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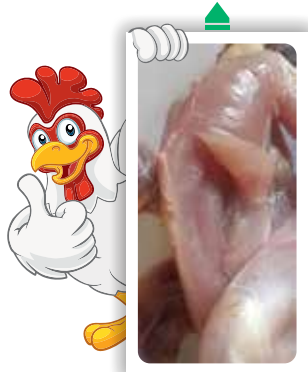
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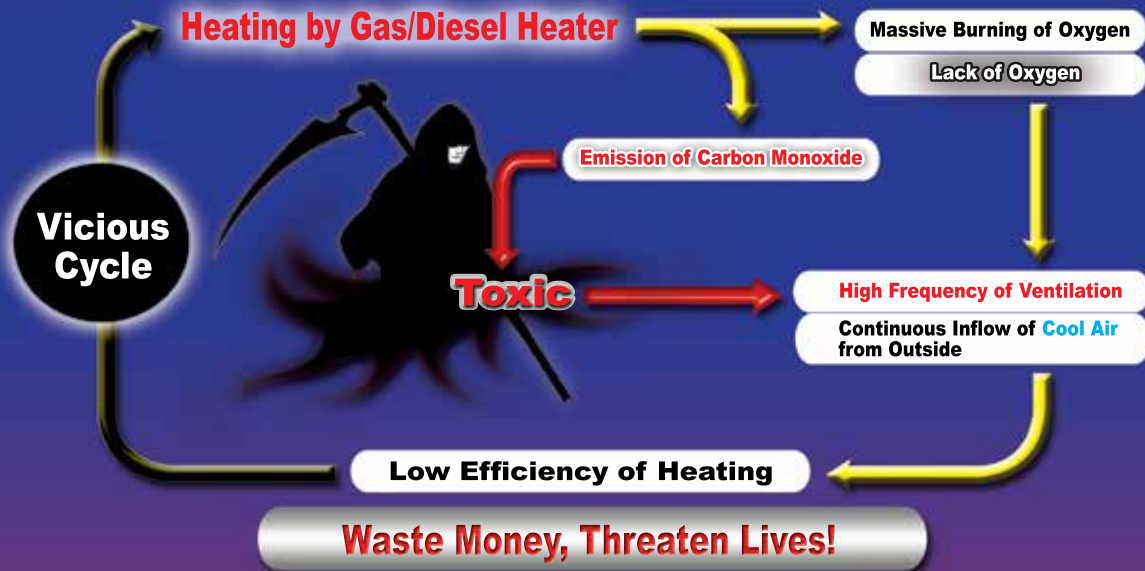


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News in this issue

SUCCESSFUL COMPLETION OF	14
CARUS PARTICIPATES AND	18
AVIAGEN APPLIES LATEST	22
PFI CONDUCTS 32ND AGM	24
NOVUS TO DEBUT NEW BOOTH, RESEARCH AT IPPE	28
IB GROUP WILL BUILD	30

Articles in this issue

DIGITALIZATION IS THE	34
CORRECT SPRAY VACCINATION	36
VITAMIN D : SUNSHINE.....	40
WINTER MANAGEMENT IN	44
THE IMPORTANCE OF MAINTAINING	48
ROLE OF PROBIOTICS IN	62
EFFECTS OF GROWING	66
LIGHTING IN BROILER PRODUCTION	72
ALTERNATIVES TO FORMALDEHYDE.....	76
GUT HEALTH IN POULTRY	79
BROILER POULTRY MEDICINE	85
PROBIOTICS WORK WITH	88
BACTERIAL GHOST	90
MANAGEMENT TIPS FOR VENTILATING	94



POULTRY PUNCH may not necessarily subscribe to the views expressed in the advertisements and articles published herein - Editor

Happy New Year

Chr. Hansen is sending warmest greetings to you, your colleagues and families, this Christmas and New Year.

We wish you health and prosperity in 2022!



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EDITORIAL

OMICRON WAVE- A THREAT TO POULTRY BUSINESS

Winter comes with a lot of problems for the warm blooded animals. So, naturally poultry management too needs to be streamlined to get optimum production. In this entire endeavor of winter management, the poultry house should be installed with adequate climatic control equipments. Ventilation needs to be taken special care of because if ammonia or any other toxic gases are formed within the poultry house, it shall lead to various respiratory and other diseases affecting the performances of the birds.

Always be in touch with a veterinarian to ascertain the health status of the poultry birds at the farm. Feed management requires attention because specific blend of feed, additives and some medicines need to be added to maintain the health and keep the birds disease free. The feed storage area should always be dry and safe from rodents.

The Environmentally Controlled Houses offer the best solutions against all weather conditions. Here the temperature and ventilation is effectively maintained to keep the birds comfortable. These houses incorporate many poultry equipments like: Temperature control systems, thermostat, exhaust fans and other automatic systems to maintain the farm house environment.

Keep an eye on the water temperature, if it is too low, adjust the temperature that is acceptable to the birds. Keep in mind that there should be no wet litter inside the farm as it is a very unhygienic condition. In such a wet litter condition, birds catch cold and staying there means rise in fungal and bacterial diseases besides respiratory disease. If possible maintain a full time veterinarian at the farm to check the farm condition on a regular basis.

Editor



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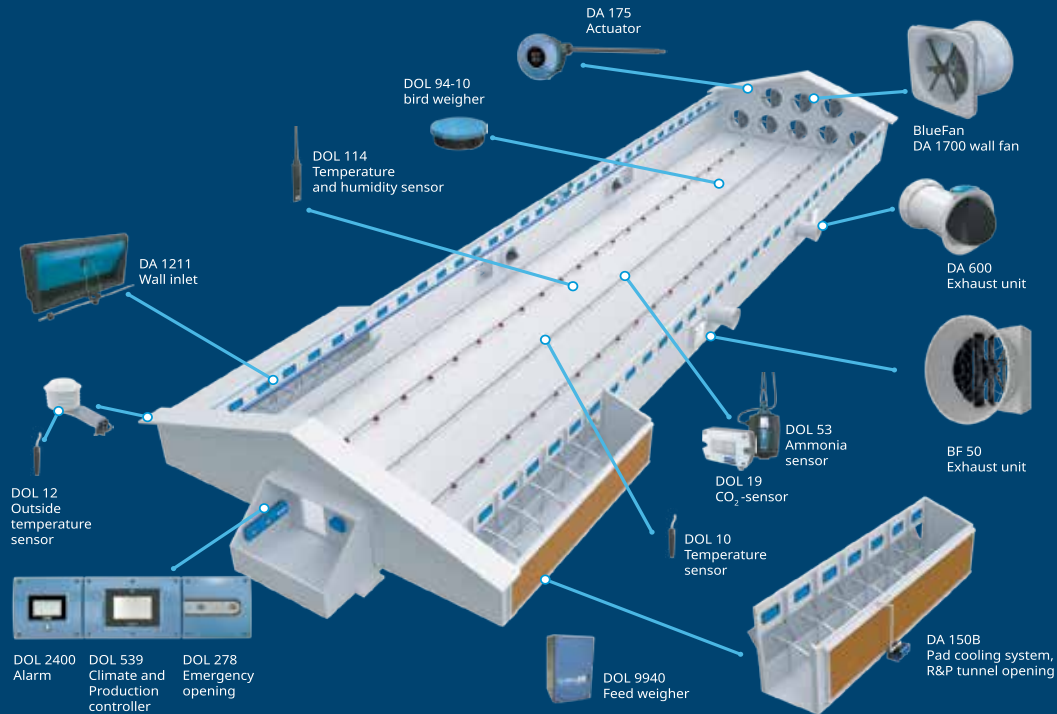




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SUCCESSFUL COMPLETION OF “3RD VETS IN POULTRY (VIP) AGM” AT GOA

Vets In Poultry (VIP) is a 950+ Veterinary doctors' association working in various fields of poultry businesses, government, research, strategy makers, Scientist etc spread over all India and overseas, implementing various social activities. VIP is a registered association under charity commissioner office Pune. On behalf of this organisation, “3rd Vets In Poultry (VIP) AGM” was conducted at Goa, Sunday, 24th Oct 2021 with the Theme: The Era of New Normal- Scenario In Poultry & Role of Veterinarian. More than 135+ VIPians participated across India and overseas.

With permission of the President, Dr Ajay Deshpande, Dr Santosh Ire, Secretary of VIP shared all the minutes of the last AGM and new resolutions to be considered along with Dr Prasad Kulkarni. The Treasurer shared all the financial details. The Closing remark and conclusion was given by the President.

The highlight of the meet was from the special guest from Government of India: Dr SK Dutta, Joint Commissioner, AH, New Delhi and Dr Lipi, Assistant Commissioner, AH, New Delhi. Team VIP gave a warm welcome to both the dignitaries.

VIP has done a major work on Bird Flu amendment draft. Dr Ajay Deshpande explained more details, supporting & insights of draft with august gathering and GOI authorities.

Dr Lipi, made a presentation on behalf of





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GOI and explained their new schemes for benefit of poultry and veterinary field. She gave all details about website and procedure to apply with necessary links.

Dr S K Dutta, added icing on the cake over Dr Lipi's presentation and gave eagle eye view about current status and approach of GOI. He offered welcome gesture and assured all kind of support from his end.

This session was followed by the theme of the event: "The Expert Panel Discussion on The Era of New Normal- Scenario in Poultry & Role of Veterinarian."

Eminent speakers, Dr Rukmangadhan, Dr Ravinder Reddy, Dr Jayaraman, Prof. Dr Ajit Ranade, Dr Sushant Rai deliberated their views on the topic with expert vision. The session was excellently moderated by Dr PS Mahesh with his unique style. The panel suggested many good topics to be considered by VIP. Some of them are: Amendment in Bird Flu, Pollution Concern, All India Disease Monitoring Body etc. It was one of the best brainstorming session.

This year VIP felicitated the contribution and great service by Prof Dr G Devegowda. It was an honour for VIP in having him on board in the VIP Journey.

All the panelists and guests inaugurated VIP's 1st ever souvenir and this was appreciated by all.

The Concluding remark and Vote of Thanks was delivered by Dr Atul Latkar.

President Dr.Ajay Deshpande and all the office bearers and volunteers and EC members thanked the Participants, Industry Colleagues, Authorities, Sponsors, Media Friends all supporters for their overwhelming support & contribution.





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CARUS PARTICIPATES AND IMPRESSES AT VIV MEA EXHIBITION, ABU DHABI

Content:

Carus Laboratories has participated with its team in VIV MEA exhibition, Abu Dhabi, UAE as an exhibitor and stole the show with its innovative and need-based solutions for the animal health care sector. As one of the fastest-growing animal health care organization in India, Carus Laboratories Pvt. Ltd. has exhibited a basket of unique solutions well researched and produced in its state-of-art FAMIQS & ISO 9001-2015 certified manufacturing plant situated at Kunjpura, Karnal 132001, Haryana, India. All Carus Lab's solutions, besides being need-based and innovative are cost-effective.

After the launch of their international business, it was their second international exhibition as an exhibitor and the team participated in VIV MEA with a very aggressive approach to enter the Middle East and African markets.

Participation proved to be fruitful as more than 150 visitors from various countries visited the stall.

Potential business partners from countries like UAE, Oman, Egypt, Saudi Arabia, Qatar, Tanzania, Bangladesh, Pakistan, Nepal, etc. visited the Carus Lab's stall and discussed exploring the immense potential of its innovative solutions in improving the health condition of animals and possibility of being business associate in respective countries.

The visitors have shown keen interest in some of the innovative solutions from Carus Lab's like Dozliv Forte, ORT calf, DCAD Minus, Latifur Ultra, Bovicharge, etc.



From Right to Left: Dr. Amit Kumar Pandey (GM: International Business, Carus Lab. Pvt. Ltd.), Mr. Jitander Piani (Director: Carus Laboratories Pvt. Ltd.), Dr. Arun Piani (MD: Carus Laboratories Pvt. Ltd.), & Mr. Vipin Sardana (Senior Manager: International Business, Carus Lab. Pvt. Ltd.)



Meeting with Dr. Bassam Abdullah and Dr. Mohammed Zuhair Muhareb of Arabian Ethicals, UAE



Meeting with Dr. Osama Shaheen and team i-Vet International, Egypt



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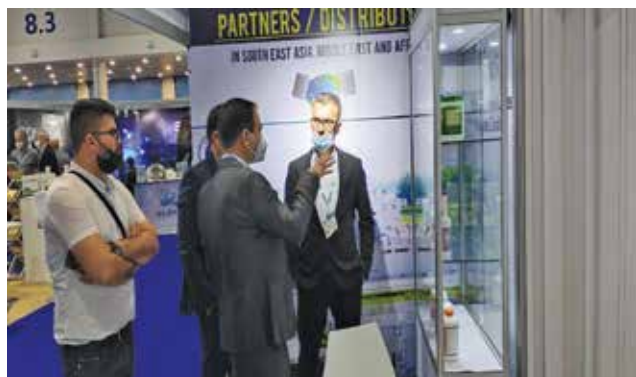
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Meeting with Dr. Mohamed Fawzy, Kubbar International, Kuwait



Meeting with Mr. Hetem, Team Aldhara, UAE



AVIAGEN SUPPORTS INDUSTRY AS SUPER PLATINUM SPONSOR OF POULTRY FEDERATION OF INDIA MEETING



As a super platinum sponsor, the Aviagen India team is presented with a PFI meeting memento

Udumalpet, India

On Dec. 23, Aviagen@India Sales and Customer Service team members took the opportunity to engage with customers and industry colleagues at the annual Poultry

Federation of India (PFI) meeting, which is considered the voice of the Indian poultry industry. Addressing current hot topics important for Indian poultry producers, the meeting saw various speakers,

including two Aviagen customers: Mr. Bahadur Ali from IB Group and Mr. Suresh Chitturi of Srinivasa Farms. Also present among the 375 meeting delegates were government officials who shared the latest support programs for the farmers of India.

Ferry Monné, Head of Sales and Marketing for Aviagen India, was present at the meeting and commented, "Transparency, communication and engagement' is one of our top 5 corporate commitments, and we value the PFI as an important forum to collaborate with other members of the poultry value chain on ways to advance the industry in India. We all share a common goal of helping to feed families throughout our country with an affordable and healthy source of protein, while promoting animal welfare and sustaining our environment for our current and future generations."

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New remote support high-technology solution is perfect complement to local personal support



HUNTSVILLE, Ala.

-Aviagen@teams in Asia Pacific, Latin America and North America have combined their talents to create a new hybrid platform for heightened customer service and internal flock management. The new solution is made possible by a combined package of the latest in bonded cellular networking, mesh Wi-Fi, Augmented Reality (AR) headsets, specialist software and other technology. Thus, through live-streaming capabilities, for example, customers will be able to bring Aviagen experts virtually to the farm, hatchery, or any area of their facility where they need help on a pressing issue.

“Being there for our customers to ensure their continual success is our number one priority, and this new suite of tools is meant as a complement to the world-class support our customers get from their local teams. Thus, they could have immediate remote access to our array of specialists, both local and global, in addition to regular face-to-face personal support,” explained Aviagen CEO Jan Henriksen.

The end goal -- Strengthening customer service

As a result of the new virtual solution, no matter where they are located on the globe,

poultry producers can have the opportunity to receive rapid advice on performance improvements and solutions to their daily challenges, directly from Aviagen’s team of global specialists in genetics, veterinary service, nutrition, flock management, incubation and hatching, and more. This solution optimizes organizational efficiency by providing on-the-spot answers to pressing issues within a poultry operation.

“Aviagen is passionate about continually improving our service to customers,” explained Aviagen President of North America Marc de Beer. “While AR and Virtual Reality (VR) headsets are largely associated with gaming and entertainment, we have found an ideal application in business, which will elevate our support efforts by providing the perfect complement to one-on-one care and collaboration from our local Aviagen customer teams.”

“We are committed to leveraging the latest and most advanced technology to champion the success of our customers,” added Rafael Monleon, Business Manager for Asia Pacific. “Our new solution will enable our Aviagen experts opportunities to collaborate with customers in remote locations, resulting in faster solutions to challenges and best-practice advice to optimize their operations.”

“We are happy to maximize the effectiveness of our customer service team by putting to use technology to further expand their abilities. These advanced tools demonstrate our innovation, not just as a breeding company, but also as a technology business,” concluded Ivan Lauandos, President of Aviagen Latin America.

An added bonus - Increasing internal efficiency and collaboration

Aviagen will also use this technology to improve information and idea sharing, as well as training for its internal teams located in Asia Pacific, Latin America and North America. In fact, the company has already started applying this innovation internally, and will introduce it to customers in early 2022 based on a structured region by region roll-out.

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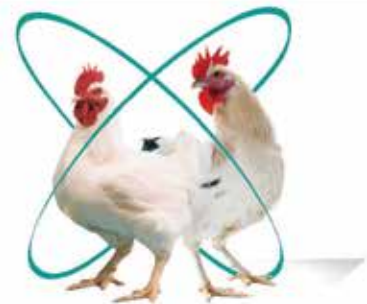
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PFI CONDUCTS 32ND AGM AT NEW DELHI SUCCESSFULLY

New Delhi

Poultry Federation of India (PFI) conducted its 32nd Annual General Body Meeting on 23rd December, 2021 at Hotel Pullman, New Delhi.

Mr Ranpal Dhanda- President PFI



Mr Ranpal Dhanda, Secretary –PFI welcomed the august gathering. He presented the complete deliberations of the PFI since last two years. He thanked Shri Giriraj Singh for his support to the poultry industry during the corona times. He highlighted the adverse impact of the Corona impact and Bird Flu on the Indian poultry industry. He mentioned the impact on the new environment guidelines and pollution impact on the poultry industry and how some of the NGOs tried to corner this industry. He said as the soybean rates were quite high, the PFI then intervened and managed to impress upon the government to import soybean, which was ultimately granted approval by the central government.



**Mr Ramesh Chander Khatri-
Chairman, PFI**

Mr Ramesh Khatri, President- PFI thanked Mr Ranpal Dhanda and welcomed the assembled guests. He felicitated Shri Mahipal Dhanda for his unstinted support to the poultry industry in the times of need.



**Mr Mahipal Dhanda, MLA-Panipat
Gramin, Haryana**

Mr Mahipal Dhanda, MLA-Panipat Gramin, Haryana, welcomed all the dignitaries and the poultry fraternity assembled at the meeting. He mentioned the problems of soybean rates and corona impact on the poultry industry. He said our effort should always be to save small farmers of the poultry sector. He also mentioned the problems faced by the poultry industry due to National Green Tribunal, environmentalists and the pollution guidelines issued by the concerned department. He offered the poultry farmers all help and urged them to present their problems to him. He said we should all work hard to save this industry.



Mr Ricky Thaper- Treasurer, PFI

Mr Ricky Thaper, Treasurer- PFI presented the Accounts Statement of the PFI which was supported by the PFI members and the assembled guests. He declared the formation of the new PFI Committee as follows:

- Chairman - Mr Ramesh Chander Khatri**
- President -Mr Ranpal Dhanda**
- Treasurer - Mr Ricky Thaper**
- Vice President Headquarter - Mr Sanjeev Gupta**
- Secretary - Mr Ravinder Sandhu**
- Vice President South- Mr DS Subramaniam**
- Chairman PFI Technical Committee- Mr Neeraj**
- Vice President West- Dr Sujit Kulkarni**
- Vice President East- Dr Pawan Kumar**
- Vice President Central- Dr Dinesh Arora**



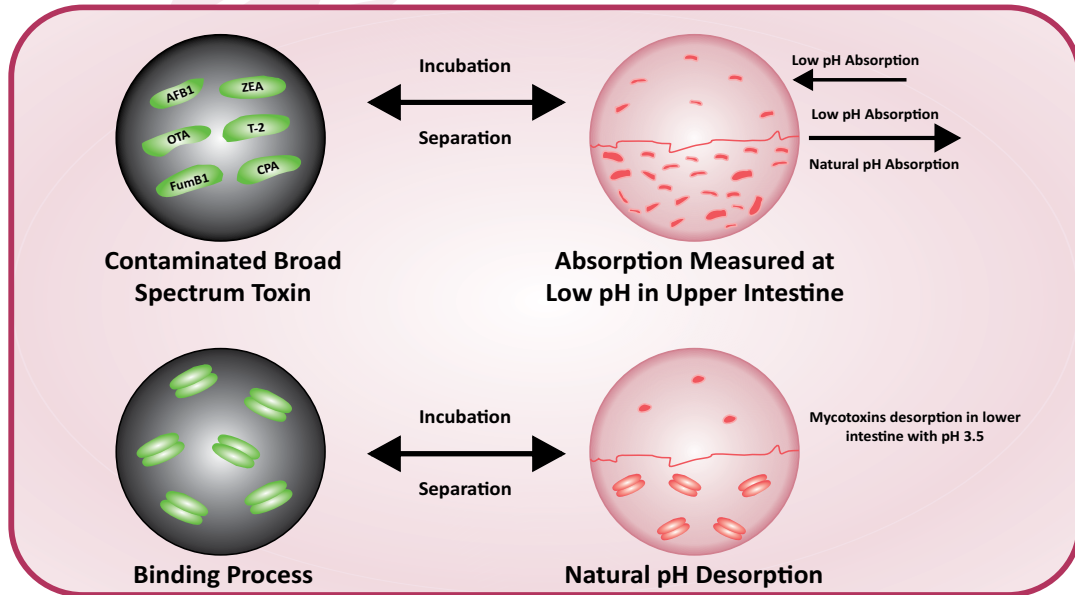
Mr Ranpal Dhanda- President PFI

Mr Ranpal Dhanda, President- PFI as new President of PFI assured his best to contribute for PFI and the poultry fraternity. He praised Mr Ramesh Khatri for his remarkable contribution. He said that we must strengthen the PFI with increased membership drive.

Mr Naveen Pashuparty, MD- Nandu Feeds spoke on - "Modern GTM

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approaches in meat retailing.” He spoke on Violent volatile pricing, sad buying experience, meat quality, forward integration, safe meat, affordable prices, distribution channel, innovative packaging, branding, revolutionizing the meat buying experience, quality control, retention, customer data and urged the poultry industry to give customer what they want.



