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Vol. 28 | No.7 | July 2026

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Announcement

CLFMA 59th AGM & 67th NATIONAL SYMPOSIUM 2026

Dear Sir / Madam,

We are pleased to inform you that, the 59th Annual General Meeting (AGM) and 67th National Symposium 2026 will be held on **September 11 & 12, 2026** at **"The Leela Mumbai"**, Sahar, Near Mumbai International Airport, Andheri East, Mumbai.

You are requested to kindly block your dates for 59th Annual General Meeting and 67th National Symposium 2026.

With warm regards,

Divya Kumar Gulati
Chairman



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Northern Region

COMPANY: Sampoorna Feeds FARMER NAME: Mr. Love Preet Singh	MAY-2026	Top #1
	Farm Type	Open House
	State	PUNJAB
	Chicks Placed	8,836
	Mean Age	36.3
	Avg Body Wt	2,755
	FCR	1.36
	cFCR	1.19
	Livability%	90.6
	Daily Gain	76.0
	EPEF	506



Eastern Region

COMPANY: IB Group FARMER NAME: Mr. Noor Alam	MAY-2026	Top #1
	Farm Type	Open House
	State	BIHAR
	Chicks Placed	1,458
	Mean Age	36.0
	Avg Body Wt	2,395
	FCR	1.35
	cFCR	1.26
	Livability%	95.3
	Daily Gain	66.5
	EPEF	468



Central Region

COMPANY: IB Group FARMER NAME: Mr. Shekh Shahid	MAY-2026	Top #1
	Farm Type	Closed House
	State	MADHYA PRADESH
	Chicks Placed	12,465
	Mean Age	40.0
	Avg Body Wt	3,304
	FCR	1.52
	cFCR	1.23
	Livability%	94.6
	Daily Gain	82.6
	EPEF	512



South Region

COMPANY: IB Group FARMER NAME: Mr. Srinivasulu Reddy	MAY-2026	Top #1
	Farm Type	Closed House
	State	ANDHRA PRADESH
	Chicks Placed	8,255
	Mean Age	34.0
	Avg Body Wt	2,454
	FCR	1.35
	cFCR	1.25h
	Livability%	94.8
	Daily Gain	72.2
	EPEF	504



May 2026 -Top PERFORMANCE BY AREA

Area	Chicks Placed	Mean Age(Days)	BW	FCR	cFCR(2Kg)	Livability%	Daygain	EPEF
North EC House	14,124	37.0	2,766	1.45	1.28	97.0	74.8	499
North Open House	8,836	36.3	2,755	1.36	1.19	90.6	76.0	506
East EC House	16,981	43.0	3,306	1.58	1.29	96.7	76.9	470
East Open House	1,458	36.0	2,395	1.35	1.26	95.3	66.5	468
Central EC House	12,465	40.0	3,304	1.52	1.23	94.6	82.6	512
Central Open House	2,921	40.0	2,654	1.47	1.33	97.4	66.4	437
South EC House	8,255	34.0	2,454	1.35	1.25	94.8	72.2	504
South Open House	2,678	40.0	2,327	1.44	1.37	95.9	58.2	385

May 2026 -Top 10 FIELD PERFORMANCE

Flock	Farm Type	State	Chicks Placed	Mean Age	BW	FCR	cFCR	Livability%	Day Gain	EPEF
Flock 1	OPEN HOUSE	PUNJAB	8,836	36.3	2,755	1.19	1.17	90.6	76.0	506
Flock 2	OPEN HOUSE	UTTAR PRADESH	5,272	40.0	2,980	1.21	1.17	95.6	74.5	498
Flock 3	OPEN HOUSE	PUNJAB	5,620	34.0	2,485	1.23	1.19	92.2	73.1	503
Flock 4	CLOSED HOUSE	MADHYA PRADESH	12,465	40.0	3,304	1.23	1.20	94.6	82.6	512
Flock 5	OPEN HOUSE	PUNJAB	4,655	34.0	2,476	1.24	1.20	93.0	72.8	501
Flock 6	OPEN HOUSE	UTTAR PRADESH	1,787	42.0	2,793	1.25	1.21	96.1	66.5	446
Flock 7	CLOSED HOUSE	ANDHRA PRADESH	8,255	34.0	2,454	1.25	1.22	94.8	72.2	504
Flock 8	OPEN HOUSE	PUNJAB	9,963	36.1	2,813	1.25	1.22	92.6	77.8	500
Flock 9	CLOSED HOUSE	CHHATTISGARH	10,276	37.0	2,793	1.26	1.22	95.7	75.5	502
Flock 10	CLOSED HOUSE	MADHYA PRADESH	12,360	44.0	3,465	1.26	1.22	95.1	78.8	471

HAIRLINE CRACKS IN HATCHING EGGS

Hatching eggs with hairline cracks pose a hidden threat, reducing the embryo's ability to hatch and increasing the risk for contamination. A normal hatching egg leaves the hen without cracks. From the moment of lay, the egg is exposed to manual or automated egg collection, sorting, packing, and movement on the breeder farm, followed by transportation to the hatchery, and, in some cases, transfer from plastic or pulp trays to setter trays.

