legislation. The recommendations are 20–30 lux at the level of the feed troughs or litter floor in aviaries. Hens might be exposed to much greater levels with windows, curtains, or free-range access. Lower light intensity inside the shed will help calm birds if necessary.
- Ensure that direct light does not shine into the nest box area and it is safe for birds to lay eggs without intrusion by other birds. Injurious pecking of the vent can occur in the nest when the vent is temporarily protruded after laying an egg.

Figure 4. Natural daylight in rearing and laying houses.

VENTILATION

A poorly ventilated environment increases stress and leads to feather pecking behavior. When ammonia levels in a laying house exceed 15 ppm, the incidence of feather pecking increases by 10%. Similarly, as CO_2 levels increase by 100 ppm, the incidence of feather pecking increases by 15%.

The ventilation system should be effective in removing CO_2, ammonia, moisture, dust, and excess heat from the house environment. As every house ventilates differently, it is

strongly recommended to consult a specialist to ensure that the ventilation system is operating optimally.

Negative air pressure ventilation systems are managed so that air is drawn from side inlets to the roof, where incoming air mixes with warm air and then circulates down through the house. This provides a homogeneous air temperature within the house and avoids cold air dropping from the air inlets directly onto the litter area, creating damp areas.

Positive pressure houses push exhaust air through vents and pop holes, preventing cold, damp air in winter from entering the house and causing wet litter.

Natural ventilation systems (Figure 5) rely on thermal buoyancy. Birds generate warm air, which rises and is released through a ridge vent. As warm air exits, fresh air from outside the building enters the house via side inlets. Natural ventilation is influenced by outside weather conditions and more challenging to manage than mechanically ventilated systems. Natural ventilation, however, is generally not recommended where outside temperatures exceed 33°C.

Figure 5. A natural ventilated house with circulatory fans

Ventilation Recommendations:

- Heat the house before birds arrive from the rearing farm; the laying house must be warm as birds arrive.
- Ensure the environment within the laying house is optimal: 18–25°C and 40–60% humidity.
- Avoid gases exceeding maximum allowable levels (Table 1).
- Provide sufficient air circulation through use of supplementary fans during hot weather to aid cooling of birds.
- For further information on ventilation, refer to the Ventilation technical update.

Gas	Max allowable level
Ammonia	< 15 ppm
Carbon dioxide	< 5000 ppm
Carbon monoxide	< 50 ppm

Table 1: Maximum allowable levels of noxious gases (measured over 8 hours).

Figure 6. House enrichments: alfalfa (Lucerne) bales (left) and a pecking block (right).

ENVIRONMENT

A diverse, well-maintained hen environment reduces bird stress and has a beneficial impact on hens' behaviors.

Environmental Considerations:

- Consumable enrichments: Non-soluble stones/grit, pecking blocks, straw, alfalfa (Figure 6). Enrichments which are edible or contain edible components, for instance forage - based material, are more likely to be effective than non-edible material. Foraging behavior can be encouraged through addition of small quantities of grain or grit to the litter.
- Non-consumable enrichments: Hang ropes, egg flats, or CDs around the house.
- Structural enrichments: Verandas, winter gardens, elevated platforms, perches, and free-range paddocks are examples of structural enrichments to help keep hens stimulated. Higher usage of the free- range area is associated with less stress. Providing a shaded area (Figure 7) will encourage birds to range and provides shelter from the elements. Use of perches within the house environment can help avoid development of antisocial behavior by providing a safe area for less dominant birds.
- Recommended stocking density: Consider reducing bird group size by introducing partitions. Maintain consistency in stocking density across the environment by ensuring consistency in range access, temperature, ventilation, enrichments, food and water availability, or other resources.

Figure 7. Free-range pasture with a shaded area

DISEASE MANAGEMENT

Stress of any kind may lead to higher levels of adverse behavior. One source of stress for poultry flocks is chronic disease or pathogen loads. Reducing disease levels through biosecurity, vaccination, and proactive management will greatly aid the productivity of a flock. Consult your local veterinarian for a regionally appropriate vaccination and parasite prevention program. For additional information, refer to the Hy-Line Brown Alternative Management Guide and the Hy-Line Technical Updates on specific diseases.