Dr Lipi Saiariwal, Assistant Commissioner, DAHD, Ministry of Fisheries, Animal Husbandry and Dairying, Government of India

Dr Lipi Saiariwal, Assistant Commissioner, DAHD, Ministry of Fisheries, Animal Husbandry and Dairying, spoke on- “Animal Husbandry Infrastructure Development Fund.” She spoke on the Rs 15,000 crore fund set up by the Central government that aims to fund the Animal Husbandry farmers. She said that the Central Government is committed to the development of the Indian Animal Husbandry sector and the farmers can present their proposal and get the loan for setting up or diversifying their production. She mentioned that the Animal Husbandry sector has immense potential and can make significant contribution to the Indian economy.

Dr SK Dutta, Joint Commissioner DAHD, Ministry of Fisheries, Animal Husbandry and Dairying, spoke on- “Government of India Schemes for entrepreneurship.” He spoke at length about the vision of the Government on the National Livestock Mission and different schemes for poultry, sheep, goat, pig, aqua and fodder. He said that

the Government is committed to the rise of Animal Husbandry sector which it turn will make significant contribution to the GDP besides generating employment and augment self sustenance.



Mr Suresh Rayudu, Chairman, International Egg Commission speaking at PFI meeting

Mr Suresh Rayudu, Chairman, International Egg Commission spoke on- “Future of Egg Industry in India.” He said India has surplus egg production which the best fortified protein but still 55% to 60% of the children in the country are malnourished. He said India has registered massive egg production in the last two decades and gave a brief presentation on the pattern of production, consumption, global egg production growth. He highlighted the benefits of increased per capita egg production.

Dr Pawan Kumar, USSEC spoke on – “Current Soy outlook and way forward.” He spoke on the existing soybean demand and supply situation, price and buyer seller equilibrium. He said soybean has massive consumption for animals as well as humans.



Chief Guest Shri Parshottam Rupala, Minister of Fisheries, Animal Husbandry and Dairying lighting the Inaugural Lamp



Chief Guest Shri Parshottam Rupala, Minister of Fisheries, Animal Husbandry and Dairying addressing the audience

The Chief Guest Shri Parshottam Rupala, Minister of Fisheries, Animal Husbandry and Dairying lit the Inaugural Lamp along with the dignitaries on the dais. He has that the Government is totally committed for the development of the Indian Animal Husbandry sector. He said that this sector is plagued by various problems but urged the poultry fraternity to come with their problems and would deliver his best to find the solutions. He hinted at more stress on research, marketing and innovation in the poultry sector.

Mr Ramesh Khatri spoke on the reduction of Soy price, soy import and informed that around two lakh farmers lost their livelihood during the Corona pandemic. He presented a long list of problems faced by the Indian poultry industry and requested the Animal Husbandry Minister present on the dais to solve it at the earliest.



Mr Bahadur Ali, Managing Director IB Group, speaking at the PFI meeting

Mr Bahadur Ali, Managing Director IB Group thanked Shri Narendra Modi for creating a separate Animal Husbandry



A hand is shown holding a red, textured 'S' shaped Bio-BanTox Plus adsorbent. The background is green and features several names of toxins and pesticides written in white, some with a pixelated effect: Aflatoxin, Heptachlore, T-2 toxin, Ochratoxin, Fumonisin, Vomitoxin, Diazinon, Malathion, Dieldrin, Zearalenone, Egg toxin, DAS, and Githinin.

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Ministry which was earlier part of the Agriculture Ministry. He thanked the present Prime minister and Animal Husbandry Minister for supporting the small farmers. On the topic of Soy import he thanked the minister for speedy approval which was a blessing for the Indian poultry industry. He urged the integrators to take care of the small and marginal farmers. He declared that 60% to 70% of the Indian poultry is antibiotic free. He said that poultry provides significant employment to the citizens of this country.



Mr Balram Singh Yadav, MD, Godrej Agrovet Limited presents his views

Mr Balram Singh Yadav, MD, Godrej Agrovet Limited spoke on poultry industry challenges and opportunities. He stated that the poultry sector has a higher growth as compared to the Agriculture sector in the last two decades. He stated that there is a sharp rise in the development of processed and value added poultry products in India. He said that it is for the Indian poultry industry to think about controlled production instead of overproduction which poses problems in egg and broiler pricing in the market.



Mr Ashok Thakur, Director, NAFED
Mr Ashok Thakur, Director, NAFED,

spoke of all the contributions made by PFI in the interest of the poultry industry. HE mentioned the problems faced by cage ban to the poultry industry. He said the Indian poultry industry should go for quality compliance and go for exports. He said poultry has immense potential and we must aim at competing in the world market.

Mr Ricky Thaper presented the Vote of Thanks. He thanked the Chief Guest Shri Parshottam Rupala, the dignitaries, PFI team, media, sponsors of the event and the assembled gathering for making this



Mr Ricky Thaper- Treasurer, PFI

event a successful one. This was followed by cocktail, dinner and amusement for the guests.



NOVUS TO DEBUT NEW BOOTH, RESEARCH AT IPPE

SAINT CHARLES, MO (January 20, 2022) – Novus International, Inc., is bringing new research and a new look to the International Production and Processing Expo (IPPE), January 25-27, at the Georgia World Congress Center in Atlanta, Georgia.

As a global leader in health and nutrition solutions for the animal agriculture industry, Novus has been a long-time supporter of IPPE. The event in 2021 was held virtually due to the COVID-19 pandemic and Ed Galo, Novus vice president and chief commercial officer for Americas & EMEA said he and his colleagues are excited about this year's in-person show.

"This is an industry built on relationships. There's something about face-to-face conversation that fosters relationship-building in a way that a computer screen cannot match. We're very excited to be back in Atlanta for IPPE," Galo said.

IPPE attendees can meet with company representatives at the revamped Novus booth, #8139 in Hall B, during the Expo. Representatives will be on-hand to share how Novus trace mineral, eubiotics, enzyme, and methionine solutions can positively impact animal protein production.

Researchers will showcase Novus solutions during the International Poultry Scientific Forum

(IPSF), held in conjunction with IPPE. These posters will be on display from 1:00 p.m. EST, January 24 to noon on January 25 in Room B313 Foyer at the Georgia World Congress Center.

- Effect of Zn Methionine-Hydroxy-Analogue Chelate supplementation on performance and carcass quality of broiler chickens from Dr. LirisKindlein of the Department of Preventive Veterinary Medicine at the Federal University of Rio Grande do Sul.
- Effect of an essential oil blend on growth performance of broilers under different coccidiosis control programs from Dr. Frances Yan, senior research scientist at Novus.

A carryover from the virtual IPPE in 2021, the TECHTalk session are short, informative live presentations where attendees can gain quick knowledge that can directly impact their business. Held at booth #8579 in Hall B, Novus is presenting a TECHTalk session titled Understanding Mixer Coefficient of Variation and Troubleshooting by Application Systems Manager Dr. Jonathan Wilson at 3:00 p.m. EST on Tuesday, January 25.

For more information on Novus at IPPE, visit <https://www.novusint.com/Events/novusatippe2022>

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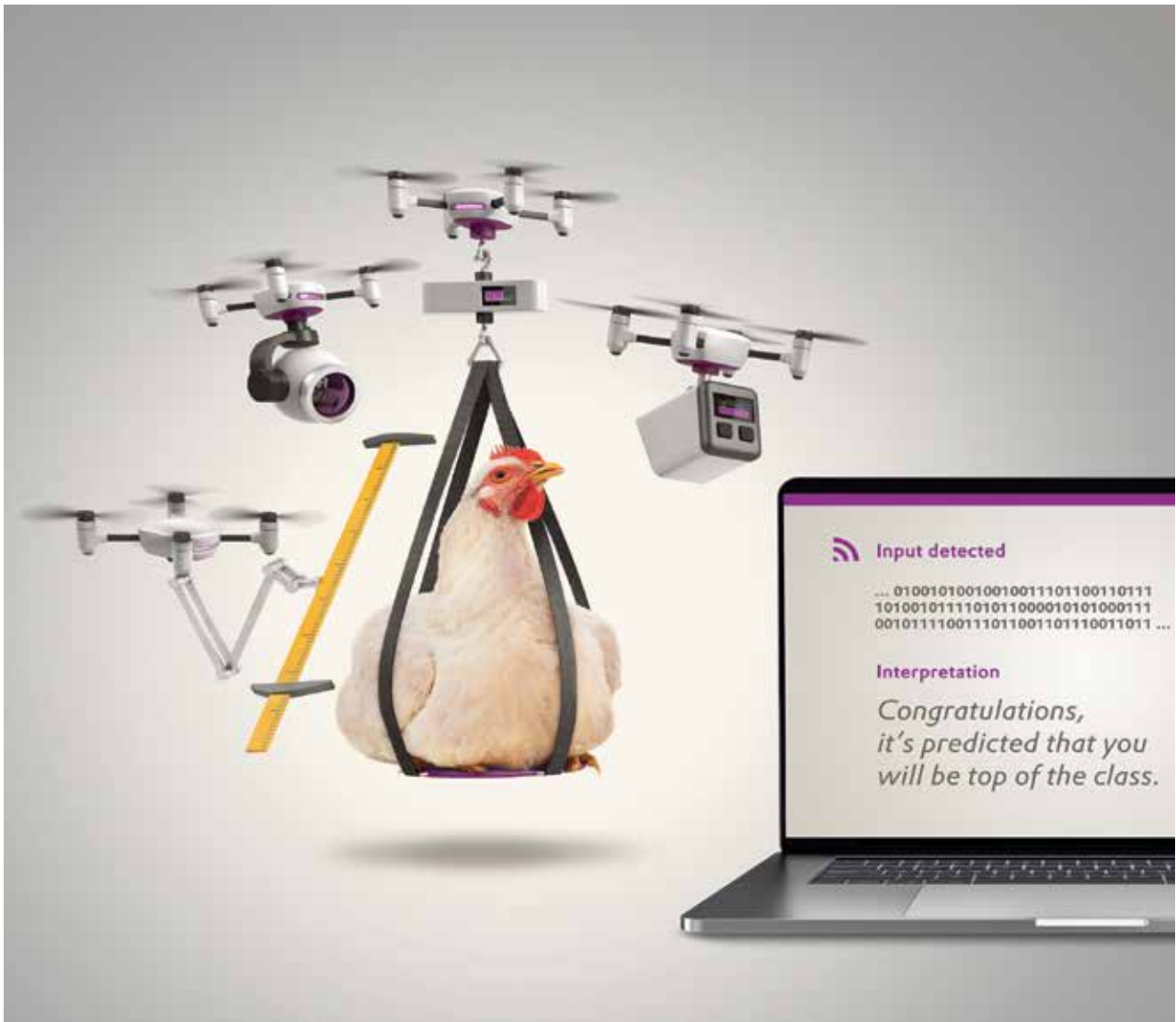
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IB GROUP WILL BUILD THE COUNTRY'S LARGEST SOYBEAN PLANT ON 65 ACRES OF LAND IN MADHYA PRADESH

Badnawar, Madhya Pradesh

Madhya Pradesh Government Industries Minister and Regional MLA Rajvardhan Singh Dattigaon on the occasion of his birthday presented the area as a major industrial development. The country's leading agro-based industry group, 'ABIS Exports India Pvt. Ltd. 'IB Group,' will establish this large industry in Badnawar. A soya plant will be planted near Kherwas, whose Bhoomipoojan took place on Sunday, January 9.

State Chief Minister Shivraj Singh Chouhan was virtually present on the occasion of Bhoomipoojan of this large industry, and as a Chief Guest, Industrial Policy and Investment Promotion Minister Rajvardhan Singh Dattigaon of the state were presented. The special guest was Sanjay Kumar Shukla, Principal Secretary of the Madhya Pradesh Industries Department. Founder and Managing Director of IB Group Bahadur Ali, as well as Corporate Directors Gulrez Alam and other officers, were also present in the program.

According to Bahadur Ali, Managing Director of IB Group, the industry will be built on 65 acres of land. Its building will cost more than 3.5 billion rupees. More than 2,500 individuals will gain direct work as a result of the Soya bean plant. This soya plant would produce soya crusher, refinery, and livestock feed, requiring around 7 lakh metric tonnes of soybean per year, which will be obtained from Madhya Pradesh soya farmers. According to Bahadur Ji, IB Group will require roughly 11 lakh metric tonnes of soybean for production in the next years, accounting for about 12% of the country's total consumption. Immediately after the Bhoomipoojan, the construction work of the plant will also be started, which will be ready soon.

The inhabitants of Dattigaon were bound by the expectation of establishing large industries as a result of becoming the Cabinet Minister MP Govt.

After Badnawar MLA Rajvardhan Singh Dattigaon was given the responsibility of a large ministry in the state government,



Honble Chief Minister of MP Shri Shivraj Singh Chauhan, Honble Minister Rajvardhan Singh Ji, Honble Shri Rajesh Agrawal, VP, Civil Corporation MP, Shri Bahadur Ali, Founder & MD la Group, Shri Gulrez Alam, Director IB Group, Mahendra Singh Ji, Manoj Somani, Shri Sanjay Mukati, District President, Shri Parmanand Patidar, Member District Panchayat, Mandal President, Rajneesh Malviya, and special guests and all officers.



Mr. Bahadur Ali, Founder & MD IB Group felicitated Shri Rajvardhan Singh Dattigaon, Minister for Industrial Policy and Investment Promotion Govt. of MP with a bouquet at the Bhumi-Poojan Ceremony of ABIS Integrated Soya Food and Feed Plant.



Mr. Gulrez Alam, Director IB Group, felicitated Shri Rajvardhan Singh Dattigaon, Minister for Industrial Policy and Investment Promotion Govt. of MP with a bouquet at the Bhumi-Poojan Ceremony of ABIS Integrated Soya Food and Feed Plant.



Mr. Bahadur Ali, Founder, and MD IB Group, Mr. Gulrez Alam, Director IB Group, Presenting a memento to Shri Rajvardhan Singh Dattigaon Hon. Minister for Industrial Policy and Investment Promotion, Govt. of MP at the Bhumi-Poojan Ceremony of ABIS Integrated Soya Food and Feed Plant.



Mr. Bahadur Ali, Founder, & MD IB Group, Mr. Gulrez Alam, Director IB Group presented a memento to Shri Sanjay Kumar Shukla, Principal Secretary Industry MP. Mr. Rohan Saxena, ED, MPDC received it on his behalf at the Bhumi-Poojan Ceremony of ABIS Integrated Soya Food and Feed Plant.

such as the Industries Department, the residents of the area expected employment through the industry, and given a large amount of soybean production in the area for a long time, the demand for the establishment of an industry or factory has been made for years. Dattigaon should receive the blessing of a huge industry in this area through IB Group.

Opportunities for advancement and employment will arise.

In this regard, Rajvardhan Singh Dattigaon, the State Government's Industries Minister, stated that the formation of this large soya-related enterprise in the area would pave the way for the region's development. Along with this, the business will grow, and unemployed youth will find work.

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Correct spray vaccination is critical for effective IB flock immunisation

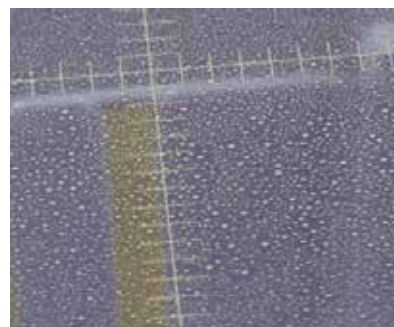
Spray vaccination at the hatchery is the most relevant procedure to achieve a uniform and effective prevention strategy for infectious bronchitis (IB).

Even though spray vaccination is a very common and well-established practice all over the world, the process needs to be re-evaluated and audited to ensure the successful immunisation of the flock.

by Paola Cruz-Dousdebés, Jessica Lee, Andrew Zhang, William Boyer, Kevin Liu, Fernando Lozano and Miren Arbe, Ceva Animal Health, Poultry Franchise. www.ceva.com



Taking direct dosing control at the beginning of each vaccination day.



The results of good crate coverage and droplet homogeneity checking with the Droplate.

This article gives a review of the key control points for a good spray vaccination quality and provides field trial evidence on how some differences in the IB vaccine administration at the hatchery can have a serious impact on proper and effective flock immunisation.

Avian infectious bronchitis

IB is a highly contagious disease that affects several organ systems in chickens in addition to the respiratory system, such as the urinary and reproductive tract, and remains latent in the caecal tonsils of the birds.

The disease is caused by a coronavirus and has worldwide distribution in commercial poultry operations and also in backyard flocks.

Spray vaccination at the hatchery

Spray vaccination at the hatchery is a practical and habitual method of immunisation for IB or Newcastle disease in poultry operations.

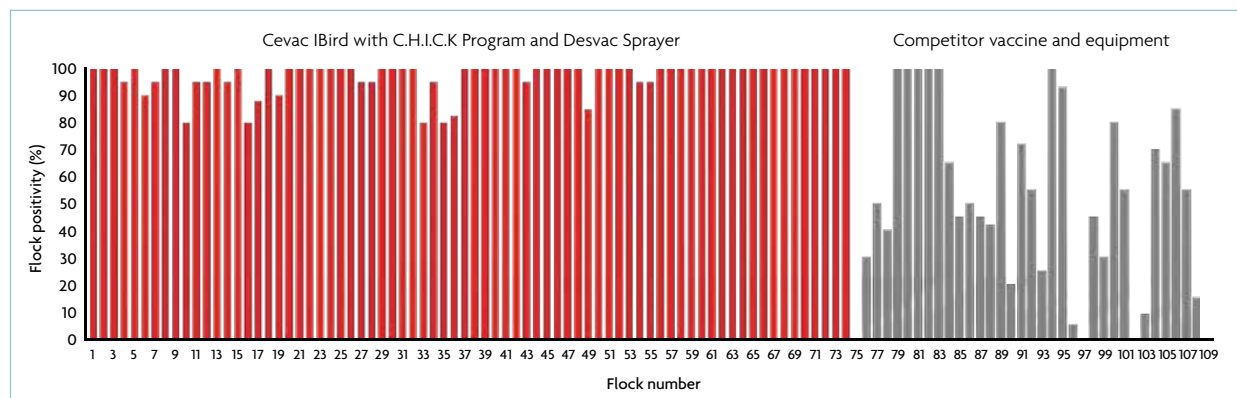
A worldwide hatchery survey conducted in 2020 showed that 90% of hatcheries use spray vaccination regularly.

At first glance, spray vaccination appears to be a simple technique to master, you select the type of nozzle and pressure applied to generate the right droplet size and then expose a standard number of chicks in a box to the spray to cover them with the IB vaccine solution attempting to reach the upper respiratory tract of the chicks.

In reality, there are many variables that affect the quality of spray vaccination among different hatcheries, mainly due to the sprayer equipment operational status and operator training and monitoring.

Continued on page 28

Fig. 1. Positivity rate using qPCR testing for IB vaccine strain detection in choanal swabs five days post-hatchery vaccination (Ceva Scientific Services Investigation Unit (SSIU), China. Internal Study, April 2021).



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Continued from page 27

There are four main considerations for good spray vaccination quality:

● **Optimal crate coverage:**

The entire crate surface has to be covered by the spray in order to guarantee that all the birds receive the proper vaccine dose.

Nowadays, by using current nozzle technology, such as a flat pattern nozzle, crates can be perfectly covered from beginning to end without any missed areas.

● **Uniform droplets at the right size:**

The recommended droplet size to vaccinate day-old chicks is around 150µm. The droplet size is defined by two main parameters: nozzle type and air pressure.

● **Keep a good distribution of chicks in the crate:**

Sudden stops by the automatic conveyor before the crate enters the sprayer could, for example, cause uneven distribution of the chicks in the crate. In other cases, manual handling of the crates is too rough when it should be smooth. This could cause vaccine waste (vaccine on areas with no chicks) and deficient vaccine delivery (birds receiving less vaccine than needed).

Table 1. Control points during a spray vaccination quality audit according to the C.H.I.C.K program standard.

VACCINE PREPARATION	VACCINATION PROCESS
Cold chain & storage	Equipment setup
Vaccine preparation room	Equipment performance
Water quality	Operational control
Dosing control	Operational control
Preparation procedure	Cleaning & disinfection

Hatcheries	Flocks	Choanal swabs (5 DPV)	qPCR positive (%)	Ct values <35 (%)
Cevac IBird w/Desvac sprayer (C.H.I.C.K. program included)	74	1,445	97	100
Other IB vaccine w/Sprayer X	34	626	56	59
Total	108	2,071	–	–

Table 2. Results of qPCR IB detection in flocks sampled by choanal swabs at five days post-vaccination.

● **A consistent volume of vaccine solution:**

The vaccine volume sprayed into every crate must be consistent. Some older sprayers use a pressurised vaccine system that is susceptible to variations in air pressure. This can result in vaccine volume variations up to ± 50% of the desired volume, which will be very detrimental to achieve good flock coverage and immunisation.

Large scale monitoring of IB vaccination efficiency after hatchery spray application

A large trial was performed in China to compare and monitor vaccination efficiency with different IB vaccines, sprayers and hatchery services. The PCR on reverse transcribed RNA (RT-PCR) is a very sensitive and rapid detection method for IBV which helps to discriminate vaccine and field viruses strain for epidemiological studies.

The RT-qPCR technique was chosen for the present study to determine the IB vaccination efficiency at the hatchery by sampling birds in the choanal swabs at five days post-vaccination (DPV). Their Cycle Threshold value (Ct) were recorded to determine the level of viral load present in individual birds.

● **Study design:** Hatcheries selected by the IB vaccination programme and type of sprayer were selected for this study. The control points used during the spray audits

were according to the C.H.I.C.K. Program standard (Table 1). A total of 2,071 choanal swabs from 108 commercial broiler flocks were analysed by quantitative PCR and their Ct value recorded for analysis.

The flocks vaccinated with Cevac IBird/Desvac sprayer (C.H.I.C.K. Program included) showed 97% positivity by PCR and 100% of them obtained Ct values less than 35 versus 56% PCR positivity and 59% Ct values greater than 35 for competitor vaccine and equipment (Table 2).

Conclusion

The results of this large scale monitoring showed how the differences in the IB vaccine application in hatcheries, evidenced by the presence or not of a monitoring service and the adapted vaccination equipment, had an impact on the proper and effective flock immunisation.