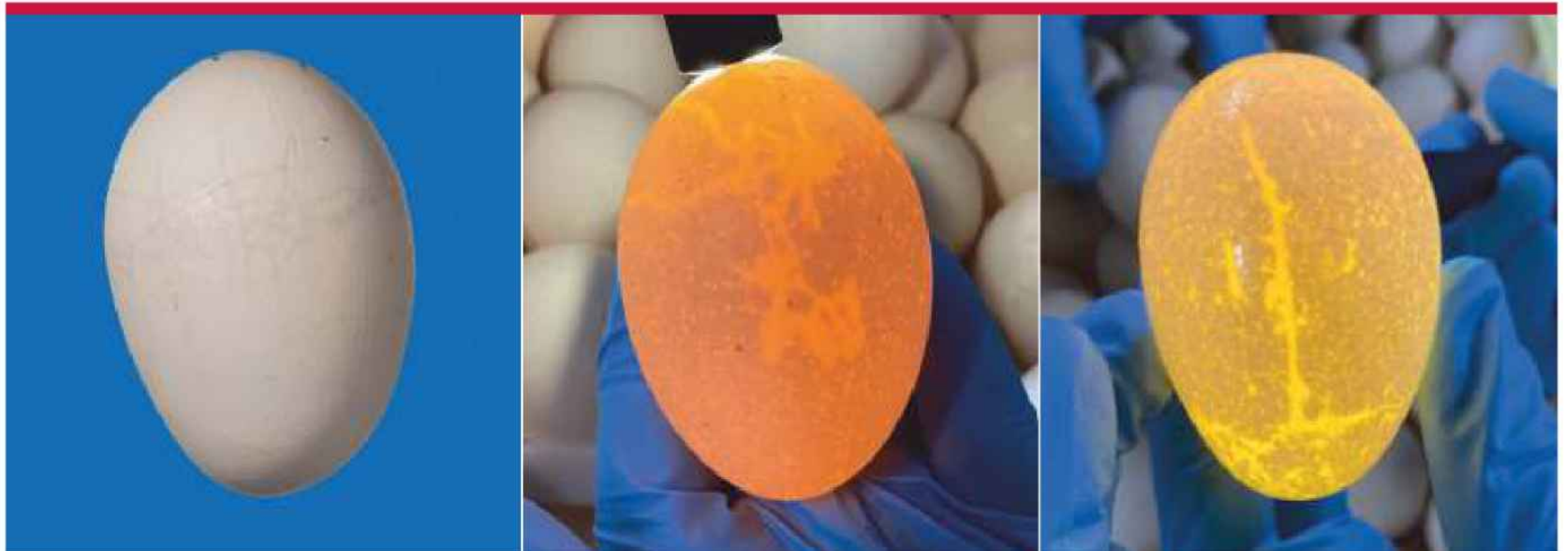
During this journey, rough egg handling may cause hairline cracks in the egg shell and possibly disrupt the underlying shell membranes. These hairline cracks may not be immediately visible to the naked eye and do not leave a trace of the exact moment of impact. Because of this, hairline cracks are often missed when doing quality checks during egg collection at the breeder farm. On arrival at the hatchery, hairline cracks that have occurred on the breeder farm are visible, but not consistently recognized, removed, and discarded. Egg quality analysis, conducted by Aviagen incubation specialists at customer hatcheries, revealed that the percentage of hairline cracks can be as high as approximately 7% for certain flocks.

This article focuses only on hairline cracks. It does not address body-checked eggs that were cracked and repaired inside the hen's reproductive tract. These eggs typically have a crack covered by a layer of calcium, making the crack appear as a ridge or band (**Figure 1**).

HOW TO FIND HAIRLINE CRACKS?

Hairline cracks only become apparent after a few days when moisture from the air has had time to penetrate the crack and produce a faint gray line at the shell surface. When searching for hairline cracks in an egg pack, pick up and inspect each egg with a flashlight, as the crack may be located at the bottom or on the other side. A flashlight makes it easier to detect the moisture that has entered the crack becomes illuminated (**Figure 1**).

FIGURE 1: Examples of a body-checked egg (left) and illuminated hairline cracks (right).



HOW TO LOCATE THE POINT OR LOCATION OF IMPACT?

Hairline cracks are often caused by collisions with other eggs or hard materials in the egg collection system. Whether an eggshell cracks depends on the speed of the impact and the quality of the eggshell. High impact speed (G-force) and weak shells increase the likelihood of cracks.

The location of impact can be found in several ways. A quick check can be done by using your eyes and ears to detect the sight and sound of colliding eggs before or during egg collection, and by looking for sharp edges or rough transitions. Start from the laying nest and work down the egg collection system. Another method is to collect eggs after each transition point, store them for two days, and examine them for hairline cracks using a flashlight.

However, modern technology allows us to use a more sophisticated approach. An artificial egg with G-force sensors inside can be used to track the egg's journey from laying until arrival at the hatchery. Each transition point should be checked several times, and real-time data provides information on the range of impact and the corresponding time. There are several artificial eggs on the market, for example: Wireless Egg Node, Cracklessegg, Mach-sens Egg Tracker and Gregg Smart Egg (**Figure 2**).

FIGURE 2: An artificial egg with a G-force sensor inside (cracklessegg.com).



HAIRLINE CRACK PREVENTION

Gentle egg handling

Minimize the use of harsh or overly automated equipment, and train staff and drivers on the importance of delicate egg handling.

Transport safeguards

Use shock-absorbent materials and avoid jarring motions during egg transportation from the farm to the hatchery.

Routine hatchery inspection

Candle samples from every batch of eggs immediately upon arrival at the hatchery, and track the hairline crack trends over time.

Routine breeder management evaluation

Any condition that makes the egg shell weaker will increase the likelihood of cracks. This could be related to heat stress, nutrition, water quality, disease, or bird age.