- Viral diseases: Chronic viral challenges such as infectious bronchitis, avian metapneumovirus, lentogenic Newcastle disease can impact flocks without causing high mortality. These underlying viruses, especially in combination with Mycoplasma or E. coli can create hen discomfort and lead to stress.
- Bacterial diseases: Although often secondary, Mycoplasma and E. coli can also be primary pathogens that increase bird discomfort. Other bacteria such as Enterococcus, Staphylococcus, Campylobacter, and Clostridium are present at higher levels in aviary and free- range environments and if not properly managed can lead to management challenges.
- Parasites: The presence of red mite can lead to higher levels of stress which in turn increases the risk of feather pecking. Ensure there is an effective red mite prevention program in place for the lifetime of the flock. Intestinal parasites can be problematic on litter and free range systems.

FEEDING SYSTEM MANAGEMENT

A well-managed feeding system will not only support good performance but also promote good bird behavior.

- Access
  1. Maintain constant access to feed throughout the day from transfer to 22 weeks of age.
  2. From 22 weeks of age onwards, allow the birds to consume all the feed from the feeding system during the morning period. This will encourage consumption of small particles of feed. Ensure feed is adequately distributed around the entire feeding system quickly to avoid separation of components. A track speed of 20 m/ minute will distribute feed efficiently. Checking distribution of feed from the beginning to the end of the system is important, especially for longer systems over 120–130 m. Loading hoppers positioned halfway along the feeding system aids distribution of feed.
- Stimulate feed consumption by running the system without adding additional feed.
- Check the presentation of feed within the system, ensuring adequate depth, while at the same time preventing spillage.
- Set the feed system at an appropriate height (level with bird's back) to allow birds to consume freely.
- Provide adequate drinker and feeder space to prevent competition and stress.
  1. Feed: 5 cm/bird (with access on both sides), 10 cm/ bird (with access on one side), 4 cm/bird with circular feeders.
  2. Water: Nipples/cups: 1 per 10 birds; circular drinkers: 1 cm/bird; linear drinker: 2.5 cm/bird.

NUTRITION AND DIET NUTRIENT SPECIFICATIONS

Diets fed to fully beaked flocks should not only provide the nutrients required to achieve optimum production, but should also support favorable behavior within the flock. Full nutrient recommendations are available in all Hy-Line Management Guides. Some key points pertinent to feeding fully beaked flocks include: achieving fiber levels, optimizing feed form, maintaining the consistency of nutrient supply, and fulfilling the nutrient needs of the bird.

Fiber

Increased insoluble fiber levels in layer diets have been shown to increase feeding time, which has a positive impact on bird behavior. Fiber also has a positive effect on satiety, gut function, and condition by stimulating gizzard activity and mechanical function3,4,5. Typical fiber levels are 3.5–4.5%; however, higher levels can increase feeding time and reduction in boredom and are associated with decreased feather pecking. Elevated fiber levels are attainable by adding more high-fiber materials such as sunflower, wheat feed, whole oat (hulls), or rape meal (Figure 8).

Cellulosic products can also be used to increase the fiber level of the diet (based on supplier recommendations). Using a blend of fibers from a variety of sources is advisable.

Feed Particle Size

Feed particle size is nutritionally important and also engages hens in good feeding behavior.

Utilize the Hy-Line feed particle size profile (Table 2) and aim for the majority of particles to fall between 1 and 3 mm. Particles above 3 mm should be kept within a maximum of 15% and not exceed 4 mm. The correct feed particle size will provide enough large particle size mash to stimulate a mechanical function to the intestine and enough small particles to engage the hens in longer feeding time.

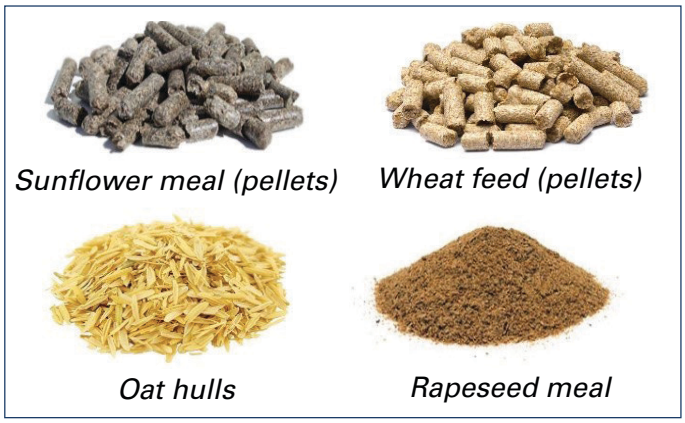


Figure 8. Raw materials which contribute to the fiber density of the diet. Images courtesy KW Alternative Feeds

- If the feed is too coarse, an excessive quantity of large particles may result in feed selection by dominant birds. This may lead to aggressive competition and uneven nutrient intake.
- If the feed is too fine, the ration will be less palatable, resulting in hens more likely to engage in explorative or boredom pecking.