Indeed, superior vaccination effectiveness was proven by quantitative PCR detection of the vaccine strain that was observed in commercial broiler flocks vaccinated with Cevac IBird using the Desvac sprayer and audited with the C.H.I.C.K. program.

This trial is still ongoing and more data is being collected. This will be statistically analysed for publication in the future. ■

References are available from the authors on request



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VITAMIN D: SUNSHINE VITAMIN

Vitamins are chemical entities which are essential in small quantities for maintaining the proper metabolic process in animals and birds. These essential nutrients can't be synthesised at all or not in sufficient quantities. So, there is need to give these vitamins to animal and bird in feed as daily allowance.

Vitamins are two types as Fat soluble and Water soluble, fat soluble are A, D, E and K and water soluble are B complex and Vit C.

Vitamin D is fat soluble vitamin which regulates calcium haemostasis, which is vital for normal growth, bone development, egg shell formation and routine metabolic processes in birds. Vitamin D₃ production process can be activated when sunshine spreads on bird skin. But due to present extensive farming and managerial practices and housing method, it is difficult to get sunlight to form the Vit. D process naturally in birds. So, there is need to supply proper Vit D sufficient levels of Vit D through feed or water.

Two major forms of Vit D are available i.e., Ergocalciferol or Vit D₂ and Cholecalciferol or Vit D₃. Ergocalciferol is derived from plant steroid, ergosterol and Cholecalciferol is product from the precursor 7 dehydrocholesterol which further form absorbable Vit D conversion in animals and birds. In birds pre-vitamin 7 dehydrocholesterol is derived from cholesterol or squalene, and they present in large quantity in skin of the animals & birds.

The provitamin 7-dehydrocholesterol which is present in epidermis of skin get converted to cholecalciferol with UV irradiation from sunlight, then it get absorb in blood circulatory system after binding it with Vit D blood transport protein (DBP).

As of this Vit D form is not biologically active and must be converted to biologically active form which takes place in liver and kidney before it absorbs in system.

Once Vit D reaches to liver for transformation, in which a microsomal system of hydrolysate to produce 25-hydroxy-vit D[25-(OH)D].

This metabolite is major circulating form of Vit D in blood, which is transported to kidney with Vit D transport globulin. In kidney it is converted into various compounds including 1,25-(OH)2D₃ which is also known as Calcitriol.

Then this compound is transported to the intestine, bones or other organs where it is involved in metabolism of calcium and phosphorous.

In maintaining the normal blood calcium levels, Vit D acts along with Parathyroid hormone. Vit D facilitates absorption of calcium through intestine.

Vit D plays important role in regulating Calcium haemostasis which is also required for skeletal development, embryo development, immunity and basic metabolism processes. It becomes a vital nutrient in breeders, layers, broilers and chicks.

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In market various products of active Vit D₃ are available as feed additives. Active Vit D₃ can be destroyed with over treatment with UV light and by peroxidation in presence of various fatty acids in feed.

Vit D₃ is fat soluble vitamin and it is mainly absorbed in ilium part of intestine, where the feed remains for long duration. The fat absorption is depended on presence of bile salts for lipid absorption. If there is stress on liver due to mycotoxicosis, fatty liver, IBH where liver function gets stressed, bile production and secretion may not be normal, then the Vit D metabolism in liver may get hampered and so the deficiency symptoms may be seen.



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As Huvepharma's product Bio D which is 25-hydroxy vitamin D₃ is directly get absorbed and activated in kidney and it bypasses liver metabolism and conversion. Vit D₃ is also important in broiler breeder nutrition which are high performing birds, needs vitamins for proper skeletal development.

Bio D absorption is good as it is natural fermented product. In eggs Vit D₃ absorbed & get accumulated in egg yolk, which gets utilised by newly hatched chicks in first week. As the lipid digestion mechanism is not well developed in early life in chick, chick can use Vit D₃ from yolk. So, in breeder Bio D is essential not only for own skeletal development but also for early chick nutrition. It is also important for egg quality, hatchability, immunity etc. making it necessary. So proper supplementation of the Vitamin is important for optimizing broiler breeder operations.

Vit D plays important role in regulating Calcium haemostasis which is also required for skeletal development, embryo development, immunity and basic metabolism processes. It becomes a vital nutrient in breeders, layers, broilers and chicks.

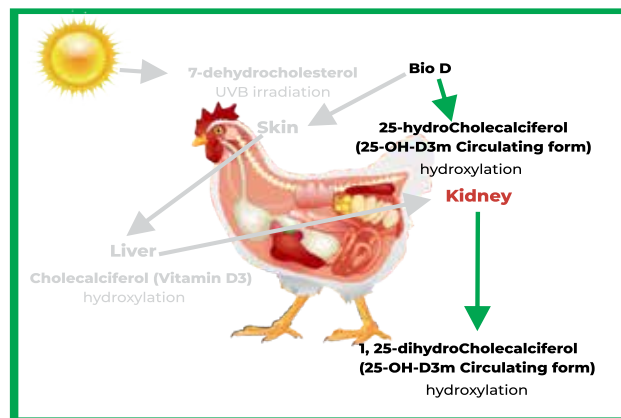
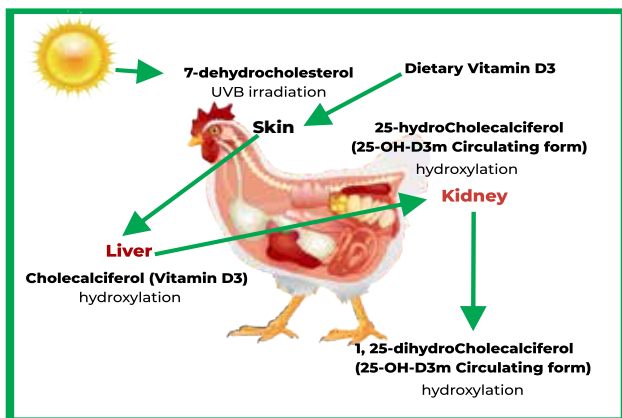
In present commercial broiler operations fast growth rate is obtained in muscle and skeletal development, which calls for fast bone mineralisation without any porosity.

Otherwise, bird may show lesions of lameness, femur head necrosis (osteomyelitis), tibial dyschondroplasia. Bio D[®] helps in Ca and P haemostasis to maintain proper growth of broiler.

Bio D[®] can support immunity system to have better defence mechanism for bacterial and viral diseases in poultry.

In laying hens, if the laying period get extended, where egg quality and egg shell may be a problem in later stages of lay. In this mechanism Vitamin D₃ plays an important role for regulation of intestinal calcium absorption. Bio D[®] acts as metabolite which can bypass liver hydrolysis, so the action of Bio D[®] is not dependable on liver function which may affected due to mycotoxins, fatty liver syndrome, IBH etc.

In conclusion Vitamin D is essential for birds and as standard diet ingredients do not contain enough of this vitamin, it should be supplemented to make sure the animals vitamin D needs are met throughout production as efficiency is key in diet formulation, opting for a highly effective vitamin D metabolite makes sense. This is where Bio D[®] which contains 25-hydroxy vitamin D₃ with unique properties due to its fermentation origin.



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WINTER MANAGEMENT IN POULTRY FARMING



Dr Milind Rainchwar



Dr Milind Rainchwar,
Technical Service Manager – South Central Asia,
Novus International

Poultry rearing is an art as well as a science and management plays most crucial role in deciding profitability of this business. It has been observed in past several years that high market rates of broiler meat & eggs are observed only in those times when rearing is very difficult due to harsh climate and thus, demand is more than supply. Therefore, it is very important to understand and implement the best management practices in such harsh climate.

Every region in India has different climatic challenges and variable climate extremes and thus management practices differ between different parts of country. But almost all parts of India experience three to five distinct seasons across the year.

Winter is one of the seasons which presents very harsh temperature extremes and maintaining liveability and production becomes very difficult without taking extra measures. Management in winter is very difficult and often described as double edged sword, as a very perfect balance is required between climate management and ventilation management. Similarly, a very careful decision making is required

to reduce cost of production and to provide healthy environment at the same time. It requires ample of experience to understand the economic feasibility of cost involving management practices.

Chickens are unable to maintain body temperature in young age and although they improve their tolerance to cold with age, they cannot perform well when ambient temperature drops below 20 degrees Celsius and start exhibiting stress and drop in productivity. Failure to provide optimum temperature very frequently results in high mortality, high disease incidence and drop in performance.

Although ways of practicing the management in harsh climate may differ slightly across region, the basic principles remain same. Below listed are few basic principles which may guide proper decision making.

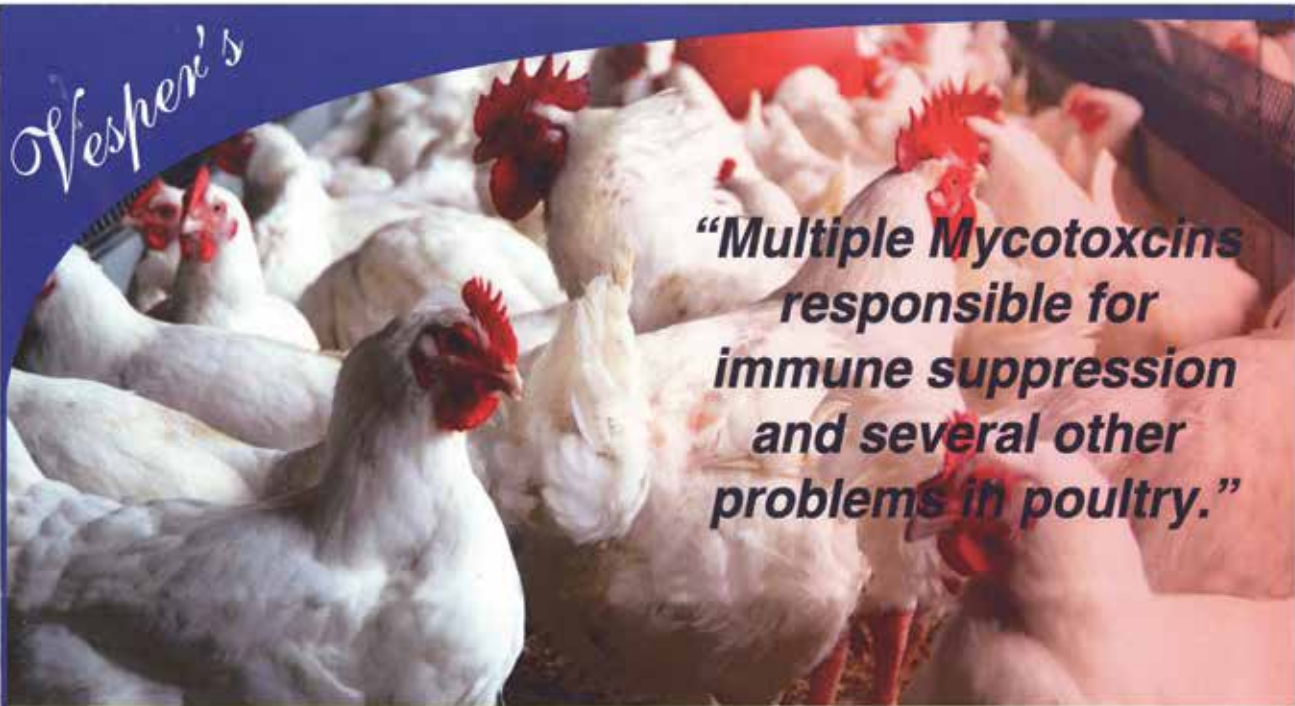
- Proper temperature and humidity suitable for the age is always required
- Proper ventilation to provide fresh air and removing gases inside house is always required
- The rearing surface and bedding material should be always warm and dry
- The drinking water should be maintained at suitable temperature

to promote water intake

- The feed & feeding practice should help bird to maintain their body temperature, metabolism, and osmo-regulation
- To achieve these goals, following practices are implemented across country
- External heat source is provided to keep the poultry shed warm and dry
- False ceiling is often used to reduce the volume of shed
- Various types and layers of curtains and jute bags are used to insulate the farm
- Round brooding is often practiced when spot heating is done

As stopping the air flow becomes necessary to maintain temperature, it is very difficult to remove the gases like ammonia and to keep bedding material dry in winter. These challenges affect the respiratory, hepatic, and gut health directly.

The wet litter and humid conditions provide a very suitable environment for gut pathogens like Coccidiosis and Clostridium. The stressed and immunosuppressed birds become easy target for these gut pathogens and



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therefore, very high-performance losses are observed due to poor gut health. It is a well-known fact that body only gets that part of nutrition, which gut retains. An unhealthy gut loses a lot of nutrients which are necessary for weight gain and egg production. The major part of poultry immune system is also situated in gut. Thus, healthy gut is key to a developed immune system.

While managing good management practices, essential needs such as Proper feed and water is an utmost need to optimise performance during this difficult time. Gut health compromise always leads to poor performance and thus loss in business. Different feed additives play crucial role in maintaining and improving gut health such as Protease, NSPase Enzyme, Probiotics, Essential oils, Organic Acids, etc.

Serine Protease, A broad spectrum protease when added in the feed improves the digestibility and absorption of Amino acids which otherwise are the food for pathogens in the hind gut like Clostridium, Salmonella, etc. This Protease thus enables the improved

digestion of Nutrients and reduces the pathogenic load and helps to improve litter condition.

Serine protease has other benefits as well. It has good impact on neutralisation of trypsin inhibitor, an Antinutritional factor in Soybean. Use of Serine Protease also helps to reduce the allergen proteins like Lectins, B Conglycinin by significant amount which otherwise causes the gut irritation. Hence, Proper use of Protease in winter leads to improved litter quality with better absorption of nutrients.

NSPase when added in the feed improves the absorption of nutrients and helps to reduce wet litter condition. Improvement in litter quality leads to the less damage by pathogens.

Organic Copper has the strong impact on litter quality in winter (copper is antifungal in nature). It helps to improve the Clostridium cluster IV & XIVA which are responsible to increase the Lactobacillus count in the gut and maintains or improve microflora through competitive expulsion. This, then enables to improve the litter quality.

Organic Acids such as Coated Benzoic acids helps not only to reduce pathogenic bacteria such Clostridium, Salmonella as well they help to improve Lactobacillus count in gut through increase in Clostridium clusters IV and XIVA which are responsible for Increase in Lactobacillus count.

Essential oils are considered primarily Digestive enhancers apart from their immune function. They help to digest the nutrients in early stages effectively where endogenous enzyme is not active fully. Also, they impede quorum sensing, thus acts as Antibacterial in nature too.

Addition of God organic Acids such as formic Acids, Propionic acids in water to keep water acidification at par is key to improve water quality. Water intake is always a concern in winter. Thus, Effective use of Organic acids along with water Sanitisers to improve water quality and intake should always be considered in winter season.

Below are some pics showing the brooding in Winter and Impact of Winter on gut Health if not managed well...

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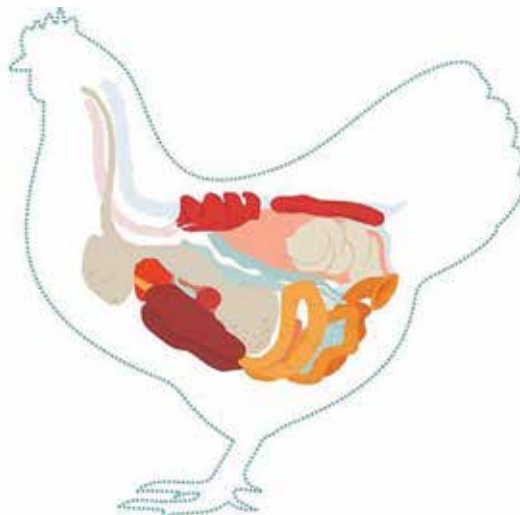
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THE IMPORTANCE OF MAINTAINING A HEALTHY GUT

Joaquim Boix,
Product Manager – Intestinal Health, ADIVETER



The gut is a complex system in which several factors act in order to achieve its optimal function. These factors that we could consider key are the immune system -based on the local action of certain immunoglobulins, the intestinal morphology -based on the enterocytes integrity and the unions between them, the diet, and the whole of the microorganisms present - the microbiota.

A good intestinal health relies on the balance between the saprophytic and pathogenic floras found in the gut. The breakdown of this balance is what is known as dysbiosis and can lead to disease when the saprophyte flora decreases or disappears and the pathogenic one increases. There are authors who consider dysbiosis as a breakdown of the balance between the microbiota and the host, considering the whole factors involved in the functioning of the digestive system. This perspective is given by the introduction of the concept of holobiont, in which the association of a macroorganism (animal or plant) and the microorganisms that make up its microbiota is considered as a single entity (Van de Guchte et al., 2018).

There is not a clear definition of what can be considered a healthy microbiota, even so, a high microbial diversity in the animal can be associated with a healthy situation (Ocejo et al., 2018).

The advances made in molecular biology

allow, as of today, to carry out studies on the set of the genomes present in a given medium, the metagenome, without having to make the isolation and the culture of the different microorganisms, field that is dealt with by metagenomics. Thus, the set of genes of the microorganisms present in an animal (the microbiota) is called microbioma.

Several factors affect the microbiota composition, such as an excess of certain nutrients, a poor digestibility of them, the use of antibiotics and several environmental factors, as well as factors related to the animal itself (age, sex ...).

The optimization of the microbiota characteristics has an obvious impact on the productive performance of the animals and consequently on their profitability.

Although there are few studies on this subject, there is evidence that the gut microbiota composition may partly explain differences in Feed Efficiency in pigs. Although microbial diversity doesn't vary between animals, Feed Efficiency can be related to some specific intestinal microorganisms, so they could potentially be used as biomarkers of this Feed Efficiency and even consider the use of these microorganisms as a probiotic. For example, at the genus level it has been stated that there is a positive correlation between *Prevotella* and pig weight (McCormack et al., 2017)

MICROBIOTA

The distribution of microorganisms throughout the animal intestinal tract is not uniform. This microbial configuration varies according to the gut section considered, both qualitatively and quantitatively. For example, in the case of birds, a greater number and diversity of microorganisms is observed in the cecum in relation to sections of the small intestine (Ocejo et al., 2018), and in the case of pigs, diversity and composition vary between the small intestine and the large intestine (Crespo et al., 2017). The total number of bacteria in the pig colon is estimated to be between 10¹⁰-10¹¹ ufc/g of gut content (Gaskins et al., 2002) and in the cecum of birds it is around 10¹⁰ ufc/g of gut content, compared to the 10³ ufc/g of the small intestine.

This high microbial diversity in the bird caecum is due to a greater intake retention and to the fermentations that occur in this gut section (Ocejo et al., 2018). In the case of pigs, reasons are similar: in the small intestine there is a shorter transit time of the digesta and a continuous entry of new bacteria coming from the feed (Donaldson et al., 2016).

Diversity measures of the microbial population.

Alpha Diversity: this diversity measure describes the number of different species in a given population and its structure, based on the calculation of a series of indices. The main

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indices used are:

- **Observed Species:** expresses the number of species present in a given environment.
- **Chao 1:** basically reflects the number of species present in a specific population based on the determination of presence-absence data, so they are an expression of richness.

- **Shannon and Simpson:** These estimators describe the structure of a population with respect to the proportional abundance of each species. The Shannon index considers the number of species present (richness) and the relative quantity of individuals of each one of these species (abundance). Regarding the Simpson Index, it also takes a certain number of species present in an environment and their relative abundance.

Beta Diversity: this measurement of diversity describes the variation in the structure of a given community, in a given environment, over time, or the difference between populations of different environments in a given time. The estimator used is the Bray-Curtis index that quantifies the dissimilarity between two environments based on the counts of each medium. It expresses whether two populations have the same composition or they don't share any species.

Phylogenetic Diversity Measurements: The indices described above describe diversity considering all species in the same way without taking into account the evolutionary differences between them. There are other indices that also express diversity between populations based on the genealogic relationships between them, taking into account the different evolution models and expressing their uniqueness.

Taxonomy

The microbiota taxonomy of animals, as well as the average of certain microorganisms regarding the rest, might be a reflection of their health status.

There are three predominant phyla in the animal gut.

- **Firmicutes:** formed by Gram+ bacteria. It includes the families Lachnospiraceae, formed by butyric acid producing bacteria, Clostridiaceae and Lactobacillaceae.
- **Bacteroidetes:** formed by Gram- bacteria. It includes the families Prevotellaceae and Rikenellaceae (Alistepes)
- **Proteobacteria:** it includes a wide variety of pathogenic microorganisms, such as Enterobacteriaceae; E. coli, Salmonella, Vibrio, Neisseria ...

Other bacterial families of interest and belonging to other phyla are the Bifidobacteriaceae, belonging to the phylum Actinobacteria, and the Akkermansia genus (phylum Verrucomicrobia).

The intestinal flora varies with the age of the animal. The microbiota evolution throughout the whole life of the animal is influenced initially by the population provided by the parents and the environment and later by the feed source used. In the case of mammals the most evident change occurs during the shift from a diet based on milk to another one in which the main nutrients are other types of carbohydrates.

Variations in the microbiota have also been observed depending on the breed of the animals, so the genetic profile can be considered a predisposing factor of intestinal infection due to these changes in the microbiota (Guevarra et al., 2019). Other factors can affect the microbiota evolution such as environmental factors.

INTESTINAL HEALTH

As mentioned before there is not a definition of what can be considered a healthy microbiota, and consequently a correct intestinal health, although a series of mechanisms involved in the loss of the intestinal function can be considered, among them the appearance of dysbiosis, the loss of the intestinal barrier integrity and inflammation (Van de Guchte et al., 2018).

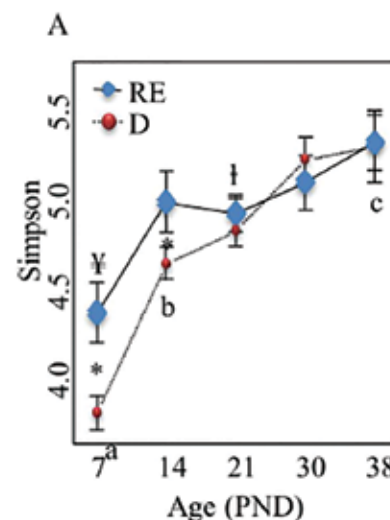
The challenge is presented when trying to predict the appearance of this loss of intestinal health in a predictive way, before the start of the problem, and not in a diagnostic way, once it appears. Hence the need to define which could be the useful biomarkers for this purpose.