Routine egg journey inspection at the breeder farm

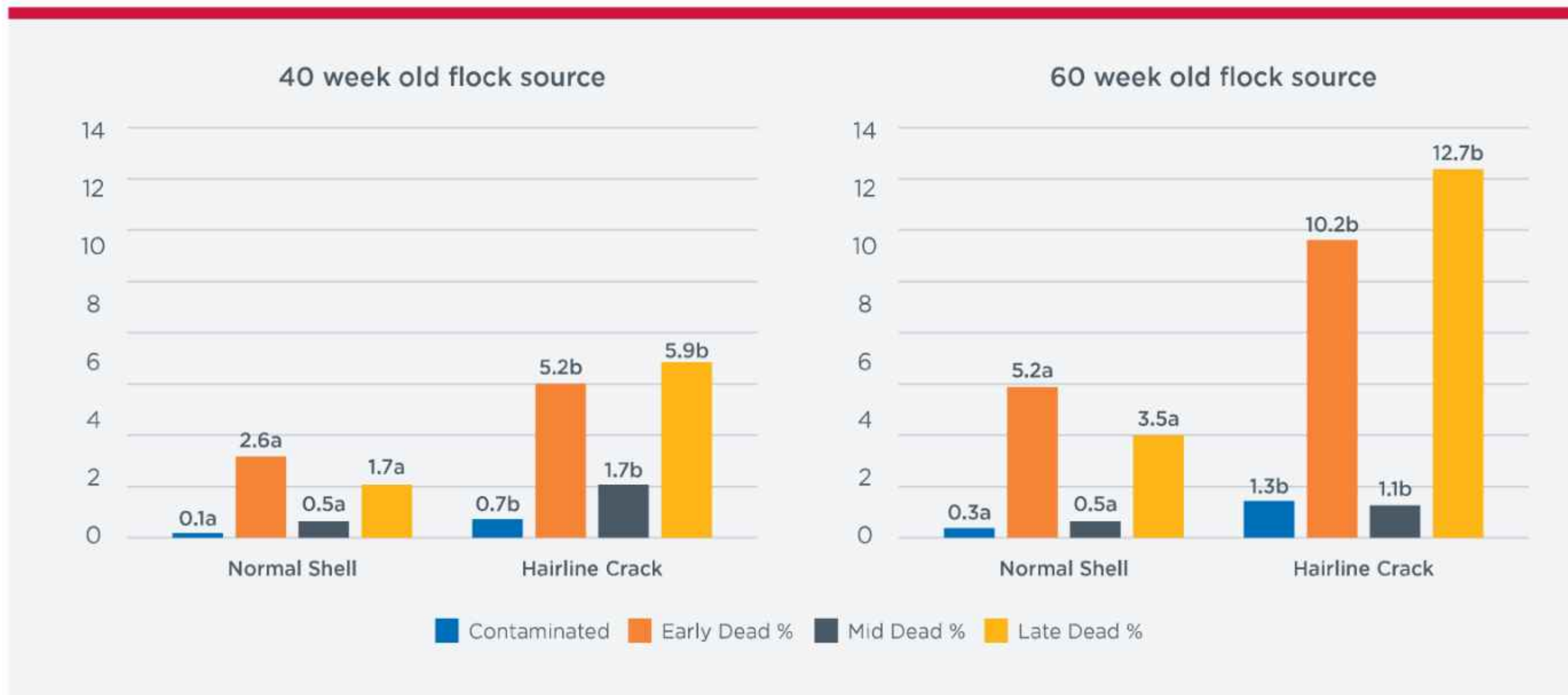
Check the basics. Every nest must have a nest mat in good condition and, in the case of automation, a nest mat that is positioned correctly so that the eggs roll gently onto the belt without colliding with the nest walls or conveyor belt structures. The collection frequency should be a minimum of 4 times per day to prevent egg-to-egg collisions on the conveyor belt.

CONSEQUENCES OF HAIRLINE CRACKS

CONTAMINATION RISK

A cracked egg leaves the door open for bacteria to penetrate and possibly cause contamination. This risk increases when a hairline crack is caused while the egg is still in the cooling-down phase, just after lay, combined with a (slightly) dirty eggshell. Egg contents shrink when cooling down from the hen's body temperature to storage temperature. This shrinking process facilitates bacterial penetration through cracks, as the slight under pressure pulls anything outside the egg into the egg. Usually, the shell and inner membrane act as a natural barrier for microbes or bacteria; however, when the shell and membrane are cracked and disrupted, the embryo is at risk. Eggshell cleanliness, affected by breeder house management, plays an important role in determining whether an egg with a hairline crack has to face a bacterial challenge. Research shows that losses due to contamination increase by a factor 5 to 6 (**Figure 3**).

FIGURE 3: Hatch debris analysis (Aviagen trials 2025 and 2026). Letters show statistical differences between normal eggshells compared to shells with a hairline crack.