- Adding fats and/or oils provides energy and increases the homogeneity and palatability of mash feed.
- Feeding mash is preferred, due to the longer feeding times relative to feeding pellets.
- Use large-particle limestone (2–4 mm) in layer diets. Larger particles not only support eggshell quality, but also provide a mechanical stimulus, which increases docility. The remainder of the limestone should be provided in smaller particles of 0–2 mm (Table 3).

Ensure large particles of limestone are adequately distributed through the feed. Uneven distribution will result in uneven presentation and potentially variable intake by birds. Mix feed components adequately during the manufacturing process.

PARTICLE SIZE	STARTER	GROWER	DEVELOPER	PRODUCTION
< 1 mm	–	< 15%	< 15%	< 15%
1–2 mm	Crumble	45–60%	25–35%	20–30%
2–3 mm		10–25%	25–40%	30–40%
> 3 mm	–	–	5–10%	10–15%

Table 2. Optimal feed particle profile.

PARTICLE SIZE	STARTER, GROWER, DEVELOPER	PRE-LAY	WEEKS 17–37	WEEKS 38–48	WEEKS 49–62	WEEKS 63+
Fine (0–2 mm)	100%	50%	40%	35%	30%	25%
Coarse (2–4 mm)	–	50%	60%	65%	70%	75%

Table 3. Ratio of limestone particle size.

Consistency of Nutrient Supply

- Base the nutrient density of the diet on the bird's nutrient requirements (egg mass output) and feed intake. Birds eat quantities of nutrients (not percentages), so accurate estimation of feed intake when setting the diet nutrient specification is critical. A deficit in nutrient intake at any stage in lay may result in a stress reaction. This is particularly important in hot weather situations, where provision of key nutrients is critical.
- Ensure a consistent supply of key nutrients to the bird through lay. Transitioning to lower- density feed should be based on existing feed intake and egg mass output, rather than age.
- Minimize significant reduction in nutrient intake when transitioning through the feeding program. Introduction to the next stage diet should be managed to avoid triggering a behavioral response. Daily nutrient intake should not vary by more than 5%.
- Ensure an optimal amino acid intake and balance throughout both the rearing and laying period. Any shortfall or misbalance in amino acid intake may predispose birds to aggressive behavior. The main amino acids to consider are methionine, tryptophan, and arginine.
- Birds respond well to consistent diets with minimal compositional change. Maintain the same raw material use between diets and ensure inclusion levels do not change more than 20% between diets.
- Low or variable intake of micronutrients can impact bird behavior. Deficiency of pyridoxin and biotin is associated with feather pecking. Ensure birds consume fine particles of feed, which tend to contain micronutrients. Check that the vitamin and trace mineral specification of the diets is adequate.
- Sodium deficiencies often lead to pecking issues. If adverse behaviors are observed, check sodium and sodium chloride levels in feed samples sourced from the feeding system.

Energy Requirements

- Provide sufficient energy to support egg mass output (Table 4) and maintain ideal body condition. Hens with inadequate levels of body fat and muscle tone are more prone to developing behavioral issues.
- Check the condition of birds: at a minimum it should be possible to feel a 2 cm layer of skin/ subcutaneous fat around the abdominal area.
- Maintain adequate muscle condition. A breast muscle score of 3 is required after reaching mature body weights at 33–34 weeks of age (see Hy-Line Brown management guide).

FEEDING PHASE	PEAKING	LAYER 2	LAYER 3	LAYER 4	LAYER 5
Period	First egg until production drops 2% below peak	2% below peak to 89%	88–85%	84–80%	Less than 80%
Metabolizable energy, kcal/bird/day*	315–330	310–325	305–320	300–315	300–315

Table 4. Metabolizable energy requirements.

**An approximation of the effect of temperature on energy needs is that for each 0.5°C change higher or lower than 22°C, subtract or add 2 kcals/bird/day, respectively.*

Reference can be provided on request.

***Courtesy:** Hy-Line International*

Postal Regn. No. HD/1067/2018-2020
Published on 8 December 2020