Two groups of markers could be considered: microorganisms, that indicate a change in the microbiota (Microbial shift) and the host own molecules that reflect cellular inflammation, intestinal integrity breakdown or the epithelial cells condition. In human medicine, for example, faecal levels of calprotectin are assessed as a biomarker of intestinal inflammation.

Considered as indicators of good intestinal health, at the hindgut level, are the presence of butyrate producing bacteria, such as those belonging to the Lachnospiraceae and Ruminococcaceae families. In animals with intestinal challenge, a decrease of these families and an increase of Proteobacteria is observed. At small intestine level there are

other bacteria of the Lachnospiraceae family, such as Candidatus Arthromitus, that are considered indicators of an optimal intestinal health.

It has been observed that piglets with diarrhoea, on day 38, showed a lower Simpson Index at day 7 than healthy piglets (Dou et al. 2017). The same study showed, when comparing the microbiota of these piglets with diarrhoea versus healthy piglets, that healthy piglets had a higher abundance of Prevotellaceae, Lachnospiraceae, Ruminococcaceae and Lactobacillaceae.



Source: Dou et al. 2017

These remarks suggests that the intestinal microbiota affects the development of post weaning diarrhoea, and not only specific pathogens, and that it's possible to differentiate diarrhoea susceptible piglets based on bacterial composition in early stages of piglet life (Dou et al. 2017)..

Regarding broiler, a correlation was observed between different taxa, specifically an appreciable decrease of the Lactobacillaceae family, associated to an increase of Campylobacter levels (Ocejo et al., 2018).

MICROBIOTA EVOLUTION

As mentioned before, the intestinal flora doesn't remain constant throughout the animal life. This evolution that occurs over time can be influenced by many other factors, both environmental and genetic.

POULTRY

Broiler

The intestine of chickens that come from the hatchery is not colonized by

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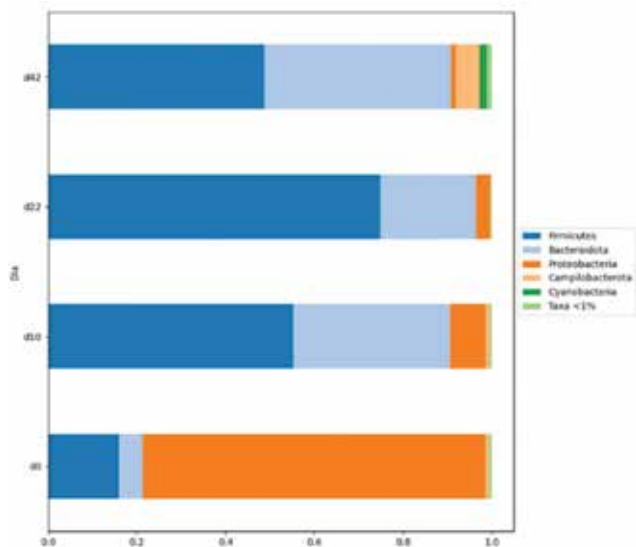


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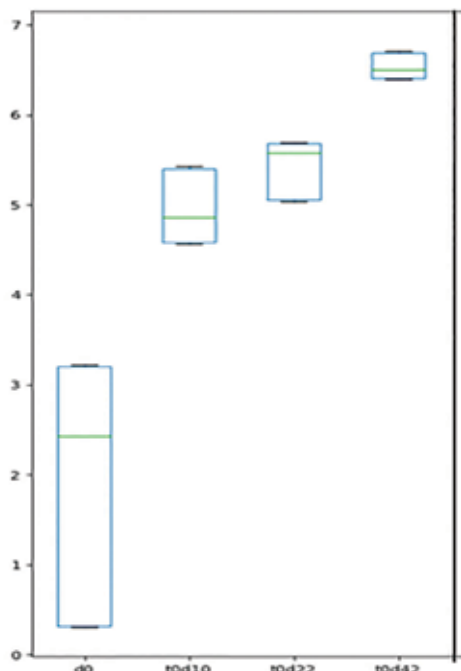
microorganisms from the hen, but by those from the environment. Initially, chicken microbiota is made up of facultative anaerobic bacteria. These bacteria consume oxygen and decrease its levels in the intestine, thus increasing the strict anaerobic bacteria population.

In one-day-old chicks, coming directly from the hatchery, the dominance of the phylum Proteobacteria is observed at caecal level, with a significant proportion of enterobacteria and E. coli among them. As the chick grows a decrease of this phylum is observed and the presence of Firmicutes and Bacteroides increases (Adiveter 2020).



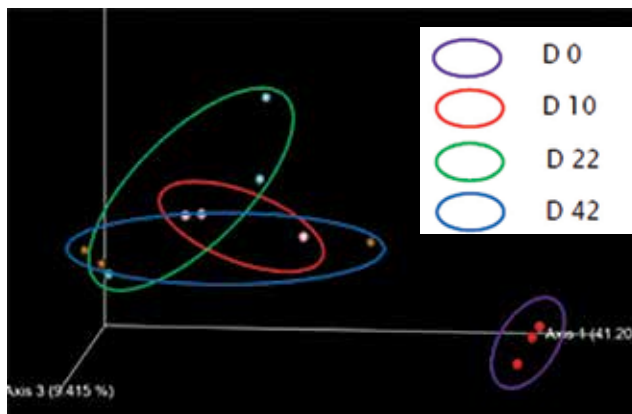
Source: Adiveter

In a study carried out by Adiveter in a commercial farm, the values of the Shannon Index were determined at days 0, 10, 22 and 42; and an increase of this estimator was observed as the animals grew.



Source: Adiveter

Regarding Beta Diversity, two different bacterial communities were observed according to age groups, showing that the bacteria of the one-day-old chicks are different from those of the rest of the animal life.



Source: Adiveter

As it was observed, chicken rearing could be divided in three different stages. First days of chicken life in which Proteobacteria is the predominant phylum; a second stage, around 22 days of life, in which a clear decrease of proteobacteria and a significant increase in firmicutes is observed; and a third one, around 42 days of life, in which Bacteroidetes replaces part of the firmicutes.

Within Firmicutes, the predominant families are Lachnospiraceae and Ruminococcaceae that are butyrate producing bacteria. In the case of Bacteroidetes, the main genus are Bacteroides and Alistipes, mainly propionate producers (Qi et al, 2019; Polansky et al., 2015). Several authors explain this variation of the bacterial populations regarding the type of Volatile Fatty Acids produced. The production of butyrate could probably be associated to the high nutritional requirements of this early stage of the animal development and because it is a period of faster growth. In the case of propionate production it could be related to a balance between energy acquisition from available nutrients and a more sustained growth of the chickens (Ocejo et al., 2018).

(Ocejo et al., 2018) compared caecal microbiota of broilers and free range slow growing chickens, observing that free range chickens presented a higher proportion of gut health related bacteria, such as the Actinobacteria phylum of which bifidobacteria is part.

Even so, it must be taken into account that the microbiota profile of these chickens corresponds to animals that have never had contact with hens because they come from hatcheries. When adult hens are reared in contact with chickens, it has been observed that they act as donors of Bacteroidetes and Actinobacteria but do not act as an important source of Firmicutes. Chickens that were in contact with adult hens showed, in the first days of life, that about 40% of its caecal microbiota was made up of Bacteroidetes, compared to animals without contact with hens whose microbiota was dominated by Firmicutes (Kubasoet al., 2019).

Laying Hens

In studies in which the caecal microbiota of laying hens was determined, it was observed that the microbiota, until 24 weeks of age, was practically similar to that observed in chickens, reaching this age with the same trend of substitution of firmicutes, which were predominant, by Bacteroidetes.

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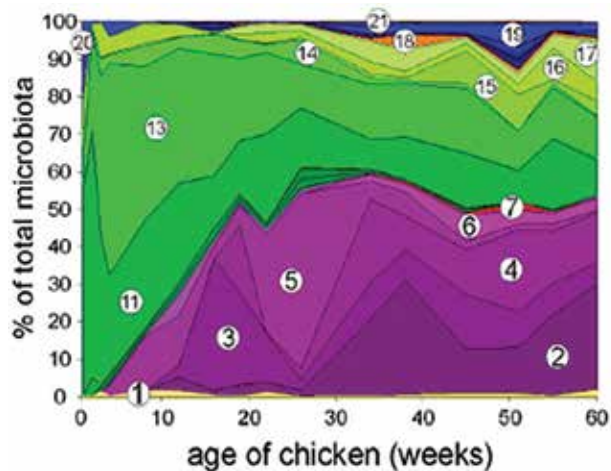
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The study stretched on until 7 months of age, observing that Firmicutes and Bacteroidetes were still predominant and each one of them represented half of the total. The increase of Bacteroidetes, at the expenses of Firmicutes, was correlated with the increase of hen weight and egg production (Videnska et al., 2014).



Firmicutes **Bacteroidetes** **Proteobacteria**
Source: Petra Videnska, 2014

PIGS

The pig microbiota colonization and evolution over time is hardly influenced by diet. The greatest change occurs in the weaning period with the shift from a breast milk based diet to another one based on solid feed (Nowland et al., 2019).

Studies have shown an increase in Alpha Diversity after weaning, and regarding Beta Diversity, significant differences between suckling and weaned piglets were also observed (Guevarra et al. 2019).

After weaning, an increase of Bacteroidetes phylum was observed, shifting from 44% in suckling piglets to 63% in the weaned ones. At the family level it goes from a population in which Ruminococcaceae (20%) and Prevotellaceae (13%) prevails in the case of suckling piglets, to another one with a higher proportion of Prevotellaceae and Lactobacillaceae, with increases of 44% and 4.8% respectively.

In the same way, Prevotella represents the main genus in both groups, increasing significantly from suckling piglets to the weaned ones. In the case of the weaned piglets, Prevotella and Lactobacillus were the predominant genus and in the case of the suckling piglets, Prevotella and Bacteroides (Guevarra et al. 2018).

These variations in the microbiota are mainly due to the type of diet the piglet receives. Bacteroides are microorganisms that use milk oligosaccharides as a source of energy and Prevotella is related to the fermentation of fibrous polysaccharides present in plants, as well as Lactobacillus that also metabolizes carbohydrates from plants, including starch (Guevarra et al. 2019).

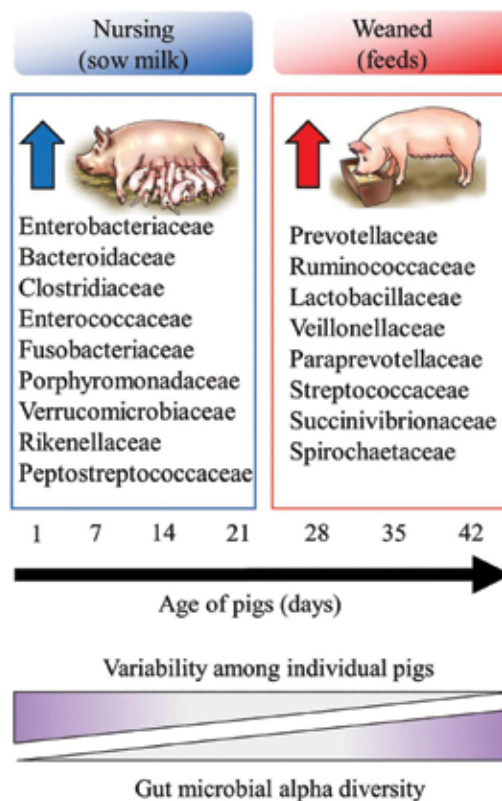
MICROBIOTA MANIPULATION

As seen, gut microbiota is influenced by multitude of factors. The control of these factors establishes the profile of microorganisms that make it up.

Among the different elements that take part in the microbiota modulation, the following should be highlighted:

Environment

Microorganisms that colonize the intestinal tract have influence on the development of the immune system and hence on the health



Source: Robin B. Guevarra et al. 2019

of the animal. The environment in which the animal develops itself affects this process and factors such as the hygienic state affects this development. Piglets reared together with their mother have greater flora diversity compared to their siblings weaned at 24 hours of age and reared in isolators (Inman et al., 2010).

Antibiotic use

When a group of piglets was subjected to a combination of antibiotics, a shift in the microbiota composition was observed after 14 days of treatment, compared to the animals not subjected to the medication. In animals subjected to the treatment, an increase in Proteobacteria was observed (from 1% to 11%), mostly E. coli which represented 62% of these microorganisms, besides a decrease of Bacteroidetes (Looft et al., 2012).

Feed processing.

The distribution of the microbial species in the gastrointestinal tract is also determined by the chemical composition and the structure of the digesta, since bacterial species differ in their substrate preferences and growth requirements.

It is known that particle size affects the digestibility of the diet and consequently their productive parameters. Likewise studies made at gastrointestinal microbiology level also demonstrated such an influence.

In the case of pigs, it is known that coarse particle size decrease gastric pH, thus maximizing the effectiveness of the “gastric barrier” against the transmission of faecal-oral pathogenic bacteria. Likewise, the low pH of the digesta ensures a higher proportion of Volatile Fatty Acids in its undissociated form, thus increasing its antimicrobial capacity. In addition to the gastric level effect, particle size also affects

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at cecum and colon levels, since it is possible that coarse particle size promote an increase of the population of Short Chain Fatty Acids-producing bacteria and consequently contributing to gastrointestinal health and preventing the proliferation of pathogenic bacteria (Kiarie et al., 2019).

In the case of poultry, it has been observed that the gizzard pH decreases when providing a coarse diet compared to a fine one due to an increase of the HCl secretion. Branton et al observed that birds fed with a coarse diet showed a lower mortality due to Necrotic Enteritis. This can be associated to the gastric function stimulation, including both HCl secretion and better utilization of nutrients in the small intestine that is related to coarse diets and influences the proliferation of *C. Perfringens* (Engberg et al., 2002).

Hydrothermal treatments (pelleting, extrusion, expansion,...) affect the chemical structure of feed nutrients. In pelleted feed, part of the starch is retrograded and becomes resistant starch that can only be degraded by its fermentation by the large intestine microorganisms with the consequent production of short chain fatty acids. Likewise, pelleting alters the physicochemical characteristics of dietary fibre (De Vries et al., 2012). Even so, there are few studies on the effect of hydrothermal feed treatment on the microbial composition of the gastrointestinal tract (Kiarie et al. 2019).

Additives (prebiotics-probiotics)

Prebiotics and probiotics are additives often used in animal nutrition.

A prebiotic is a substance that without being hydrolysed or absorbed at gastrointestinal level selectively stimulates beneficial bacteria growth. Probiotics are cultures of potentially beneficial bacteria for the intestinal flora and are administered in order to colonize the large intestine and modify its microbiota.

The solution: Adifarm G+: An holistic approach to gram + bacteria control and a good intestinal health

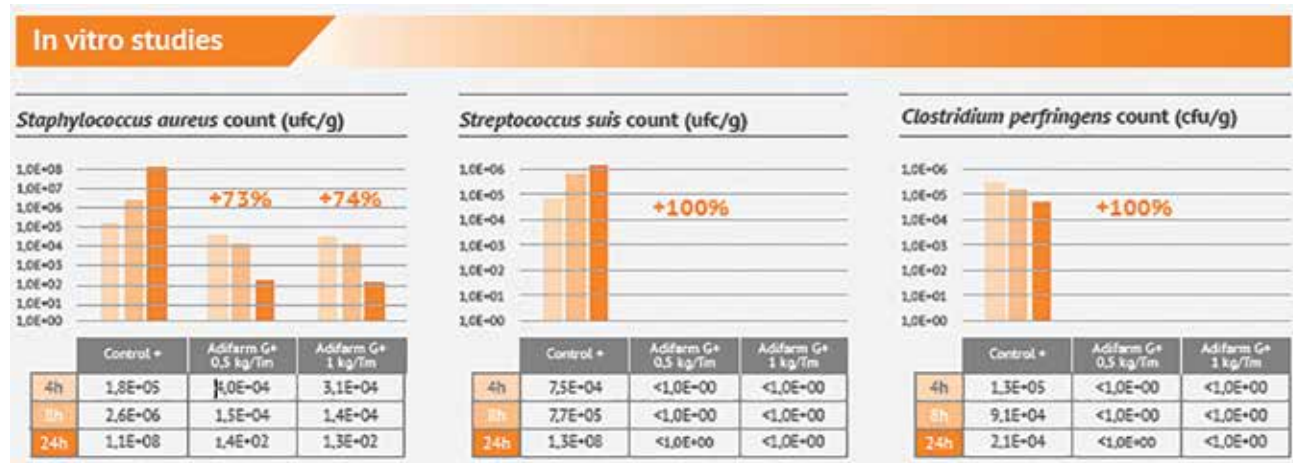
Adifarm G+ is an exclusive and innovative formula based on resin acids and monolaurin that improves productivity and animal health thanks to the control of gram-positive bacteria in the gastrointestinal tract.

Resinic acids are free fatty acids of natural origin (conifer resins) with proven high efficacy against gram-positive bacteria.

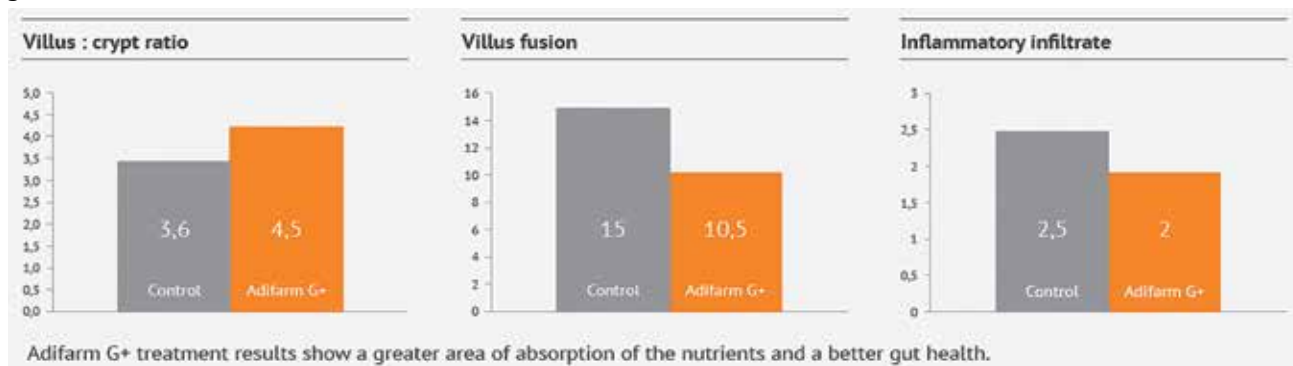
- They produce a loss of the gram-positive bacteria cell membrane integrity and an increase in the permeability of protons and ions, causing cell lysis (San Feliciano et al. 1993, Sikkema et al 1995).
- They have effects on microbiota composition (Kettunen et al. 2015).
- They have anti-inflammatory effects and cell growth promoters.

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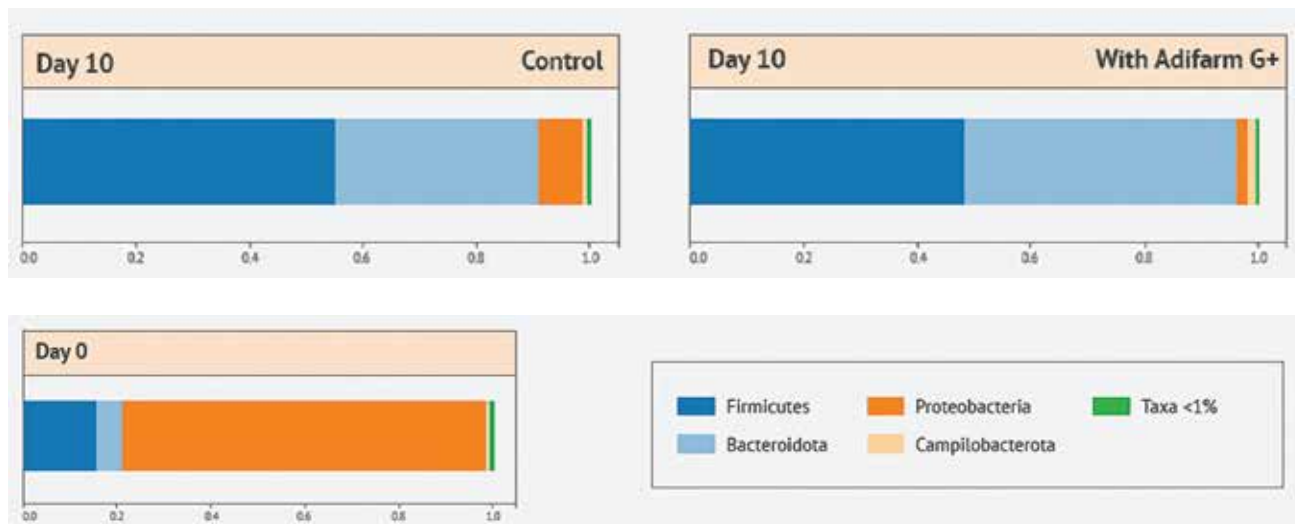
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In vitro studies (Metagenomics)

The normal evolution of the chicken cecum microbiota changes from a dominance of the phylum Proteobacteria (including Enterobacteriaceae), at the first stage of the animal's life, to a progressive increase of Firmicutes. Later, Firmicutes decrease in favor of the phylum Bacteroidota. Treatment with Adifarm G+ shows a lower proportion of Proteobacteria at day 10 compared to the control treatment, so we can assume that the flora transition is faster.



The benefits of using Adifarm G+:

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- Improves animal performance (increased digestibility and nutrient assimilation).

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BIBLIOGRAPHY

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Role of Probiotics in Poultry Gut Health

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Introduction

Probiotics are living microorganisms which when administered in adequate amount confer health benefits on the host. Probiotics are one of the more efficient methods of pathogen control and have not detrimental effects to the environment as antibiotics. The benefits include improved gut histomorphology, increase in beneficial microbiota, improved immunity, enhanced growth and laying performance.