REDUCED HATCHABILITY

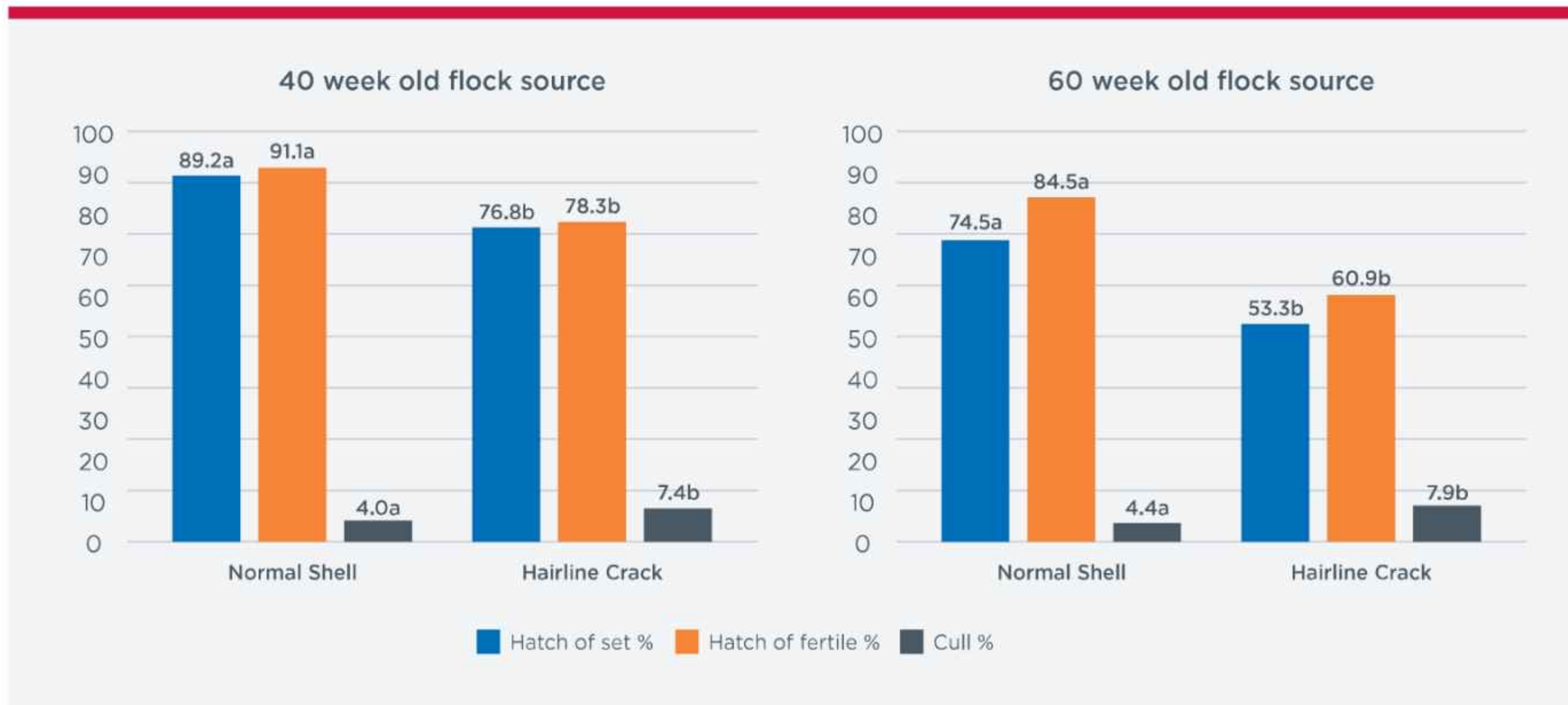
Eggs with hairline cracks have reduced hatchability, as they are more vulnerable to contamination and dehydration. Reduction in embryo viability doubles or triples across all stages of incubation compared to a normal shell (**Figure 3**). A cracked egg will lose more weight due to increased moisture loss during incubation. Egg weight loss is, therefore, higher, and this will consequently lead to a lower chick yield (**Figure 4**). Chick yield is, however, less affected, as late dead embryos and dehydrated cull chicks are not included in the chick yield parameter. Overall, chicks hatched from cracked eggs have a lower quality, if they manage to hatch, resulting in more culled chicks (**Figure 5**). However, results may differ if using in-ovo vaccination.

FIGURE 4: Weight loss and chick yield % (Aviagen trials 2025 and 2026). Letters show statistical differences for weight loss of normal eggshells compared to shells with a hairline crack. No significant difference was seen for chick yield, as all trays were close to or within target, and incubation time was variable.



The Aviagen research presented below, with an average specific gravity above 1,080 for both flock ages (**Figure 5**), illustrates the drop in hatchability when comparing clean, normal eggs to those with hairline cracks. Experiments conducted by other researchers, for example, Barnett et al. (2004), show significantly larger drops in hatchability, which may be related to the origin of the eggs and eggshell cleanliness.

FIGURE 5: Hatch of set, hatch of fertile, and cull %. Hatch of set and hatch of fertile have culls removed. (Aviagen trials 2025 and 2026). Letters show statistical differences for weight loss between normal eggshells compared to shells with a hairline crack.



As a commercial example, an average hatchery that sets 1 million eggs per week, with 4% hairline cracks in their egg pack, loses 0.5% hatchability. Assuming that hairline cracked eggs under hatch at a rate of 12.4%, this means 5,000 chicks are lost weekly. On a yearly basis, this translates to a loss of 260,000 chicks.

CONCLUSION

Eggs with hairline cracks are inferior compared to eggs without hairline cracks in terms of hatchability and chick quality, and cause an economic loss. Hairline cracks are detectable and mostly visible after a few days of storage at either the breeder farm or hatchery. There are multiple ways to find the cause, and therefore, eggs with hairline cracks are an unnecessary loss that should be avoided.

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Biosecurity: in Modern Poultry Farming

Biosecurity: The Poultry Sector's First Line of Defense Biosecurity is the poultry industry's most effective defense against infectious diseases and is essential for protecting flock health, reducing antibiotic use, and ensuring sustainable poultry production. While vaccines and treatments remain important, preventing the introduction and spread of pathogens such as Salmonella, Escherichia coli (E. coli), and Highly Pathogenic Avian Influenza (HPAI) is far more effective. A strong biosecurity program is built on three pillars. Conceptual biosecurity focuses on proper farm location and adequate separation between poultry operations to minimize disease transmission. Structural biosecurity includes physical safeguards such as perimeter fencing, controlled entry points, rodent- and wild bird-proof housing, and dedicated sanitation facilities. Operational biosecurity involves daily practices including all-in/all-out flock management, thorough cleaning and disinfection, controlled visitor access, proper carcass disposal, and the use of farm-specific clothing and equipment.