Probiotics can be provided as a live microbial feed supplement for poultry, also known as direct fed microbials (DFMs), in the poultry diet or water or can be administered to the developing embryo using in-ovo feeding technology. The use of probiotics in poultry has increased steadily over the years due to the higher demand for antibiotic-free poultry. The probiotics market was reached 80 million USD in 2018 and is projected to reach 125 million USD by 2025 at a compound annual growth rate of 7.7% (Ahuja et al 2020).

Bacillus spp, Lactobacillus spp, Streptococcus spp, Bifidobacterium spp., Lactococcus spp and yeast Candida spp. are commonly used probiotics strains. Bacillus spp. are producing heat-resistance spores. This make it possible to

make feed added with probiotics which is also made using a granulation process. Multi-strain probiotics act on different sites and provide different modes of action that create synergistic effects. The criteria for selecting probiotic strains include tolerance to gastrointestinal conditions, the ability to adhere to the gastrointestinal mucosa, and the competitive exclusion of pathogens. Probiotics should have survival ability in manufacturing, transportation, storage and application processes.



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Properties of Good Probiotics:

- Probiotics must be a normal inhabitant of the gut and capable to adhere gastro-intestinal epithelium.
- Probiotic microorganisms must be able to survive in high temperature.
- Probiotic microorganisms must be able to survive in aerobic as well as anaerobic environment.
- Probiotic microorganisms must has tolerance to low pH and presence of bile acids.
- Probiotic microorganisms must be non-pathogenic and non-toxic to the host.
- Probiotics must exert its beneficial effects like enhanced nutrition and increased immune response.
- Probiotics must be sustainable under normal storage conditions.

Mechanism of action:

A. Probiotics helps in maintaining normal gut health and intestinal microflora by:

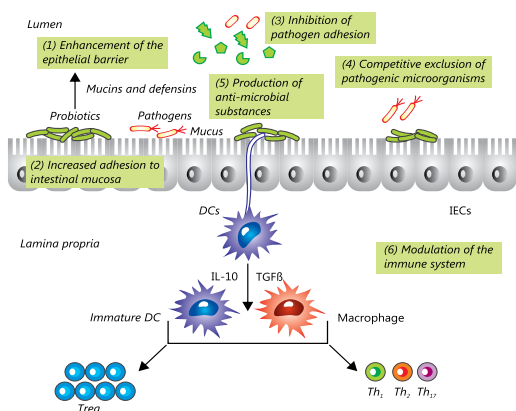
- Enhancement of the epithelial barrier with releasing of gut protective metabolites like arginine, glutamine, short-chain fatty acids, conjugated linoleic acids etc.
- Competitive exclusion by increasing adhesion to intestinal mucosa and by inhibiting pathogen adhesion to it.
- Production of antimicrobial substances like bacteriocins which helps to reduce pathogenic bacteria.
- Alteration in gene expression of pathogenic microorganisms.

B. Probiotics supplementation alters digestion, absorption and metabolism of nutrients by:

- Increasing digestive enzyme activity.
- Decreasing bacterial enzyme activity.

C. Probiotics supplementation develops Immunomodulation by:

- Enhancing serum and intestinal antibodies production against foreign antigens.
- Enhancing secretion of cytokines, lymphokines and anti-inflammatory mediators, resulting modulation of immunity.

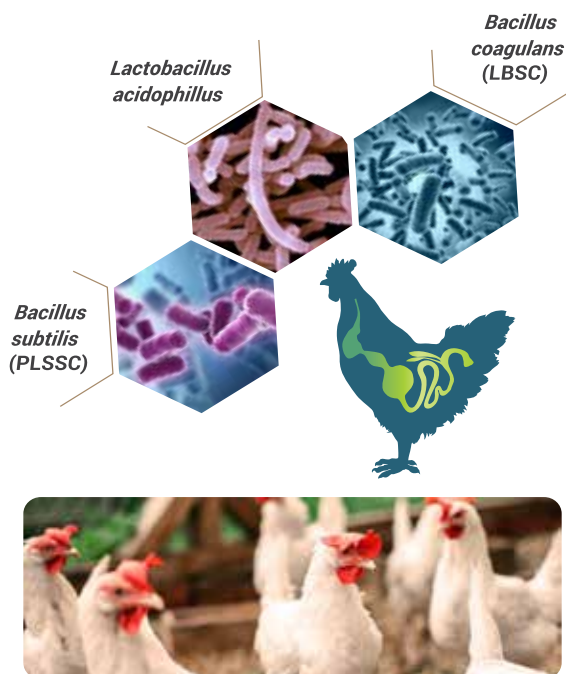


Benefits of Probiotics:

- Promotes optimal development of gut microbiota especially post-hatch.
- Re-establishes balanced gut microflora during post-antibiotic application.
- Reduces incidence of wet litter and pasty vent.
- Improves weight gain and feed conversion in broilers.
- Helps to maintain consistent egg production in layers and breeders.
- Effectively reduces early chick morbidity and mortality.
- Effectively replaces AGPs.
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CosBac™ is a uniquely blended, poultry-specific, multi-species synbiotic product that promotes development of beneficial gut microflora, increase in beneficial microbiota, improved immunity, which further leads to healthy & economics production parameters through the combined action of carefully selected probiotic microorganisms and prebiotics. It comprises *Bacillus subtilis* (PLSSC) 5×10^9 CFU/g, *Bacillus coagulans* (LBSC) 3×10^9 CFU/g and *Lactobacillus acidophilus* 2×10^9 CFU/g with guaranteed total potency of $\geq 10 \times 10^9$ CFU/g along with Prebiotics.

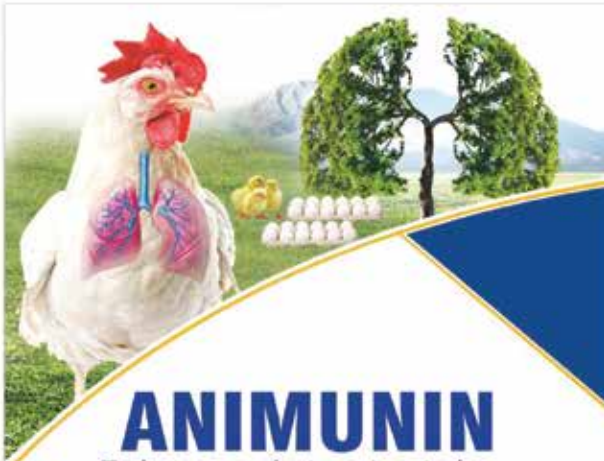




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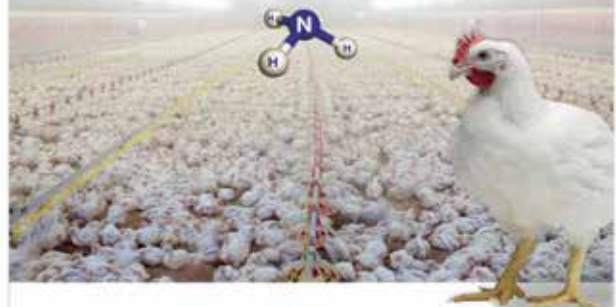
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Technical Update

Srinivasa



EFFECTS OF GROWING PERIOD LIGHTING PROGRAMS ON LAYING PERFORMANCE

Lighting programs are one of the key management tools in determining layer hen growth and laying performance. Light duration influences body weight profiles from hatch throughout the grow and until the hen reaches mature body weight in the lay period. Lighting programs also have a strong impact on the onset of sexual maturity, egg weight, and production performance.

In this study, we evaluated the impact of two common light applications on W-80 commercial bird growth and lay performances. The first treatment was the Hy-Line standard step-down (SD) lighting program starting with 20 hours of light during the first week; afterward, the light was decreased each week to reach 12 hours light at 7 weeks. The pullets were held at 12 hours light until 17 weeks of age. The second treatment (24/12) started with 24 hours of continuous light until 7 weeks of age. At 7 weeks the light was reduced to 12 hours and held until 17 weeks. The second application mimics common practice among Indian commercial layer farms. Parameters such as rearing period weekly body weight, age at sexual maturity, and production performance (hen-day %, hen-housed eggs, egg weight) were recorded and compared.

Results from the study indicate that the 24/12 lighting program reduces body weight, delays sexual maturity, limits production performances, and in general, limits genetic potential compared to the standard SD program.

TRIAL DESIGN

Hy-Line W-80 commercial strain was subjected to two different lighting practices: SD and 24/12.

- 600 chicks for each group were subject to experiment. Management practices followed the W-80 Commercial Guide for both groups.
- Birds were individually wing-banded at hatch for detailed data collection.
- Pullets were reared in floor-pens.
- No beak trimming was applied.
- During the growing period, bi-weekly body weight and mortality data was recorded.
- During the production period, body weights, mortality, production, and egg weight information was recorded.

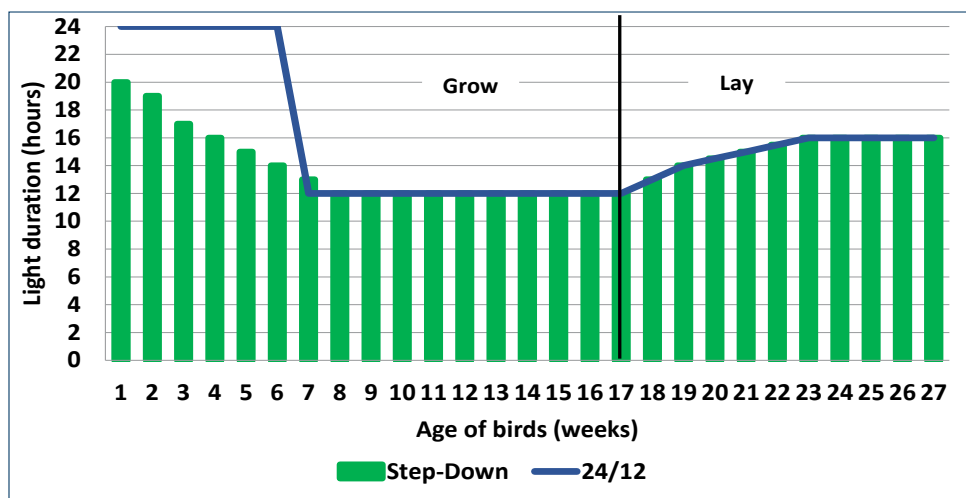


Figure 1. Lighting practices used in the study.



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RESULTS

Growing Period Body Weights

- **24/12 lighting program:** Birds from this group showed a good start for body weights up to 4 weeks of age and after showed reduced weekly body weight gain.
- **Step-down lighting program:** The body weight gain in this group was steady and on target compared to W-80 standard throughout the rearing period. Body weights were 49 grams above the 24/12 lighting program birds at 18 weeks.

All results were tested at $P < 0.05$ significance level.

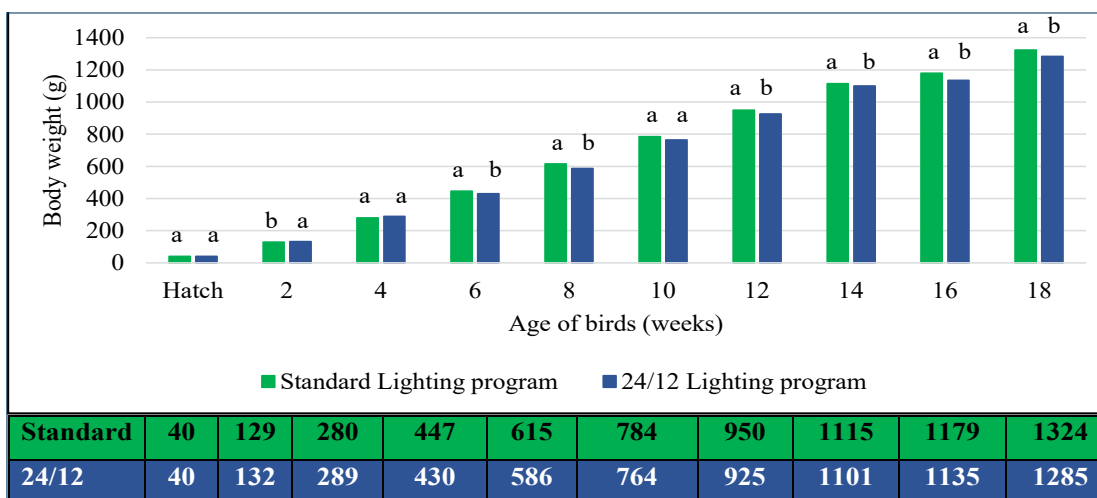


Figure 2. Comparison of body weight gain.

Sexual Maturity

Lighting programs had a significant impact on bird maturity. Birds under the step-down lighting program attained maturity 6 days earlier than 24/12 lighting program.

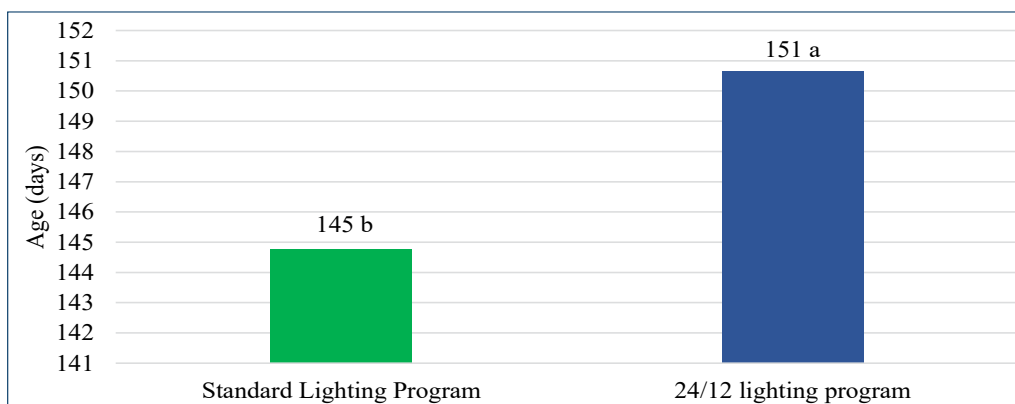
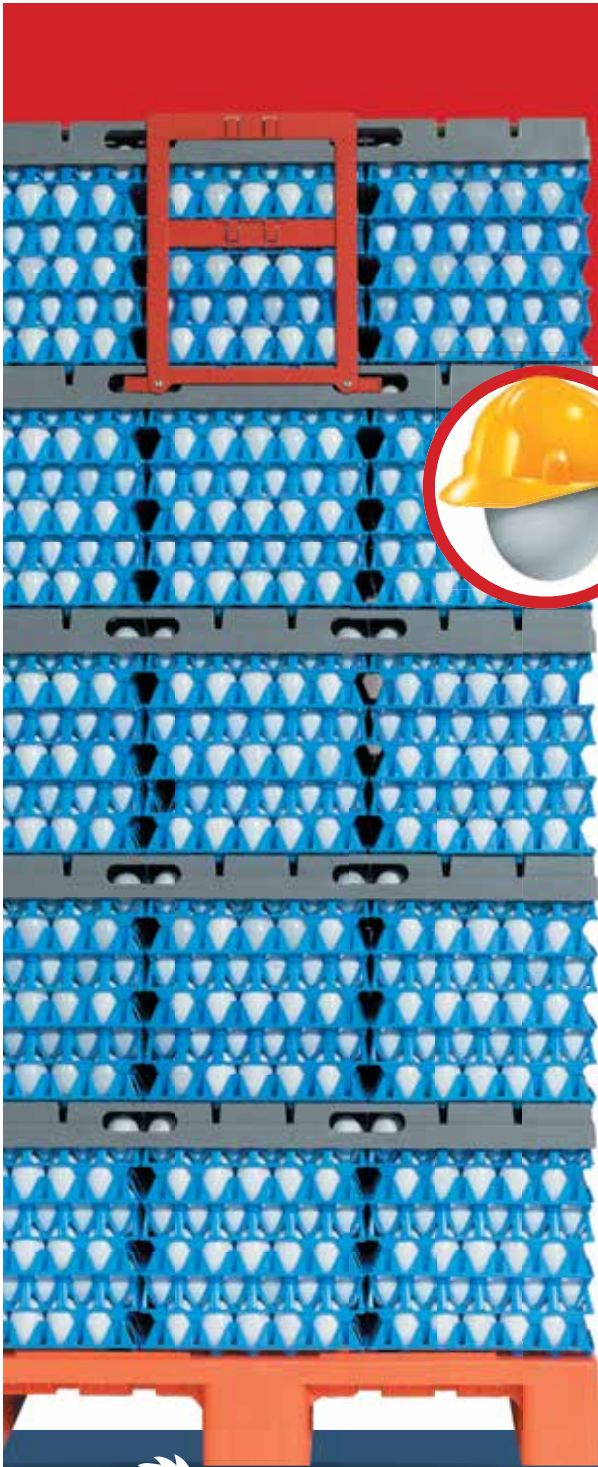


Figure 3. Comparison of sexual maturity.



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PRODUCTION PERIOD RESULTS

Hen-Housed Eggs	18–30 weeks	40 weeks	60 weeks
24/12 lighting program	84 ^b	138 ^b	269 ^b
Step-down lighting program	95 ^a	149 ^a	281 ^a

Onset of lay was six days earlier for birds under the step-down lighting program. By 30 weeks of age, the step-down group had 11 more eggs compared to 24/12 program. At the end of 60 weeks, birds under the step-down lighting program laid 12 eggs more than birds under 24/12 lighting program group.

Egg Weight

Birds with the 24/12 lighting program had 1.3 to 0.5 g heavier egg weight profile starting from the first egg. In both groups, egg weights were higher than the W-80 breed standard.

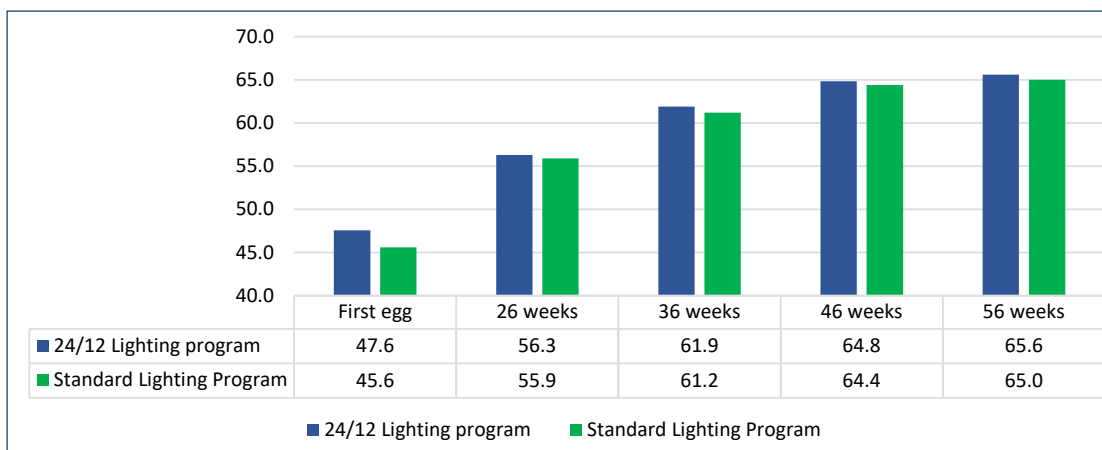


Figure 4. Comparison of egg weight.

SUMMARY

- This study shows that lighting programs in the growing period have a significant impact on body weight profiles during the rearing period, age of sexual maturity, number of eggs produced per bird, and egg weight throughout the hen's life.
- From the above study, step-down lighting program had good body weight development during rearing period. In the production period, the hens came into production 6 days earlier and by 60 weeks had 12 more saleable eggs than the birds of 24/12 hours lighting group. The heavier eggs with the 24/12 program are likely due to delayed maturity.
- The egg weight profile of the standard lighting program matches the Indian market.

CONCLUSION

Good production performances can be achieved by using the Hy-Line standard step-down lighting program during the rearing period. This program provides good resting time to the baby chicks to establish their circadian rhythm. Therefore, the supported hormone system gives a boost to muscle, bone, and intestinal development. Additionally, there is an energy-saving component by not using 24 hours of artificial light for 7 to 8 weeks. In this study, we kept birds at 12 hours of light to mimic day length; however, in an open-sided environment, we recommend no artificial light after 7 weeks, only daylight.

Recommended lighting program for Hy-Line W-80 birds in open-sided houses in India:

Growing Period		Stimulation and Laying Period	
Age in weeks	Light hours	Age in weeks	Light hours
1	20	17	BW=1100g with 85% Uniformity
2	19	18	+1 hr
3	17	19	+ 1hr
4	16	20	+1/2 hr
5	15	21	+1/2 hr
6	14	22	+1/2 hr
7	13	23	15-16
8 to stimulation	daylight	24	15-16

Day lengths vary seasonally (more than 12 hours in summer and less than 12 hours in winter). This seasonal variation may affect the onset of production. When the day length is more than 12 hours during the rearing period, it is recommended to keep the longest day length for the entire rearing period. Light stimulate the flocks once they have 1100 grams minimum body weight with 85% uniformity and only after moving the birds to production houses. In the case of uniformities less than 85%, light stimulate the flock after attaining 1200-1250g body weight.

Srinivasa |  *Hy-Line.*



LIGHTING IN BROILER PRODUCTION

Dr. Sarishti Katwal,

Livestock Production Management

Dr. Shubham Koundal,

Veterinary Public Health

Blue and green light has a calming effect on birds, while birds reared in red light are more active and shows enhanced walking, flying, head movement, litter scratching, body shaking, wing flapping, wing/leg stretching, feather pecking, aggressiveness and cannibalism. The frequency of eating, sleeping heavily, sitting and being inactive are more in the blue light and the green light encourages preening, dust bathing and drinking. Broilers under blue or green light become significantly heavier than broilers raised under red or white light. Green light accelerates muscle growth and stimulates growth at an early age, while blue light stimulates growth in older birds.

Broiler production is the fastest growing sector in India as it generates higher profits in less time compared to other enterprises. Lighting is a strong exogenous factor in controlling many physiological and behavioral processes. Light enables the bird to establish rhythm and synchronize many essential functions, including body temperature and various metabolic steps that aid nutrition and digestion. Equally important, light stimulates the secretion patterns of several hormones that largely control growth, maturation and reproduction. Poultry producers currently use various lighting programs (wavelength, intensity, and duration) and devices. The potential use of photoperiods for better production and handling is gaining interest by the day. Broiler lighting patterns are primarily intended to stimulate and control feed intake. Two programs are usually used:

- a) Continuous lighting except 1 hour of darkness,
- b) Lighting at 2-hour intervals on, 2 hours off.

Light factors affecting broiler production

1. Light intensity

In general, brighter light leads to increased activity, while decreasing intensity is effective in controlling aggressive actions that can cause cannibalism. In the first phase of life (1-7 days after hatching), a minimum light intensity of 25 lx is used in broilers. After the initial phase, it is common practice to limit both the intensity of the light and the duration of the light. The intensity should be 3 to 5 lux and a duration of 2 to 6 h/d for the rest of the growing season. Carcass yield decreases linearly with increasing light intensity from 1 to 40 lx.

2. Light duration

The duration of the lighting depends largely on the age of the chickens involved and the type of housing used. Providing broilers with 20 hours of light per day has been shown to have the highest growth rate of all age groups. Short days (i.e. 14 hours of daylight) have also been found to result in a reduced growth rate regardless of the age of the market. But increasing the length of the day to 23 hours per day also has a negative effect on the growth rate. The intermittent photoperiod significantly increases weight gain, feed gain ratio, mobility and carcass performance with a decrease in mortality rate.

3. Light colour

Blue and green light has a calming effect on birds, while birds reared in red light are more active and shows enhanced walking, flying, head movement, litter scratching, body shaking, wing flapping, wing/leg stretching, feather pecking, aggressiveness and cannibalism. The frequency of eating, sleeping heavily, sitting and being inactive are more in the blue light and the green light encourages preening, dust bathing and drinking. Broilers under blue or green light become significantly heavier than broilers raised under red or white light. Green light accelerates muscle growth and stimulates



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growth at an early age, while blue light stimulates growth in older birds. The diameter of the fibers of the breast and thigh muscles was better with blue and green light than with red light. It is recommended to use green light until the 17th and then use blue light after that.

4. Source of light

There are several types of lamps available to poultry farmers: incandescent lamps, fluorescent lamps, metal halide lamps, high-pressure sodium lamps, CFL (compact fluorescent lamps), and LEDs (light-emitting diodes). All are used on poultry farms for laying hens, breeder flocks, broilers and turkeys. No significant differences were found in weekly body weight, body weight gain and after treating the birds with different types of natural light sources- incandescent lamps (INC), CFL and LEDs. However, the average feed intake in the daylight and INC groups was higher compared to CFL and LED. Similarly, the feed conversion rate (FCR) was significantly higher in the CFL and LED groups compared to INC and natural light. Therefore, it can be said that modern light sources such as CFL and LED (both neutral LED and cold specific poultry LED) can be used instead of INC to get more benefits. Similarly, no effect of INC, CFL and LED light sources was found on the carcass characteristics, abdominal fat and giblet yield of broilers. However, incandescent light source resulted in the production of Grade 2 carcasses and therefore can be replaced with modern energy efficient light sources such as CFL and LED. Birds reared under fluorescent lighting showed lower incidence of leg problems as compared to birds under incandescent light.

Key points to remember

i. Provide 24 hours light on the first day of placement to ensure adequate feed and water intake.

- ii. Broiler performance and welfare are optimized when between 17 and 20 hours of light are given.
- iii. As birds age they are able to adapt to shorter day lengths. Broilers marketed at older ages perform relatively better on shorter day lengths than birds marketed at younger ages.
- iv. Short day lengths (i.e. 14 hours of light) lead to a reduced growth rate regardless of market age.
- v. Feed intake was highest in broilers given 20 hours of light a day. There was a marked and significant reduction in feed intake when day length was decreased below or increased above this.
- vi. Response to day length will not differ between strains or sexes.
- vii. Mortality and culls due to leg weakness are increased with increasing day length. Broilers given 23 hours of light had the highest incidence of leg weakness despite not having the fastest growth rate.
- viii. Increasing day length beyond 17 hours led to a significant decline in walking and running activity with walking and running activity being lowest in birds given 23 hours of light.
- ix. New modern energy efficient lighting sources like CFL and LED can be used for lighting.



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CROWN OF SOUTH INDIA





ALTERNATIVES TO FORMALDEHYDE IN ANIMAL FEED FOR PATHOGEN CONTROL

Alicia Baz Montero
Marketing Manager
Adiveter S.L.

“Since the authorities banned the use of formaldehyde as a feed additive, Adiveter has been researching in the development of alternatives for this in European and Turkish market in order to keep a safe feed production. Form-ad Plus and Form-ad Plus P are liquid preservatives based on a specific combination of selected volatile short organic acids and their salts, medium chain fatty acids and essential oils.”

Feed safety is one of the major concerns of feed producers given that feed contamination can negatively affect animal health and performance. Animal feed can be a carrier for several microbial contaminants such as bacteria, yeast and moulds (Maciorowki *et al*, 2007), being considered as a major source of infection with *Salmonella*. To prevent this pathogen feed contamination, feed compounders used to add formaldehyde or organic acids as preservatives.

Although formaldehyde is very effective reducing *Salmonella* contamination, it was classified as carcinogen and its use was banned by EFSA since 2017 in Europe and Turkey. The ban on formaldehyde allows formic acid and other blend of organic acids to be used as bactericides, being one of the most potent organic acids for reducing microbial load such as *Salmonella*, *E coli*, *Clostridium* and *Campylobacter*, according to scientific research.

More than 25 years back Adiveter’s leadership in feed safety. Since the authorities banned the use of

formaldehyde as a feed additive, Adiveter has been researching in the development of alternatives for this in European and Turkish market in order to keep a safe feed production. **Form-ad Plus** and **Form-ad Plus P** are liquid preservatives based on a specific combination of selected volatile short organic acids and their salts, medium chain fatty acids and essential oils.

The specific combination of SCFA and MCFA in Form-ad Plus and Form-ad Plus P has synergistic effects in bacterial inactivation and animal performance. They reduce the bacterial load in raw materials and feed and protect them from further contamination. Thanks to lipophilic properties, MCFA destabilizes and damage the microbial cell membrane and increases the penetration of SCFA. SCFA can directly trigger the intracellular acidification of bacteria and inhibits their replication.

It is well demonstrated the antimicrobial effect of organic acids. While SCFA are more effective against gram-negative bacteria, MCFA have a great-



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er effect on gram-positive bacteria. MCFA can also provide a protection against some viruses.

Form-ad Plus and Form-ad Plus P include nonanoic acid in their formula. It inhibits the growth of the bacteria by membrane disruption, involving mainly the disruption of electron transport chain and the interference with oxidative phosphorylation. The inner membrane of bacteria is an important site for energy production and it is where the electron transport chain is located.

Only a limited number of studies have investigated the roles of MCFAs like nonanoic acid (C9), particularly regarding intestinal epithelial barrier function. A study undertaken have revealed the role of C9 to increase and enhance intestinal epithelial immunological barrier function against bacterial translocation, being a method for preventing bacterial infections and intestinal disorders in animals. (Wang et al., 2018)

As we known, intestinal epithelium are important barrier to protect the host from virulent pathogens and reduce the number of intestinal virulent pathogens is beneficial to the health of the host. Epithelial

physical barrier damage and immunological barrier damage are usually related to bacterial translocation during a pathogenic infection. (Wang et al., 2018)

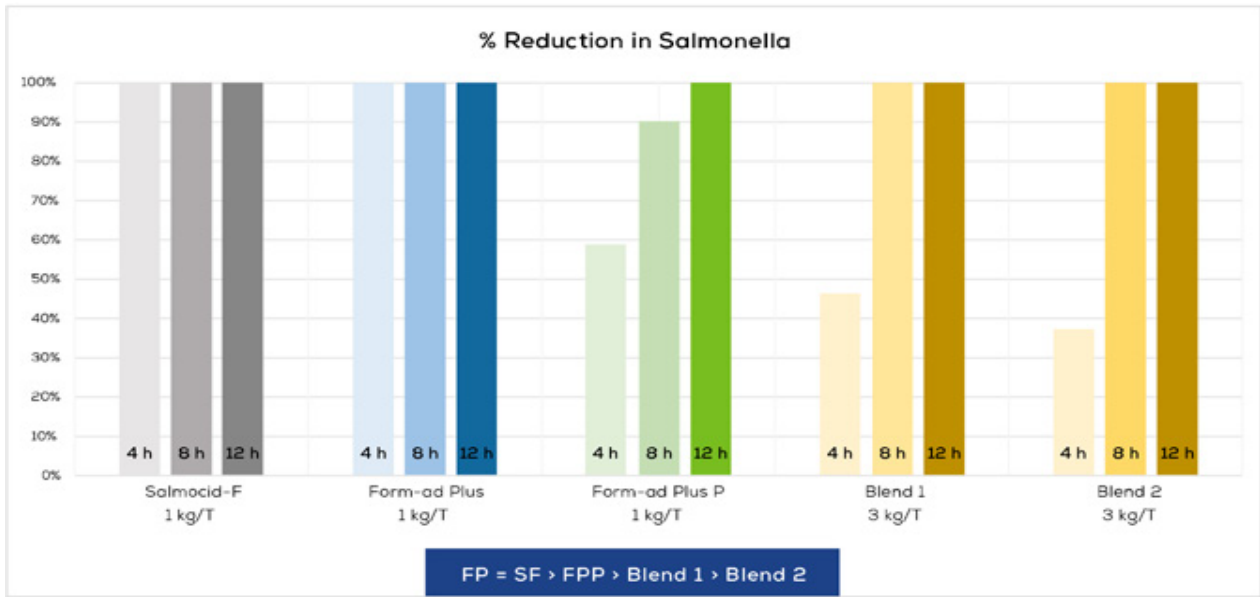
It is also suggested that C9 has the capacity to induce the expression of pBD (porcine β -defensins) genes in some cells, including the pBD-1 (that plays a potential role in surveillance and maintenance of a homeostatic state of gut microbiota on the mucosal epithelium) and pBD-2 expression (that likely inhibits pathogenic bacteria). (Wang et al., 2018)

TRIAL REPORT

These experiments were carried out to show the efficacy and corrosivity of Form-ad Plus and Form-ad Plus P (synergic blend of short and medium chain fatty acids and essential oils), Salmocid-F (formaldehyde-based product) and two competitors: blend 1, a mixture of free organic acids (formic acid 75 % and propionic acid 25 %) and Blend 2, a mixture of free organic acid (formic acid 75 %) and ammonium formiate 25 %.

In order to analyse the bactericidal efficacy of Form-ad Plus and Form-ad Plus P, we analysed the % of reduction in *Salmonella Tiphymurium* (10^3 cfu/g) of Form-ad Plus, Form-ad Plus P and Salmo-





cid-F at a dosage of 1 kg/T compared to blends 1 and 2 of organic acids at a normal dosage of 3 kg/T.

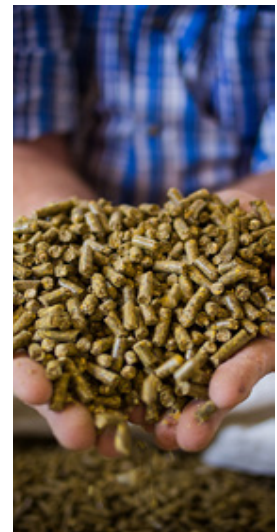
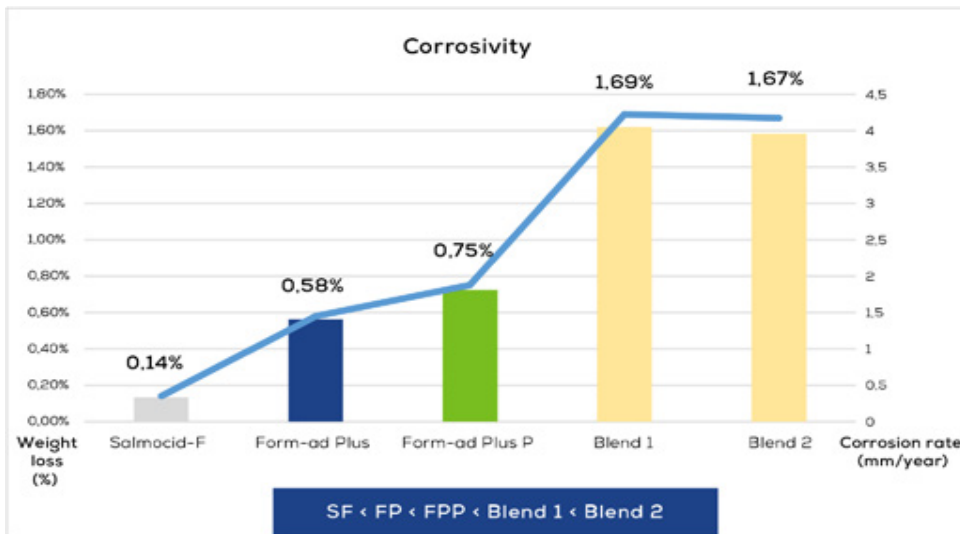
Form-ad Plus has the same effect than the formaldehyde-based product. Even at one-third dose, Form-ad Plus and Form-ad Plus P show higher bactericidal effect than blends 1 and 2.

In order to analyse corrosivity, we conducted a corrosion experiment, whereby test strips were immersed in different liquid solutions. Two parameters were analysed for corrosivity: test weight loss

(%) and corrosion speed (mm/year).

It should be highlighted the low corrosivity of these Adiveter products compared to other products based on free organic acids. This allows for safe handling and prevents the product from corroding the feed mill equipment and facilities, making them available for using during feed processing.

We conclude that **the high efficacy of Form-ad Plus and Form-ad Plus P are effective non-corrosive alternative solutions to formaldehyde-based products.**



GUT HEALTH IN POULTRY: A COMPREHENSIVE OUTLOOK



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¹Division of Veterinary Medicine, G.B.P.U.A & T, Pantnagar (Uttarakhand)
²Division of Veterinary Surgery and Radiology, IVRI Bareilly

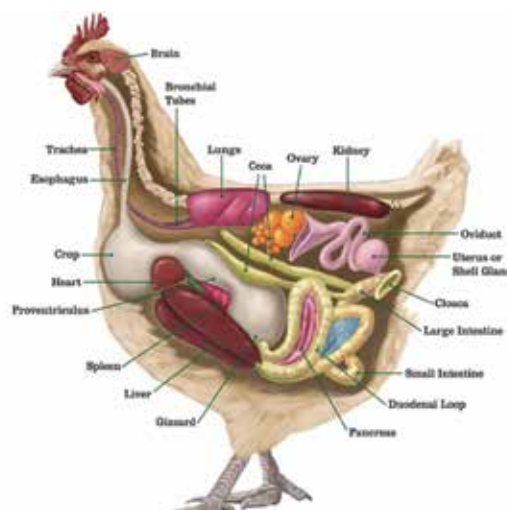
Introduction

The demand for poultry products has grown steadily in recent decennary. Modern poultry operations have withstood dramatic changes in production practices over the last 50 years. Amid traditional livestock species, poultry are the utmost efficient feed converters, with a feed conversion ratio in the range of 1.6–2.0. Over the last 10 years, the expression ‘gut health’ has entered the communal consciousness of poultry industries and research organizations. The expression ‘gut health’ has become a foremost tool of poultry health status. The intestinal mucosa provides a constructive barrier between luminal content and the host internal tissues. Intestinal integrity refers to maintaining the strength of the intestinal barrier to augment nutrient absorption within the bird. The intestinal barrier comprises of a layer of epithelial cells, preventing harmful pathogens and toxins from entering the system (i.e., leaky gut), and is critical for fluid and electrolyte secretion. Since it is regularly exposed to up to 10 trillion microorganisms, it’s important to keep this barrier functioning congruously.

The intestinal tract of a bird is a functional tube that starts at the beak and ends in the cloaca. The primary function of the gut is the conversion and digestion of food into its basic elements for absorption and utilization by the bird. The gut is separated into five well defined regions i.e. the crop, proventriculus, gizzard, small intestine (duodenum, jejunum and ileum) and large intestine (ceca, colon and rectum). Each of these regions plays pivotal role in the digestion process and absorption of nutrients.

What is gut health?

Within the scientific literature, there has been rampant increase in the use of ‘gut health’, ‘intestinal health’, ‘enteric health’ or similar terms, and great interest in the development of this concept. Gut health is an abstruse and convoluted area combining nutrition, microbiology, immunology and physiology and has a key role to play in poultry. A healthy gastrointestinal system can aid poultry to achieve optimal production of meat or eggs. The gastrointestinal system for poultry has two foremost functions: digestion & absorption and immunity. Gut health reckon on the effective maintenance of the intricate balance between the host, the intestinal microbiota, the intestinal environment and dietary compounds. This balance can be notably affected by factors such as bird management, feed quality and



the birds’ environment. When gut health is optimal, there is thorough digestion of the feed and absorption of the nutrient components. If there is a severance to the normal processes in the gut, incomplete digestion and absorption of nutrients can occur, leading to malabsorption and gut imbalance. Any disparity in the gut environment will lead to gut health at risk of being compromised which can impact the health and production performance of the poultry. Hippocrates believed that ‘all disease begins in the gut’ and ‘death sits in the bowel’. Poultry live in environments full of microbes where every day they are exposed to multitude of potentially pathogenic organisms through the air, water and food they consume, and through contamination of poultry house and pen mates.

The Significance of Chicken Gastrointestinal Microbiota

The gastrointestinal compartments of chickens are populated with complex microbial communities (Bacteria, fungi, Archaea, protozoa, and virus) but the predominant one is bacteria. Microbial colonisation of the gastrointestinal tract of newly hatched chicks commences at hatch, seeded from the immediate hatching environment, and quickly results in dense colonisation. Different bacterial species have different substrate preferences and different growth requirements therefore the chemical composition of the digesta, to a large extent, determines the compositions of the microbial community in the GI tract. There is also




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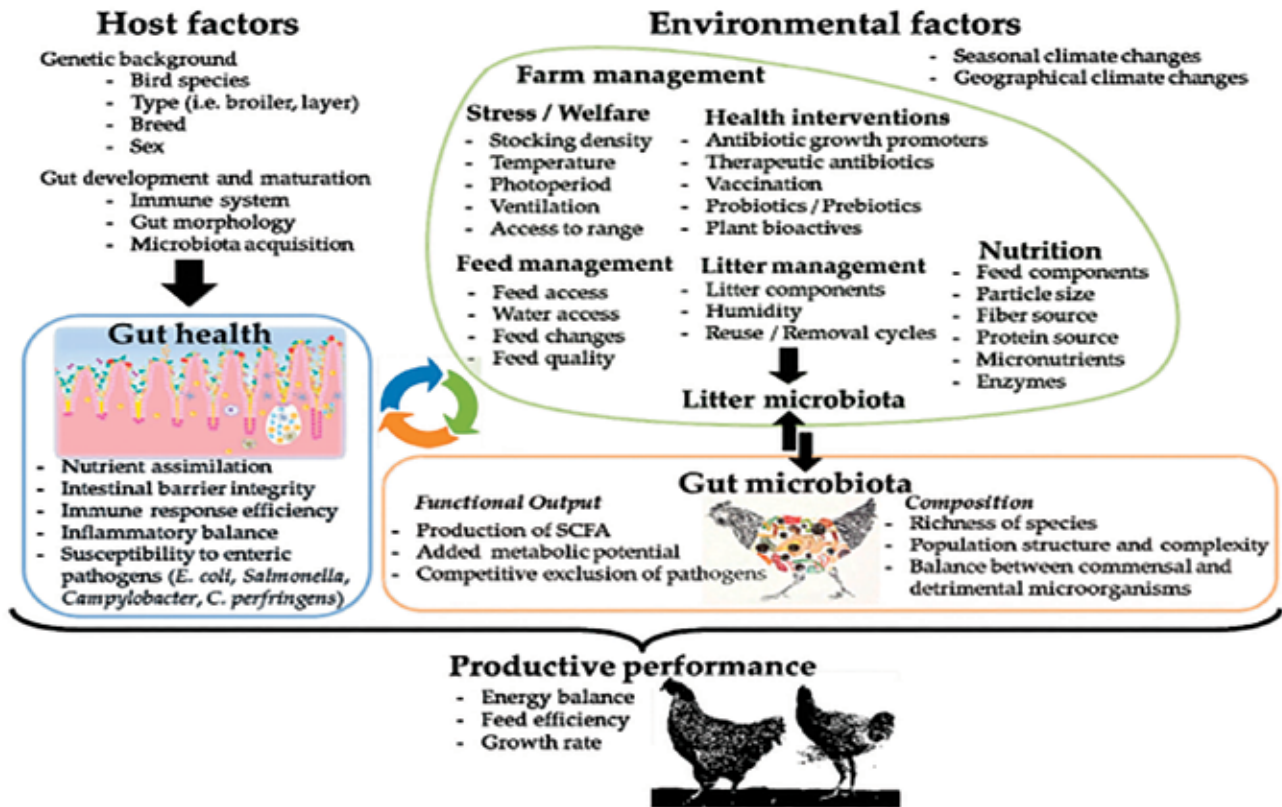


Figure 1. Key environmental and host-related factors that shape chicken gut microbiota and its interplay with gut health and productive performance.

notable diversity in bacterial populations among different parts of the GI tract and population densities tend to increase from the proximal to distal GI tract. Selective culture-based techniques have been used to identify and characterize the microbial diversity of the avian gut. The poultry intestinal microbiota has evolved into its present form incorporating many different communities from the environment and the animals and humans they contact. The practices of commercial poultry production expose newly hatched chicks to microbes from the hatchery environment, from human handlers, transport boxes, and transport vehicles, prior to arrival at the farm. This process is typically carried out in the first days of life, during the period when there is a rapid increase in bacterial diversity and load in the gut.

The gut microbiota can form a protective barrier by attaching to the epithelial walls of the enterocyte and thus reduce the opportunity for the colonization of pathogenic bacteria. These bacteria produce vitamins (e.g., vitamin K and vitamin B groups), short chain fatty acids (acetic acid, butyric acid and propionic acid), organic acids (e.g., lactic acid) and antimicrobial compounds (e.g., bacteriocins), lower triglyceride, and induce non-pathogenic immune responses, which provide both nutrition and protection for the animal.