The success of any biosecurity program depends on consistent implementation by farm personnel. Regular training, awareness, and strict compliance with protocols are critical to preventing costly disease outbreaks. Effective biosecurity not only protects farm profitability but also reduces antimicrobial use, supports animal welfare, enhances food safety, and helps combat antimicrobial resistance (AMR). Ultimately, investing in biosecurity is an investment in the long-term sustainability, resilience, and future of the global poultry industry.

Bhavana Gupta

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Introduction

Managerial biosecurity refers to the day-to-day management practices adopted on poultry farms to prevent the introduction and spread of infectious diseases. Proper management is essential for maintaining flock health, improving productivity, and ensuring sustainable poultry production.

Concept of Biosecurity in Poultry

Biosecurity includes all preventive measures designed to reduce the risk of disease entry and transmission in poultry farms. It involves sanitation, isolation, traffic control, vaccination, and proper management of feed, water, and waste materials (WOAH, 2022). Management plays an important role in implementing all these components effectively. Biosecurity programs are generally divided into three major components:

MANAGEMENTAL ASPECTS IN BIOSECURITY OF POULTRY

- a) **Isolation** – preventing contact between poultry and potential disease sources.
- b) **Traffic control** – regulating movement of people, vehicles, and equipment.
- c) **Sanitation** – maintaining cleanliness and disinfection of farm premises.

Important management practices include:

- a) Restricting unnecessary visitors.
- b) Maintaining visitor registers.
- c) Providing separate clothing and footwear for workers.
- d) Installing footbaths containing disinfectants at shed entrances.
- e) Disinfecting vehicles before entry.
- f) Cleaning and Disinfection

Disinfection should be carried out:

- a) Before introducing new flocks.
- b) After disease outbreaks.
- c) During routine farm operations.
- d) Proper litter management also helps reduce microbial growth, ammonia accumulation, and moisture levels inside poultry houses.
- e) Quarantine and Isolation of Birds.
- f) Vaccination Management- Newcastle disease vaccine, Marek's disease vaccine,

Infectious bursal disease vaccine and Fowl pox vaccine.

- g) Rodent, Insect, and Wild Bird Control.
- h) Dead Bird and Waste Disposal-Deep burial, Composting and Incineration.
- I) Record Keeping and Health Monitoring

Worker Training and Awareness: Well-trained workers are more likely to follow biosecurity protocols effectively and minimize disease risks (FAO, 2023).

Importance of Good Management in Poultry Biosecurity

Effective management in poultry biosecurity provides several benefits:

- a) Reduction in disease outbreaks.
- b) Lower mortality rates.
- c) Improved feed efficiency and productivity.
- d) Reduced use of antibiotics.
- e) Better product quality and food safety.
- f) Increased profitability and sustainability.
- g) Good management practices also help protect public health by reducing the spread of zoonotic diseases.

Conclusion

Management is the foundation of successful poultry biosecurity

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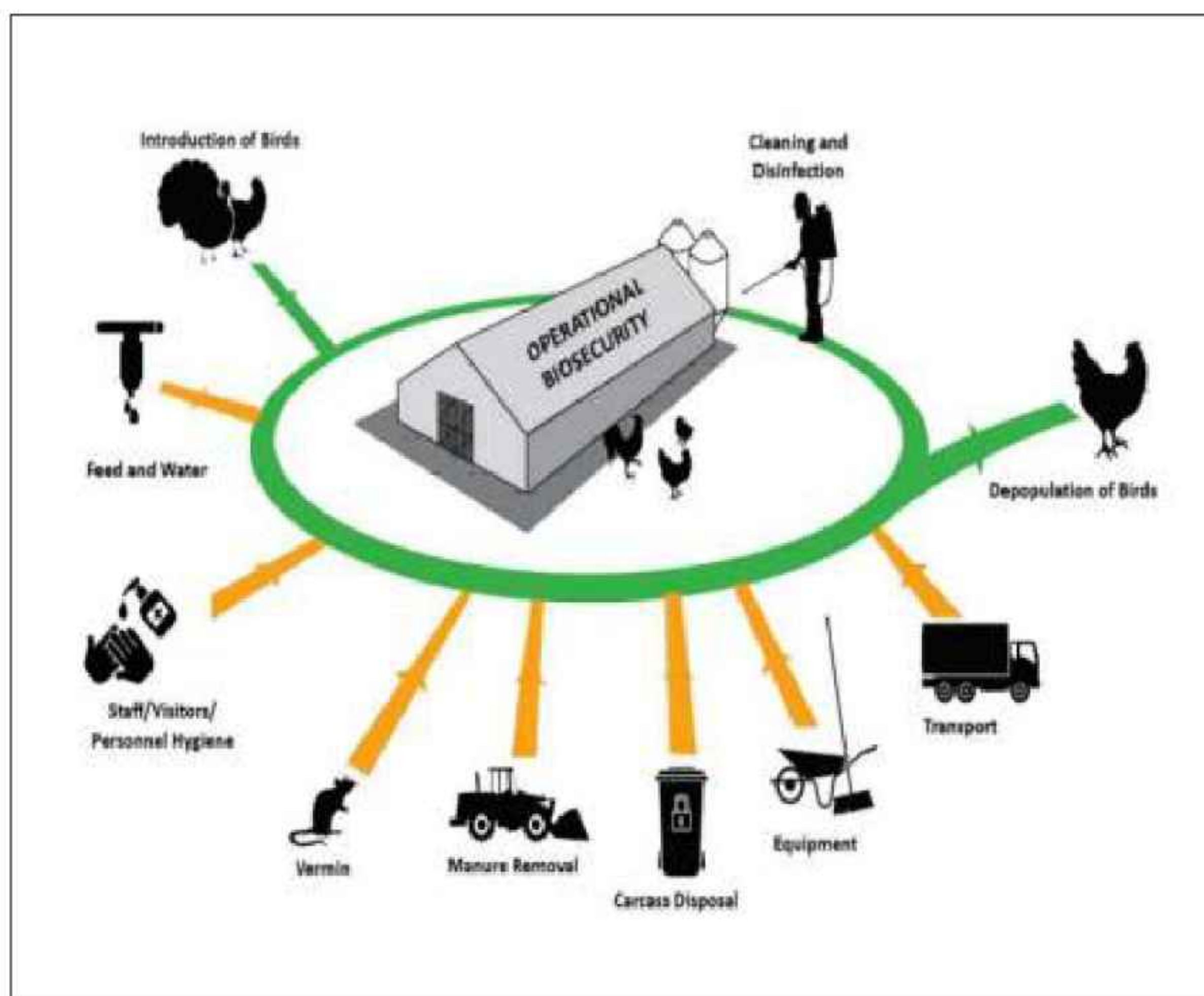
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programs. Proper planning, sanitation, vaccination, feed management, pest control, waste disposal, and worker training collectively help prevent disease outbreaks and maintain flock health. Scientific and efficient management practices not only improve poultry productivity and profitability but also support sustainable and safe poultry production systems. In modern poultry farming, strong biosecurity management is essential to protect birds from emerging diseases and ensure long-term industry growth.

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FAO (2023). Biosecurity for Highly Pathogenic Avian Influenza Control. Food and Agriculture Organization.

World Organization for Animal Health (WOAH) (2022). Biosecurity Procedures in Poultry Production.



EVENT CALENDER



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Introduction

Poultry farming is one of the fastest-growing livestock industries worldwide, providing meat and eggs that are important sources of high-quality protein. However, poultry farms are highly vulnerable to infectious diseases such as Newcastle disease, avian influenza, infectious bursal disease, Marek's disease, and fowl cholera. Disease outbreaks can cause severe economic losses through mortality, reduced productivity, treatment costs, and trade restrictions. Hence, biosecurity is considered the first line of shield against disease introduction and spread in poultry farms.

What is Biosecurity?

Biosecurity refers to a set of management practices, hygienic procedures and preventive

BIOSECURITY AS A CORNERSTONE OF MODERN POULTRY FARMING

measures designed to reduce the risk of introduction, establishment, and spread of infectious diseases in poultry populations. It is the cheapest and at the same time most effective means of disease control. It involves controlling the introduction of pathogens from outside into the farm (**Bio-exclusion**), as well as between sheds on the same farm, carryover of disease agents from one batch to the next in the shed environment, as well as from breeding flocks to their progeny via the egg (**Bio-confinement**), movement of animals, people, equipment, and vehicles, along with maintaining proper sanitation and hygiene.

Objectives of Biosecurity

The main objective of biosecurity is to keep disease risk at the farm as low as possible which reduces stress on the animals' immune systems, lowering the risk of disease outbreaks. The poultry farm should ensure that all of the following objectives are met out for sustainable poultry production:

- ✓ Prevent the entry of disease-causing organisms into the farm.
- ✓ Minimize the spread of infections within the farm.
- ✓ Protect the health and welfare of poultry birds.
- ✓ Improve productivity and profitability.
- ✓ Ensure food safety and public health.

Key Components of Poultry Biosecurity

The possible ways for the introduction of pathogens into the farm mainly includes contaminated people, vehicle, equipments and live vectors like wild birds, other livestock, pets, rodents and insects which accounts for about 80% of the diseases transmitted either by airborne transmission, contaminated feed or drinking water or by direct with the birds in close proximity and indirect contact.

➤ Farm Location and Isolation

- ❖ Poultry farms should be located away from other poultry farms, at least 3 km away from nearest poultry in the case of breeder farm and 1.6 km in the case of commercial layer and broiler farm as well as human settlements.
- ❖ Enough distance between breeders and grow-out farms and facilities such as hatcheries and feed mills should be maintained.
- ❖ **Separate Poultry Farms:** Isolate poultry farms from others to minimize the risk of infection transmission between different farms.
- ❖ **Quarantine New Birds:** Place new birds in a separate enclosure for quarantine to detect any infectious agents before they are introduced to the main flock, ensuring the health of the existing birds.

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- ❖ **Observation Period:** Keep new birds isolated from the old stock for at least 21 days. During this period, observe them for any signs of illness to prevent potential disease outbreaks.
- ❖ No vehicles or equipment should be allowed within the farm area from the time of delivery of flock until disposal in a breeder farm
- ❖ A minimum of two weeks inter flock interval is recommended when commercial broiler birds are reared.
- **Controlled Entry**
 - ❖ Adequate fencing should be provided to restrict unauthorized entry.
 - ❖ Visitors and personnel should be restricted to minimize the introduction of pathogens.
 - ❖ Entry points should have footpaths and hand sanitizers.
- **Sanitation and Disinfection**
 - ❖ Regular cleaning and disinfection of surfaces like poultry houses, egg room, feeders, drinkers, equipment, buildings, footwear and vehicles with phenol, cresol, chlorine compounds and iodophors as well as 5% liquid formalin or formaldehyde gas by fumigation, will also serve as an effective disinfectant.
 - ❖ Proper disposal of litter, manure, and dead birds to prevent disease transmission within the farm.
 - ❖ Farm workers should wear dedicated clothing and footwear.
 - ❖ Recycling of egg packing

materials etc. should be decontaminated at the point of entry of farm.

➤ **Pest and Rodent Control**

- ❖ Construction of safe housing that effectively prevents access by wild birds, rodents, insects, and other pests that can act as disease carriers to minimize the risk of disease introduction.

- ❖ Effective pest control measures should be implemented.