Methods for improving gut health in poultry

1. Probiotics

Probiotics is also accredited as direct-fed microbial (DFM). Probiotics are live microbial feed supplements, which profitably affect the host

animal by improving its intestinal microbial balance. Probiotics effectively increase the normal microbiota population by the selective exclusion of specific pathogenic microbes in the gut. Probiotics help in improving poultry health and production by competitive exclusion of microbes, maintaining integrity of epithelial barrier, nutrient transfer and by enhancing enteric immunity. Common probiotics used in poultry are as follows: *Bacillus subtilis*, *Bifidobacterium* spp. and *Lactobacillus* spp. An ideal probiotic should be of host origin, non-pathogenic, resist gut conditions (acidic pH conditions), produce antimicrobial compounds, improve commensal bacteria growth, modulate immune response, improves performance of an animal.

3. Prebiotics

Prebiotics are non-digestible feed ingredients that are accountable for modifying the composition and metabolism of gut microbiota selectively. Prebiotics has the ability to increase the number of bifido bacteria and other species that affect the health of host positively. The β -glucan fed birds were found to have anti-Salmonella property by increasing the IgA-secreting cells, IgG level, and goblet cells causing immune-modulation to help birds boost immunity during Salmonella challenge.

3. Organic acids

Organic acids are the normal constituents of the plant and animal tissues. It includes acids such as lactate, acetate, propionate, butyrate, tannic, fumaric, and caprylic acids, among others. These acids play

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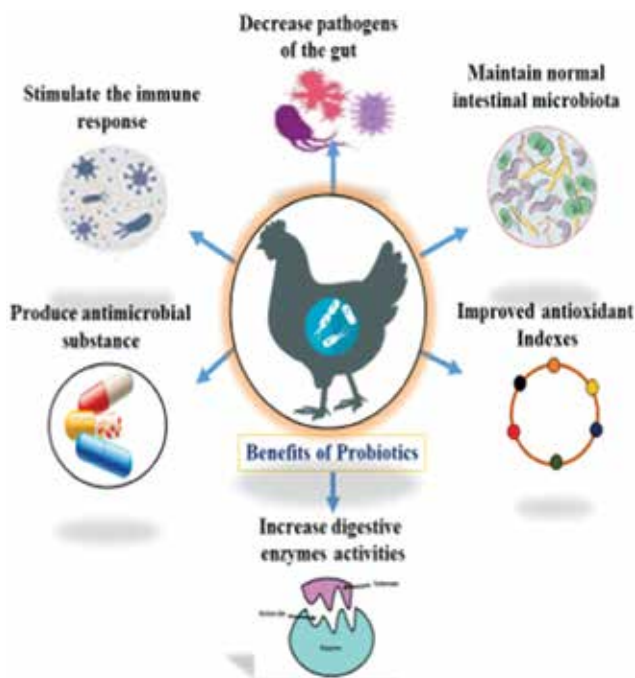
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a beneficial role in the gut health and performance of birds. The organic acid is also produced in the host gut after fermentation of carbohydrates, especially in the ceca of birds where the microbial population and diversity is at its highest level. Feeding organic acids may result in improved body weight gains and feed conversion ratio. A good range of organic acids with variable physical and chemical properties are available for poultry, for usage in water or feed. They are either available as single product or in combination. Recently, there is more awareness and the industry prefers to use protected (encapsulated) organic acids as they have the advantage of sustained and targeted release in addition to reduced odour issues. Supplementation of organic acids can modify enteric bacterial population, so it is recommended to use it along with probiotics.

4. Exogenous enzymes

Enzymes are specialized proteins that catalyze or accelerate the chemical reaction. Enzyme usage is quite important for poultry as feed contains corn and soya which have some anti-nutritional factors and

enzyme inhibitors. To reduce production cost, there is a tendency to use non-conventional feed raw materials. Enzyme supplementation reduces the pollutant potential of excreta. Enzymes also modulate the intestinal microbiota. Commonly used exogenous enzymes in poultry diets are β -glucanase, xylanase, amylase, α -galactosidase, protease, lipase, and phytase. The role of exogenous enzymes is to fulfill the absence of endogenous enzymes, to counter the anti-nutritional factors present in conventional and unconventional poultry diet.

5. Essential oils (EOs)

EOs are extracted from plant flowers, leaves, stems, roots, seeds or fruits by steam distillation, extrusion or solvent extraction [3]. The major components of many EOs are phenolic compounds (terpenoids and phenyl propanoids) such as thymol, carvacrol and eugenol. The in vitro minimum inhibitory concentration assay showed strong antibacterial activity of the EO product, thymol and carvacrol against pathogenic *Escherichia coli*, *C. perfringens* and *Salmonella* strains and weak activity towards beneficial *Lactobacillus* strains. Therefore, EOs are receiving increasing attention as potential antibiotic growth promoter alternatives in animal production.

6. Bacteriophages

Bacteriophages are viruses that infect and utilize bacterial resources for their own reproduction. They are very common in all environments and have a high specificity rate for bacteria at infection. Bacteriophages are specific for particular type of bacteria, and phage therapy is considered as a very safe and effective in comparison to antibiotics partially because they infect one species, serotype or



strain. This mechanism of action does not inhibit the proliferation of commensal flora of intestinal. Most research works have conveyed the efficacy of bacteriophages in reducing bacterial count and in the control of bacterial count and in the control of bacterial infections in poultry, which are zoonotic and have a substantial impact on public health.

Conclusion

Chickens' early lives present important constraints, with gastrointestinal health being among the key factors determining overall productivity of poultry sector. Maintaining the balance of quality gut health is a key point of getting the best growth and FCR out of any food producing animal. An integrated approach should be followed to attain the goal of gut health in poultry and ultimately the health status to improve the production performance in poultry.

BROILER POULTRY MEDICINE SCHEDULE CHART



*Mr. Rakesh Kumar
Growel Agrovet Private Limited*

Poultry Medicine Chart for broiler poultry is meant for healthy and profitable broiler poultry farming. Apart from good quality feeds, chicks, and following bio-security rules, a proper poultry medicine schedule and method are required for broiler poultry farming profitability. In broiler poultry farming, at a different stage of age, different medicines and supplements are needed. Growel broiler poultry medicine chart is time-tested worldwide.



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Benefits of following Growel' Medicine Schedule Chart:

- Each bird's extra weight gains of 200 gm. to 300 gm. over and above the current weight you are getting.
- Better immunity, least fear of diseases outbreaks, least or no mortality.
- 25% better FCR.

Please find broiler poultry medicine schedule chart developed by Growel as follow:

Growel's Medicine Schedule Chart for Broiler Poultry

1. Viracleam: The shed should be cleaned three days before birds come, and Viracleam should be regularly sprayed inside and outside the shed for three days. All feeders, drinkers & equipment should be washed with Viracleam solutions twenty-four (24) hours before the birds reach the farm. Once birds reach the shed, Viracleam should be sprayed regularly inside and outside the shed three times a week.
2. Aquacure: Aquacure should be mixed regularly with drinking water. Medicines should also be given with Aquacure treated water.
3. Electral Energy: After birds reach the farm, Electral Energy must be given on the first day and the second day in the morning. In summer or during any kind of stress, it should be given regularly.
4. Respiratory Herbs: Respiratory herbs should be given as a preventive dosage from the third day to the sixth day. The preventive dosages of Respiratory Herbs should be one ml. for 100 birds. Under the condition of CRD and E-Coli, the dosages should be 5-10 ml. for every 100 birds till recovery.
5. Amino Power: Amino Power should be given from the first day to the twelfth day. From the first day to the sixth day in the evening and from the seventh day to the twelfth day in the morning. For faster growth and better immunity, Amino



- 1. Viraclean:** *The shed should be cleaned three days before birds come, and Viraclean should be regularly sprayed inside and outside the shed for three days. All feeders, drinkers & equipment should be washed with Viraclean solutions twenty-four (24) hours before the birds reach the farm. Once birds reach the shed, Viraclean should be sprayed regularly inside and outside the shed three times a week.*
- 2. Aquacure:** *Aquacure should be mixed regularly with drinking water. Medicines should also be given with Aquacure treated water.*
- 3. Electral Energy:** *After birds reach the farm, Electral Energy must be given on the first day and the second day in the morning. In summer or during any kind of stress, it should be given regularly.*



- Power should be given regularly.
- 6. Grow B-Plex: Grow B-Plex should be given from the thirteenth day to the eighteenth day in the morning.
- 7. Growlive Forte: Growlive Forte should be given from the nineteenth day to the twenty-fifth day in the morning.
- 8. Grow Cal -D3: Grow Cal-D3 should be given from the twenty-sixth day to thirty- second day in the morning.
- 9. Grow E- Sel: Grow E-Sel should be given from thirty- third day to the fortieth day in the morning.

Special Notes:

- This medicine schedule is for around forty to forty-five days (40-45) for broiler farming. The medicine’s schedule can differ from one to three (1-3) days. Kuroiler and other breeds of birds should follow the exact schedule; only the dosages should be stretched, accordingly total no. of rearing days. For example, suppose that if you are rearing Kuroiler birds for eighty days, then the medicine you give to the broiler for 12 days should be given 24 days.
- For best results, Growel medicine should be given from day one. Medicine should be given preference in the morning.
- If same day two medicines are given, then one medicine should be given in the morning and one in the evening.
- The water should be mixed with medicines so much that all water mixed medicines should be consumed at the earliest possible time, approximately within 2-3 hours.
- Always take care that medicines should not be wasted or left in a drinker or feeder. First, shake well all liquid medicines before every use, then mix the medicines properly with feed or water.

The proper method of feeding poultry medicine chart as per schedule:

1. Medicine mixed water should be kept only that bird should drink it within two to four hours.
2. Always take care that medications should not be wasted or left in a drinker or feeder.
3. For a better result, follow the medicine chart schedule from day one.
4. Usually, try to feed the medicines in the morning.
5. Shake well all liquid medicines before every use.
6. Then, mix the medication properly with feed or water.
7. Keep sufficient drinkers and feeders.



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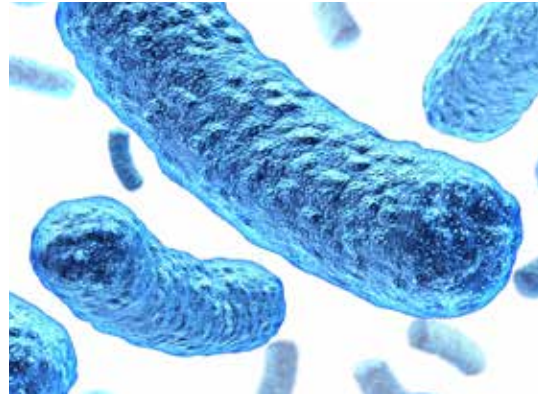
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Probiotics Work With or Without Antibiotics

*Christophe Bostvironnois, DVM, Global Poultry Product Manager
John Schleifer, DVM, DACPV, Technical Services Manager - North America*



Feed additive antibiotics, including ionophores, are effective in broilers but concerns are increasing as a result of development of antibiotic resistant bacteria and the presence of antibiotic residues in poultry meat. Concurrently, interest in the use of probiotics in broiler production is on the rise. It is known that probiotics benefit poultry through various mechanisms by modulating the microbiome and without the negative connotations associated with antibiotics.

There are regular debates over whether or not probiotics should be used only for Raised Without Antibiotics (RWA) production systems, which include No Antibiotic Ever (NAE) and organic production.

One **MYTH** is that antibiotics provide a performance-enhancing effect by their pure antimicrobial action. Thus, no additional benefit can be achieved with the combined usage of a probiotic and an antibiotic. The misconception is that the mode of action for each of the products is similar and probiotics aren't necessary when an antibiotic is used.

A second **MYTH** is that the simultaneous use of the two products will result in the destruction of the probiotic by the antimicrobial activity of the antibiotic. This also is a misperception or over simplification as to the susceptibility of the probiotic bacteria to the antibiotic. In particular, the spore-forming bacteria probiotics are naturally protected against chemical aggressors (acids) or thermal stress. The non-spore forming probiotics, such as the *Lactobacillus*-based probiotics, could be sensitive. Further sensitivity verification of germinated probiotic bacteria can be analyzed by Minimum Inhibition Concentration (MIC) studies (Table 1).

Table 1. Compatibility of Chr. Hansen probiotics with most common antibiotics.

Antibiotic Name	Therapeutic Class	Recommended in feed Dose (ppm)	<i>B. subtilis</i> MIC (µg/ml)
Bacitracin	Polypeptides	10-50	>800
Colistin	Polypeptides	30-40	160
Lincomycin	Lincosamides	5-20	80
Tiamulin	Pleuromutilin	30-50	>800
Virginiamycin	Streptogramin	5-10	16

The **REALITY** is that Chr. Hansen investigated this question seriously years ago. Over the last 10 years Chr. Hansen has conducted many research studies analyzing the additive value of the combined usage of a *Bacillus*-based probiotic with a feed additive antibiotic. Those results consistently

demonstrate that Chr. Hansen probiotics deliver performance benefits with or without concurrent usage of a feed additive antibiotic, regardless of the type of antibiotic fed (Table 2).

The **REAL** explanation resides in the different and unique modes of action of effective and ethical *Bacillus*-based probiotics.

Mechanisms of action proven to be associated with these products are: Competitive exclusion (direct and/or indirect), immuno-modulation, bacteriosin production, and enzyme production.

Competitive Exclusion:

Competitive exclusion is a probiotic mode of action that can occur via several different mechanisms. The direct mechanism is the basic space-occupying effect of the probiotic on intestinal cells. The result is less space for pathogenic bacteria to populate the gut. The indirect mechanism is through the production of secondary metabolites which affect the immediate environment of the probiotic bacteria. These metabolites result in the proliferation of lactic acid-producing bacteria, which benefit the intestine.

Bacteriocin or antimicrobial peptide production:

Effective *Bacillus*-based probiotics produce antimicrobial substances that inhibit the growth of pathogens. Growth inhibitory and/or bacteriocidal effects against certain poultry pathogens have been described, based on *in vitro* analysis of a number of probiotic bacteria. Probiotic strains of *Bacillus* spp. are shown to be especially effective (Svetoch et al., 2005; Teo and Tan, 2005; Latorre et al., 2016; Poormontaseri et al., 2017).

A Case Study: *Bacillus licheniformis* and bacteriocin effects

Bacillus licheniformis produce lichenysin (antimicrobial peptide). However, it is known that other *Bacillus* species produce bacteriocins or bacteriocin-like substances, such as subtilin and coagulins.

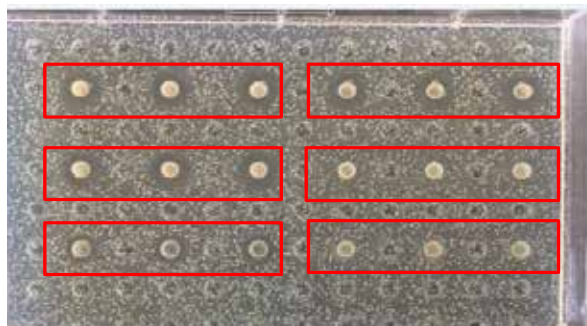
Bacteriocins are cationic (positive charged) peptides that display hydrophobic or amphiphilic properties and, in most cases, the bacterial membrane is the target of their activity. Several models have been proposed demonstrating the mechanism of action of these cationic peptides. The thrust of this action involves the formation of channels through which ions can pass and (or) the disruption of bacterial cytoplasmic membranes. This has a lethal effect on bacteria via the formation of pores in the bacterial membrane. The three principal steps required for this effect are: 1) binding of peptides to the bacterial membrane 2) peptide aggregation within the membrane 3) formation of channels.

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Bacteriocins must cross the negatively-charged outer wall of Gram-negative bacteria, which contains lipopolysaccharides (LPS), or the outer cell wall of Gram-positive bacteria, which contains acidic polysaccharides.

Recently, Chr. Hansen discovered a combination of *Bacillus* strains, the first to demonstrate the inhibition of Gram-negative bacteria such as *Salmonella* spp. and *Escherichia coli* (Figure 1).

Figure 1. Example of direct *in vitro* pathogen inhibition of GALLIPRO® Fit against *S. Typhimurium*.



Enzyme production:

Bacillus-based probiotics can be a factory of digestive enzymes. Those enzymes are released in the intestinal content by the germinated probiotics. Once released they will continue to act locally, transforming the undigestible nutrients into digestible nutrients. Many of these enzymes are summarized in the table below.

Table 2. Example of enzymes produced by *Bacillus subtilis*.

Enzymes produced by <i>B. subtilis</i> determined by ApiZYM and API20E	Substrate
Alkaline phosphatase	Phosphorus (LPS of Gram neg. bact)
Estearase (C4)	Fat
Estearase lipase (C8)	Fat
Leucine arylamidase	Protein
Cystine arylamidase	Protein
Acid phosphatase	Phosphorus
α-galactosidase	NSP*
β-galactosidase	NSP*
α-galactosidase	Carbo**
β-galactosidase	NSP*

*NSP: non-starch polysaccharides **Carbo: other carbohydrates
Source: Chr. Hansen, Innovation CD News M1006

The practical differences between antibiotics and probiotics

Probiotics have a versatile and dynamic mode of action

Antibiotics are chemical molecules acting effectively on specific types of bacteria. Depending on the therapeutic class, the antibiotic affects either the bacterial cell wall, the cellular protein synthesis, or DNA synthesis of the bacteria. Probiotics can have a similar mode of action, (ex: lichenysin of *Bacillus licheniformis*). However, other beneficial effects on intestinal health associated with probiotics are absent with antibiotics. For instance, antibiotics do not modulate the intestinal immune system. Antibiotics do not produce enzymes that can digest the undigestible. Antibiotics do not occupy space on intestinal cells, thereby naturally excluding pathogen attachment.

There is no need for probiotic rotation

Long-term usage of antibiotics may result in antibiotic resistance by pathogens. This complicates the choice for poultry specialists and results in frequent rotation. Chr. Hansen continually evaluates the efficacy of our strains with pathogen inhibition assays. So far, there is no development of resistance or acquisition of resistance genes by pathogenic bacteria in relation to a probiotic being used as a feed additive.

Chr. Hansen probiotics are proven to have a complementary efficacy to antibiotics

Covering a span of over 10 years, Chr. Hansen has completed many research studies on the combined usage of their probiotics with commonly used antibiotics (Table 3). Studies consistently show an additive effect of probiotics with antibiotics. MIC (Minimum Inhibitory Concentration) studies show compatibility between feed additive antibiotics and Chr. Hansen probiotics. These effective probiotics can be used in RWA or NAE production systems, as well as conventional production systems which utilize feed additive antibiotics, including ionophores.

Table 3. Summary of 10 years of Chr. Hansen research on combined use of probiotics with antibiotics and ionophores.

Year	Institute	Probiotic Tested	Antibiotics Used	Combination Effect of Probiotic/Antibiotic on:			Combo Effect
				Weight	FCR	Mortality	
2005	Customer Experience, BR	GalliPro® GalliPro®MS	Avilamycin 10ppm Lasalocid 60ppm (S/G) Monensin 100ppm (F)	Yes	Yes	Yes	Yes
2010	Auburn University, Alabama, US	GalliPro® GalliPro®Tect	Virginiamycin 5ppm Monensin 90ppm	Yes	Yes	Yes	Yes
2010	University of Viçosa, BR	GalliPro®	Salinomycin 55ppm Bacitracin 50ppm	Yes	Yes*	=	Yes
2010	Southern Poultry Research, Georgia	GalliPro® GalliPro®Tect	Salinomycin 60ppm BDM 50ppm	Yes*	Yes*	NA	Yes
2010	Southern Poultry Research, Georgia	GalliPro® GalliPro®Tect	BDM 50ppm (S/G) Virginiamycin 20ppm (F)	=	Yes*	NA	Yes
2014	Chinese Academy of Agri. Sciences	GalliPro®	Virginiamycin 20ppm	Yes	Yes	Yes	Yes + (Yield)
2015	Bangladesh Agri. University	GalliPro®	Lincomycin 15ppm	Yes	=	No	Yes + (Yield*) under Heat stress challenge)
2016	Masagounder et al.	GalliPro®	Virginiamycin 5ppm BDM 50ppm Monensin 80ppm	Yes*	Yes*	NA	Yes (both Ross and Cobb*)

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BACTERIAL GHOST: PRODUCTION AND APPLICATIONS

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Dr. Deep Shikha (PhD, SKUAST-J, R.S.Pura)

Dr. Mehak Tikoo (M.V.Sc, SKUAST-J, R.S.Pura)



im: Inner membrane

om: outer mebrane

INTRODUCTION

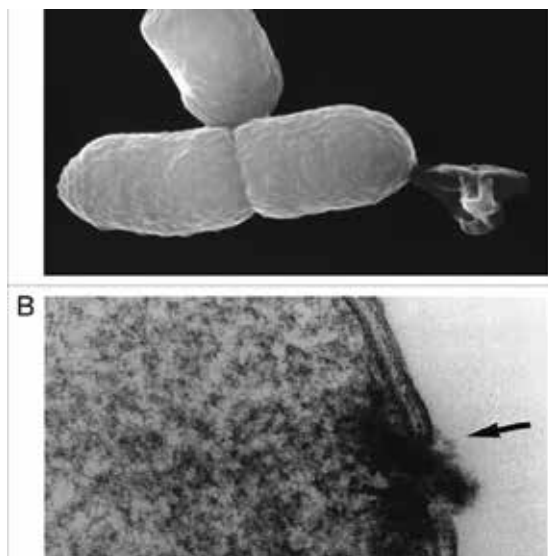
Bacterial ghost's (BG's) are envelopes created by regulated expression of the cloned lysis gene E in Gram-negative bacteria. In 1966, it was established that gene E plays a critical role in the lysis of *Escherichia coli* after infection with bacteriophage X174. E was the first bacteria deadly gene that could be silenced on plasmids. When E phage expression is established in non-host range bacteria, Gram-negative bacteria are converted to BG's, whereas Gram-positive bacteria are eliminated without lysis. Gene E produces a 91-aa polypeptide with no inherent enzymatic function, unlike lytic proteins from other phages. E is a membrane protein that can form a transmembrane tunnel shape when oligomerized. Protein E's basic structure revealed a hydrophobic area at its N-terminal end, indicating co-translational integration into *E. coli*'s cytoplasmic membrane. The fact that stationary phase host cells do not respond to E-lysis induction yet lyse when given fresh medium, as well as other discoveries such as the inhibition of E-lysis by non-physiological pH levels, suggest

that E-mediated lysis is dependent on the host cells' growth phase and autolytic system. An E-specific lysis tunnel bridging the inner (IM) and outer membrane (OM) was discovered by analysing the hydrophobicity sections of protein E. This tunnel is most likely positioned at membrane adhesion sites within the host cell. The BG is formed by E-mediated lysis, which releases all cytoplasmic content into the environment while leaving periplasmic components attached to the empty cell membrane. The initiation of E-lysis is preceded by the collapse of the bacterial membrane potential. The E-specific lysis tunnel was visible when high-magnification scanning and transmission electron microscopy were used to examine the E-lyzed *E. coli*. *E. coli* E-lysis was also accompanied by a fusion of the inner and outer membranes, which sealed the periplasmic gap, according to electron microscopy images.