➤ **Water and Feed Hygiene**

- ❖ Supply clean and safe drinking water by testing water sources for mineral content, bacterial contamination, chemical pollutants, and pathogens regularly to ensure they meet safety standards for poultry consumption.

- ❖ Faecal contamination of water leads to the presence of coliform organisms.

- ❖ Mineral levels in water need to be taken care of as it influences the hardness of water and affect the taste and palatability and should range within 60-180.

- ❖ Ideally other parameters should be within the range of nitrate- 10 mg/litre, nitrite- 0.4 mg/litre, total bacterial count- 0/ml, Coliform count - 0/ml, Calcium chloride - 60 mg/litre, sodium- 50 mg/litre, sulphate- 125 mg/litre

- ❖ The pH of the water should be between 6.8-7.5

- ❖ Water can be sanitized with chlorine, iodophores, quaternary ammonium compounds to get rid of the water borne infections and also to prevent the slime

formation in the pipelines supplying water to the birds.

- ❖ Protect feed from contamination by rodents, insects, and wild birds by allocating a designated area for storing bagged feed to prevent contamination and maintain feed quality.

➤ **Vaccination Programs**

- ❖ Flock health should be monitored regularly and periodic serum antibody assay to determine immune status of the flock.

- ❖ A proper vaccination schedule should be followed.

➤ **All-In-All-Out System**

- ❖ Birds of the same age group are reared together.
- ❖ Complete cleaning and disinfection are performed between batches.

➤ **Separation of Areas:**

- ❖ Store feed, litter, and equipment in separate areas from live bird zones to prevent cross-contamination and maintain biosecurity standards.

Importance of Biosecurity

➤ **Disease Prevention**

Biosecurity reduces the risk of infectious diseases entering the farm and protects poultry flocks from devastating outbreaks.

- **Economic Benefits** Healthy birds show better growth, feed conversion efficiency, egg production, and reduced mortality, resulting in increased profits.

➤ **Reduced Use of Antibiotics**

Good biosecurity lowers disease incidence and decreases

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NOSIHEPTIDE 1%

ENRAMYCIN 8%

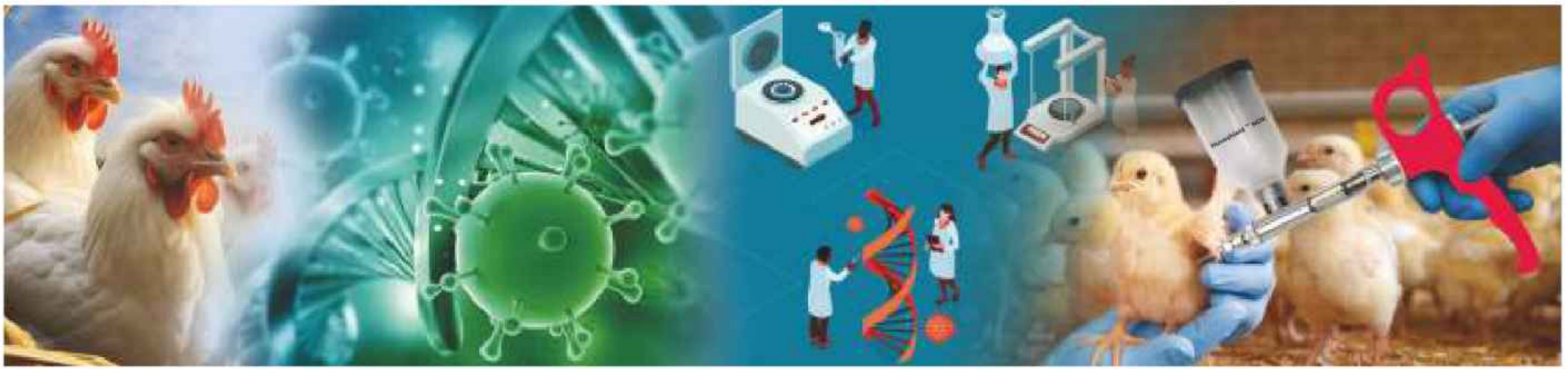
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PCR-Based Diagnostic Strategies and Molecular Surveillance of *Mycoplasma gallisepticum* and *Mycoplasma synoviae* in the Poultry Industry

INTRODUCTION TO AVIAN MYCOPLASMOSIS

Avian mycoplasmosis continues to be a major infectious challenge affecting commercial poultry farms across the world. The disease is primarily associated with *Mycoplasma gallisepticum* (MG) and *Mycoplasma synoviae* (MS), two highly adapted bacterial pathogens belonging to the class Mollicutes.

The pathogenic process begins when the organisms attach firmly to epithelial surfaces of the respiratory and reproductive tracts using specialized terminal attachment structures. MG is predominantly responsible for Chronic Respiratory Disease (CRD), while MS is strongly associated with infectious synovitis and Eggshell Apex Abnormalities (EAA). Important virulence-associated proteins include GapA, CrmA, VlhA proteins, PlpA, and Hlp3.

EPIDEMIOLOGICAL DYNAMICS AND ECONOMIC BURDEN

Recent epidemiological studies indicate increasing prevalence of MS infections in Indian poultry farms. Significant economic losses arise due to poor feed efficiency, reduced egg production, low hatchability, and carcass condemnation. Transmission occurs through vertical and horizontal routes, with multi-age farming systems contributing significantly to disease persistence.