BG's—APPLICATIONS

BG's solo: In numerous animal models, BG's have been used to immunise against harmful Gram-negative bacteria. BGs have been employed as a model for human lung pathogens and for the development of veterinary vaccine candidates, such as *A. pleuropneumoniae* immunisation of swine (App). In most models mucosal application has proven to be a favorable route for administration of BG candidate vaccines inducing both humoral and cellular immune response. Mucosal injection of BG candidate vaccines has proven to be a suitable method for generating both humoral and cellular immune responses in most mice.

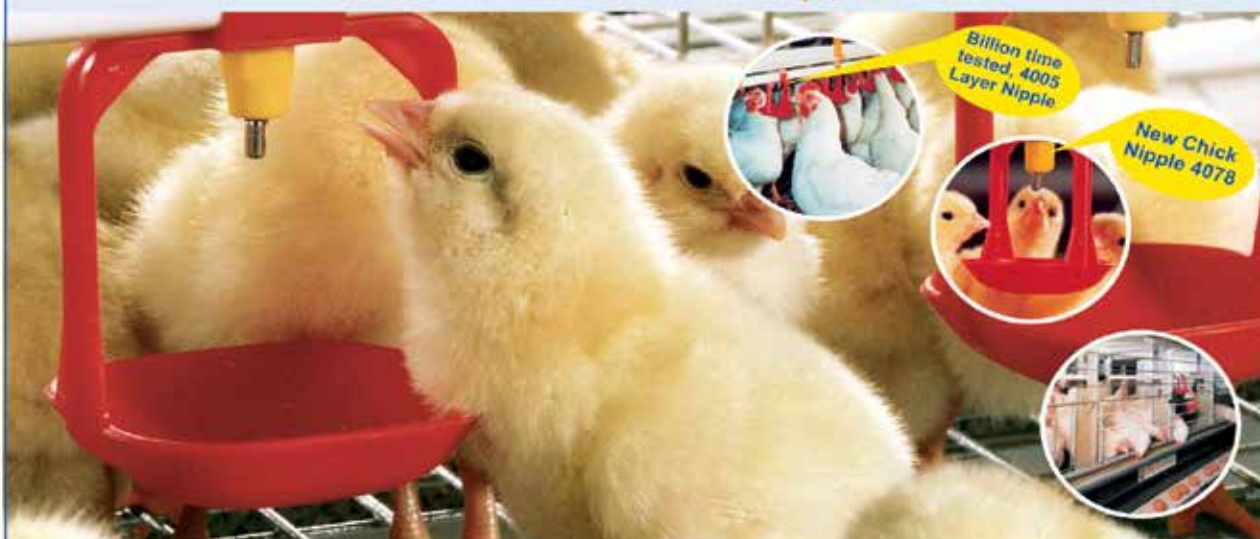
BG's as adjuvant's: During the lysis phase, the BG morphology is not denatured. As a result, all of the major immunostimulating components are preserved. Lipopolysaccharides (LPS), monophosphoryl lipid A (MPL), peptidoglycan, and flagella are all examples of pathogen-associated molecular patterns (PAMP's). PAMP's induce the innate immune response because they are identified by toll-like receptor's (TLR). As a result, all bacterial strains that produce BG's trigger innate immune responses as a first response. They also have inherent adjuvant qualities, making them exceedingly adaptable in terms of inducing specific humoral and cellular immunological responses in laboratory animals.



(A) Lysis tunnel formation and expulsion of the cytoplasmic contents (B) Lysis tunnel formation, accompanied by the fusion of IM and OM.

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BG's as carriers of foreign protein antigen's: Foreign antigens (AG's) can be integrated into or connected with the bacteria's envelope complex before lysis and become components of the BGs using recombinant DNA technology. AGs can be provided on the cell surface as membrane anchor fusions with N-, C-, or N/C-terminal targeting or as membrane anchor fusions with N-, C- or N/C-terminal targeting on the IM as membrane anchor fusions with N-, C- or N/C-terminal targeting. Fusion with these membrane anchors had no effect on AG folding or assembly, nor did it reduce enzyme functionality, implying that AG's are in the correct conformation.

BG'S as carriers of DNA Vaccine's: Virus and bacterial vaccine delivery technologies with high transfection efficiencies run the danger of reverting to their harmful forms. Transfection efficiency have been reduced in non-viral systems such as attenuated bacteria, polycation/DNA complexes, and nucleoporation. With a new extremely efficient gene delivery platform, the BG system offers an alternative to current viral and bacterial approaches in vaccine development. The safety of BG's is one of the most significant features of the new DNA-carrier system. In vitro studies have shown that after reciprocal co-incubation, BG's have no cytotoxic or genotoxic effects on many types of human cells.

BG's as enzyme carrier's: The absence of cytoplasm and membrane potential caused by E-mediated lysis does not result in a complete loss of enzyme activity. ATPases and other membrane-associated enzymes are still functional in BG's. Furthermore, whereas the cytoplasmic material is removed after lysis, the cytoplasmic membrane and its associated products are preserved. PPS enzymes such as alkaline phosphatase is substantially maintained and active because the IM and OM are united at the edge of the E-specific lysis tunnel. Even after one week of storage at 4°C, relative activity of ATPase and -lactamase in suspended BG's were maintained. Enzyme activity were also detected in lyophilized BG-batches that had been maintained at room temperature for a long time.

ADVANTAGE OF BG's

1. Lyophilized items for long-term storage at room temperature.
2. Antigens that have been genetically modified or produced on the surface can be directed to the inner or outer membrane.
3. Different types of drugs, chemicals, and proteins can be loaded into the BG's internal lumen or periplasmic region.
4. They can activate a variety of immune-regulatory cytokines.

5. A single kind of Microbial Ghost (MG) can contain many antigens from the native BG envelope as well as recombinant protein or DNA.
6. Cells that recognise BG's have no cytotoxic or genotoxic effects on their viability or metabolic function.
7. BG's can replace adjuvants, allowing them to perform several functions when used as a drug delivery system.

DISADVANTAGE OF THE BG's

1. They must be sealed if they are to be used as a drug delivery device.
2. To avoid any surviving cells, aggregation should be avoided.
3. Exopolysaccharide-producing bacteria can produce erroneous MIC values.
4. If enzymes are used for processing, any protein contamination will activate the host immune system.
5. Because they are dead cells, they must be carefully counted.
6. Increased dosage to balance the effect of active cells
7. The drying process should be handled with care.
8. H₂O₂ has the potential to cause mutation in host cells.

FUTURE PERSPECTIVE

BG are prospective envelope structures that can be used as potent candidate vaccines while simultaneously acting as an effective adjuvant and delivery vehicle. The future of BG appears promising, and several significant studies have reported the effectiveness of BG for the delivery of bio-therapeutics, drugs, and vaccines in animal models; however, the ability of BG as drug delivery vehicles to effectively deliver bio-therapeutics to their target sites is critical. Furthermore, to deploy the BG system in humans, a series of rigorous and systematic research are required. The inherent adjuvant qualities of BG, as well as the preservation of native envelope structures, would definitively replace the use of live or attenuated bacteria as vaccines, which are frequently associated with the danger of unintended infection. There are numerous areas of research that should be pursued in relation to the use of BG as adjuvants and delivery systems. What are the long-term effects of BG in terms of dosage and delivery route? Are there any other pathways involved in the identification of BG besides TLR? How much do BG's direct effects on T and B cells contribute to the adaptive immune response as a whole? A deeper understanding of how BG interacts with adaptive immune cells such as T, B, and Tregs, will eventually allow them to be targeted and rationally selected for certain vaccinations.



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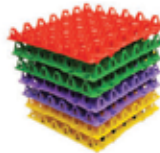
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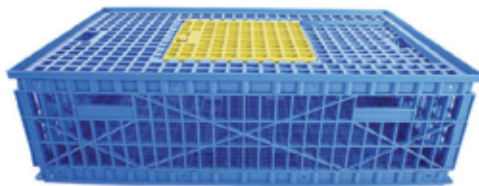
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MANAGEMENT TIPS FOR VENTILATING BROILERS IN HOT AND HUMID CONDITIONS

SKOV TEAM

1 Background

Many areas in the central regions of the world are well known for hot and humid conditions. Temperatures and relative humidity (RH) averaging over 25°C and 80% RH are common for many periods of the year. See the example below showing a typical yearly average daily temperature/humidity high and low profile in tropical parts of the world- Figure 1 and Figure 2.

These hot and humid conditions provide a challenge to achieve top broiler performance.

It is now recognized that an enclosed environment house, with a good quality ventilation system and a combination of side and tunnel ventilation will achieve significantly better broiler performance than a traditional open house system. Lower mortality, higher stocking density, improved FCR and average daily gain are better when comparing enclosed environment and open house systems. Reports state that if properly implemented, a controlled environment house can improve overall productivity by up to 20% compared to an open house.

The use of tunnel ventilation in hot and humid conditions enables a large volume of air to remove heat from the birds by producing a wind chill effect. The reduction in effective temperature felt by the birds using air movement is called the "wind chill". The air movement removes heat generated by the bird's body as they increase in age. Increasing volume of airflow creates a lower effective temperature for the bird and it feels cooler. The key message of this article is "hot and high humidity conditions are best managed by high air speed".

A key point in assessing the effect of wind chill is bird age. Younger, less feathered birds will feel a lower effective temperature at the same wind speed than older, better feathered birds. Explained

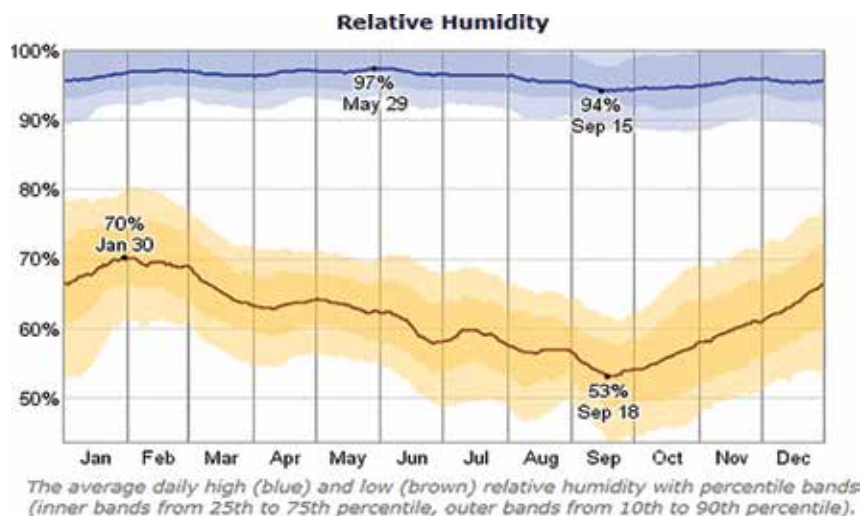


Figure 1: Daily high and low temperature.

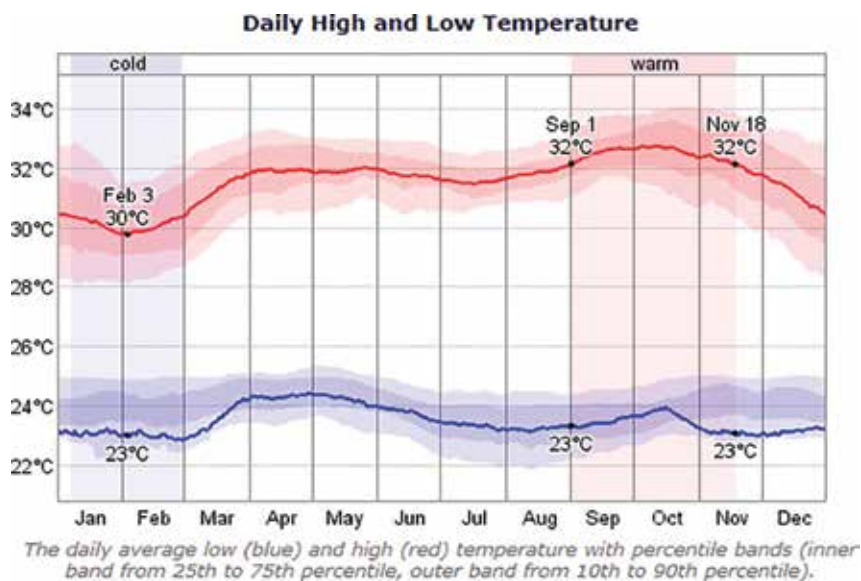


Figure 2: Relative humidity.

by, older birds have less skin surface compared to younger birds. This fact will reduce the cooling effect of wind speed on older birds.

Other factors such as stocking density and relative humidity should be considered when assessing the most effective temperature in the house. Observation of the birds in the house

is the best method to determine ideal conditions for each age stage.

Evaporative cooling pads are found in the tunnel ventilation section of the house. The energy absorbed during evaporation reduces the air temperature in the house. Airflow creates a cooling effect which can reduce the house temperature by 10 °C or more. Maximum



evaporation is achieved when water pumps are set to provide just enough pad moisture to ensure optimum water evaporation. If too much water is added to the pads, it is likely to lead to higher relative humidity and in some cases a higher effective temperature in the house.

The poultry specialists at SKOV have combined their industry experience to produce some useful tips to help producers manage their houses in hot and humid conditions.

2 Management tips for hot & humid conditions

(a) Ensure fanning capacity produces enough wind chill in the house to cool birds later in the broiler grow out. Wind chill is greatly reduced when the outside temperatures over 32°C, therefore use cooling to reduce house temperature below 32°C. A wind speed greater than 3m/sec is recommended in hot and humid conditions. Measured at bird level.

Tip 1: Check fans, cool cells and the evaporative cooling system for any maintenance issues regularly. A special focus on equipment maintenance prior to yearly peak in hot and humid conditions is recommended.

(b) Birds cool down by using internal evaporative cooling through their respiratory tracks by panting to cool themselves. This form of thermoregulation is less effective as humidity increases in the house. Where the temperature increases and RH is high, you need to find the optimum balance between wind speed, temperature and humidity. Wind chill is effective until temperature reaches 32°C. The birds' internal evaporative cooling is effective until RH reaches 80%. Therefore, be careful with the use of evaporative cooling pads, as they will increase the house humidity levels while in use. As a rule, for every 1°C reduction in house temperature by evaporative cooling methods, the relative humidity increases by 4-6%.

Tip 2: As a guide Temperature < 33°C - Use pad cooling with a limit of 80% RH in the house Temperature 33-36°C - Use pad cooling with a limit of 85% RH in the house Temperature > 36°C - Use pad cooling with a limit of 90% RN in the house

Tip 3: A SKOV climate controller can be set at a maximum RH setting to limit pad cooling as well as automatically reduce chill factor when temperature exceeds 32°C.

(c) Night-time ventilation can be your friend. Older birds can benefit from running tunnel ventilation through the night. This will allow the birds the opportunity to cool down after hot day time conditions. As a guide, to enable the bird to get rid of the excess build-up of daytime heat, the night-time temperature can drop significantly compared to daytime temperatures. With older birds (>25 days / >1,8 kg) you can allow night-time temperature to drop 15-18°C below the day-time temperature.

Tip 4 Reduce or turn off evaporative cooling at night and run maximum tunnel fan operation to reduce day time temperatures.

(d) Evaporative cooling will lower the inside house

temperature. However, as stated above, evaporative cooling can also cause stress to the birds by raising humidity and limiting the ability of the birds to cool themselves. Never let the evaporative cooling turn off a fan. Firstly, ask your service technician to adjust the cooling cycle timer, thereby only using the minimum volume of water to produce cooling. Evaporative cooling should complement tunnel ventilation, it is not a replacement for house cooling with ventilation fans. The SKOV climate controller gives the user the option to choose between prioritizing maximum energy savings, by starting cooling before maximum air speed, or prioritizing bird comfort by starting cooling after maximum airspeed is achieved.

Tip 5: If evaporative cooling is coming "on" and its operation causes a fan or fans to turnoff, then raise the evaporative cooling "on" by 1°C. Or adjust the evaporative cooling timer in the first instance.

(e) The house temperature set point should be considered when managing birds in hot and humid conditions. Set the house temperature to a setting where you see the birds are comfortable in the house. Target an internal house temperature set point of 28°C in hot and humid conditions. Use the internal house fogging system first, if available, then evaporative cooling to help reduce high house temperatures at the 28°C target.

Tip 6: When checking house temperature look at the sensors at the tunnel fan end (warmer end) of the house rather than an average of two or three sensors.

(f) European style poultry houses tend to be very wide with relatively high ceilings. This type of housing using tunnel ventilation in hot conditions and humid conditions can lead to cooler temperatures at the front of house and warmer temperatures at the back. Birds will naturally migrate towards the cooler part of the house, increasing stocking densities and potentially overcrowding of the feeders and drinkers.

Tip 7: Use fences installed in the house to prevent bird migration and improve bird uniformity.

Tip 8: If the temperature difference between front and rear exceeds 4°C, consider installing more fan capacity to even out the temperature variance in the house.

(g) Water usage and especially water wastage can add unnecessary humidity in the house which can cause respiratory stress to the birds.

Tip 9: Monitor the water supply in the house daily for correct drinker height, water pressure, water/feed ratio and faulty equipment to avoid any unnecessary water wastage.

Tip 10 Consider lowering stocking density in the house during peak hot and humid periods to help maximize bird performance.

To discuss how to improve your broiler productivity by optimizing ventilation in hot and humid conditions contact your local SKOV Sales Manager

MONTHLY EGG RATES JANUARY 2022

Name Of Zone \ Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Ahmedabad	534	534	534	534	520	510	510	510	510	510	510	510	510	500	500	500	500	500	500	475
Ajmer	503	503	500	480	480	474	474	477	480	480	480	472	472	465	465	470	470	470	465	460
Asansole	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Barwala	502	502	502	483	483	470	470	475	477	477	477	477	471	463	463	467	467	467	467	457
Bengaluru (CC)	515	515	515	515	515	500	480	480	465	470	470	470	470	470	470	470	470	470	455	455
Brahmapur (OD)	508	508	508	493	493	493	483	483	483	483	483	483	473	473	473	473	466	460	450	450
Burdwan (CC)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chennai (CC)	520	520	520	520	520	505	490	490	475	475	475	475	475	475	475	475	475	475	465	465
Chittoor	513	513	513	513	513	498	483	483	468	468	468	468	468	468	468	468	468	468	458	458
Delhi (CC)	525	525	525	515	505	505	495	495	500	500	500	500	495	485	485	490	490	490	-	-
E.Godavari	480	480	480	470	470	470	460	460	460	460	460	460	452	452	452	445	445	437	437	-
Hyderabad	471	471	471	460	450	440	440	440	440	442	442	442	435	435	435	435	435	435	425	415
Ludhiana	501	501	501	491	481	481	475	475	476	476	476	476	470	470	465	465	467	467	459	459
Midnapur (KOL)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Miraj	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mumbai (CC)	535	535	535	535	525	515	505	505	505	505	505	505	505	500	500	500	500	500	500	490
Muzaffarpur (CC)	552	552	552	552	538	533	533	529	524	524	524	524	524	524	519	519	519	514	514	510
Mysuru	515	515	515	515	515	500	475	460	460	465	465	465	465	465	465	465	465	460	450	-
Nagpur	515	515	520	515	500	480	460	480	480	480	480	490	490	480	480	480	470	475	475	465
Namakkal	505	505	505	505	505	480	480	460	460	460	460	460	460	460	460	460	450	450	450	430
Patna	548	548	543	543	533	529	529	524	519	519	519	519	514	514	514	514	510	505	505	552
Patna (CC)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pune	525	527	527	527	520	510	500	505	505	510	510	510	510	500	500	500	500	500	500	490
Ranchi (CC)	552	552	548	548	538	533	533	533	533	533	529	529	529	524	524	524	519	514	514	510
Vijayawada	490	490	490	480	480	480	470	470	470	470	470	470	462	462	462	455	455	447	447	-
Vizag	500	500	500	475	475	460	460	460	460	460	460	460	460	460	460	460	450	450	450	450
W.Godavari	480	480	480	470	470	470	460	460	460	460	460	460	452	452	452	445	445	437	437	-
Warangal	473	473	473	462	452	442	442	442	442	444	444	444	437	437	437	437	437	437	427	417
West godavari	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

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ADVERTISEMENT INDEX

ABTL	41	NATURAL REMEDY	19
ALLTECH	32	NEOSPARK	57
AZRA'S	61	NOVUS	1ST COVER
CEVA POLCHEM	31	PAK TAVUK	17
CHR. HANSEN	10	POLARIS	53
DSM	15	PROTEON	35
EVONIK	29	PROVET PHARMA	81
FARMAKON	39	QUALITY SYSTEM	69
FRANCIS	77	RIOTH	37
GOLDEN GROUP	74	RND	73
GARTECH	63	SAI KRISHNA	93
HESTER	55	SKOV	13
HUVEPHARMA	49	SRINIVASA	33
INTERHEAT	6,7	SUGUNA	51
INTERFACE PHARMA	2,3,4 COVER	SUPREME	83
I.B. GROUP	8	VAKSINDO	5
INDIAN HERBS	65	VENKY'S	27
JANAKI GROUP	75	VOLSCHENDORF	43
KEMIN	4TH COVER	VENKATESHWARA B.V BIO CORP	60
KAYPEEYES	67	VENKATESHWARA B.V BIO CORP	59
LUBING	91	VENTRI	3RD COVER
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