PRODUCTION AREA	CLINICAL FINDINGS	SUBCLINICAL IMPACT
BROILER PRODUCTION	Respiratory distress, joint swelling, lameness	Poor feed efficiency, uneven flock growth, increased carcass rejection
LAYER / BREEDER OPERATIONS	Reduced egg production and quality, synovitis	Inferior shell quality, decreased hatchability, vertical spread to progeny
MIXED INFECTIONS	Mortality during secondary bacterial or viral infections	Chronic airsacculitis, fibrinous lesions, systemic inflammatory damage

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COMPARATIVE ANALYSIS OF DIAGNOSTIC METHODOLOGIES

Reliable diagnosis requires laboratory confirmation using culture isolation, serological assays, conventional PCR, and real-time PCR techniques.

Real-time PCR is currently preferred because of its speed, high analytical sensitivity, and capability for molecular differentiation.

DIAGNOSTIC METHOD	STRENGTHS	LIMITATIONS
CULTURE ISOLATION	Confirms viable organism recovery	Slow growth, contamination risk, specialized media requirements
SEROLOGICAL TESTS (RSA, ELISA, HI)	Useful for flock-level monitoring	Vaccine interference and cross-reactive false positives
CONVENTIONAL PCR	Rapid species-specific detection	Requires molecular laboratory infrastructure
REAL-TIME PCR	Highly sensitive, rapid, quantitative	Higher instrumentation costs

GENOTYPE-BASED DIFFERENTIATION AND DIVA STRATEGIES

Molecular DIVA (Differentiating Infected from Vaccinated Animals) strategies facilitate differentiation between field isolates and commonly used vaccine strains such as F-strain, ts-11, and 6/85 through PCR-based genotyping and sequence analysis of variable surface protein genes.

FRONTIER DIAGNOSTIC PLATFORMS: LAMP AND CRISPR-CAS12A

Loop-Mediated Isothermal Amplification (LAMP) enables rapid nucleic acid amplification under constant temperature conditions suitable for field diagnostics.

RAA-CRISPR-Cas12a systems provide highly sensitive detection with lateral-flow visualization and portable field applicability.

MOLECULAR DETECTION OF ANTIMICROBIAL RESISTANCE (AMR)

Molecular AMR monitoring targets mutations within the 23S rRNA region and quinolone resistance-determining regions involving gyrA, parC, and parE genes. PCR-based mutation analysis offers rapid alternatives to conventional susceptibility testing.

CONCLUSION AND STRATEGIC RECOMMENDATIONS

Modern control strategies require integrated molecular surveillance, enhanced biosecurity, DIVA-based monitoring, rapid field diagnostics, and antimicrobial stewardship programs. Adoption of a One Health framework is essential for sustainable poultry disease management and food safety protection.

*References available upon request.

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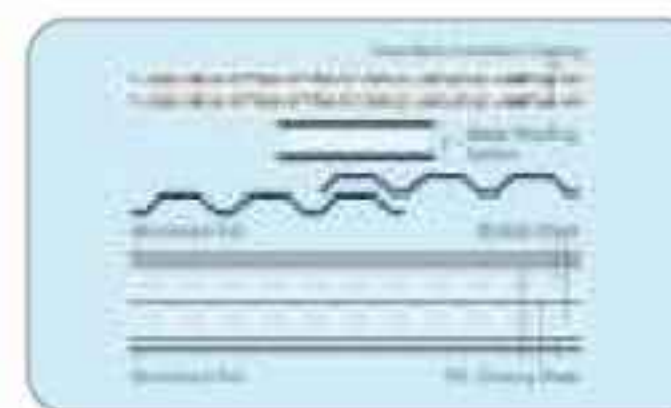
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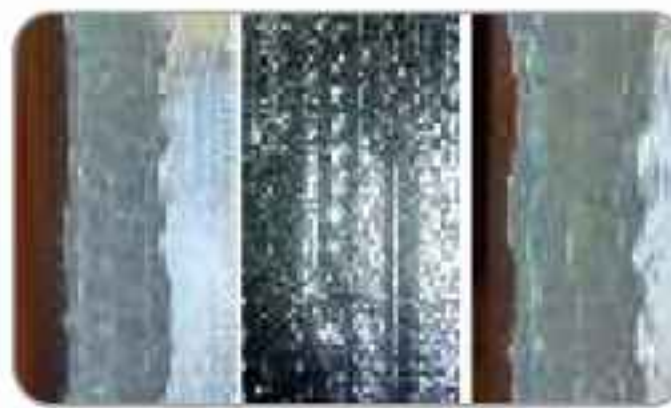
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Dr. Pallabi Das
Assistant Professor-
Department of
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IIVER, Rohtak-124001

Introduction

The poultry industry contributes significantly to global food security by providing affordable sources of animal protein in the form of meat and eggs. However, poultry birds are highly susceptible to infectious diseases caused by viruses, bacteria, fungi, and parasites, which can lead to severe economic losses and public health concerns (FAO, 2023). Disease outbreaks such as avian influenza and Newcastle disease adversely affect productivity, mortality, and international trade in poultry products. Therefore, maintaining effective biosecurity practices along with proper nutritional management is essential for sustainable poultry production. Biosecurity refers to a series of management and preventive

BIOSECURITY WITH NUTRITIONAL INTERVENTION IN POULTRY

measures designed to reduce the risk of introduction and spread of infectious agents within poultry farms. Nutritional intervention involves the use of balanced diets and feed additives to enhance immunity, improve gut health, and increase disease resistance in poultry birds. The integration of biosecurity and nutritional strategies helps improve flock health, production efficiency, and farm profitability.

Objectives of Biosecurity

The major objectives of poultry biosecurity are:

- Prevention of disease entry into the farm.
- Reduction in disease transmission among birds.
- Improvement of flock health and productivity.
- Reduction in mortality and economic losses.

Components of Poultry Biosecurity

1. Farm Location and Layout

Proper fencing and controlled access points help prevent the entry of unauthorized persons and animals.



2. Controlled Entry of Visitors and Vehicles

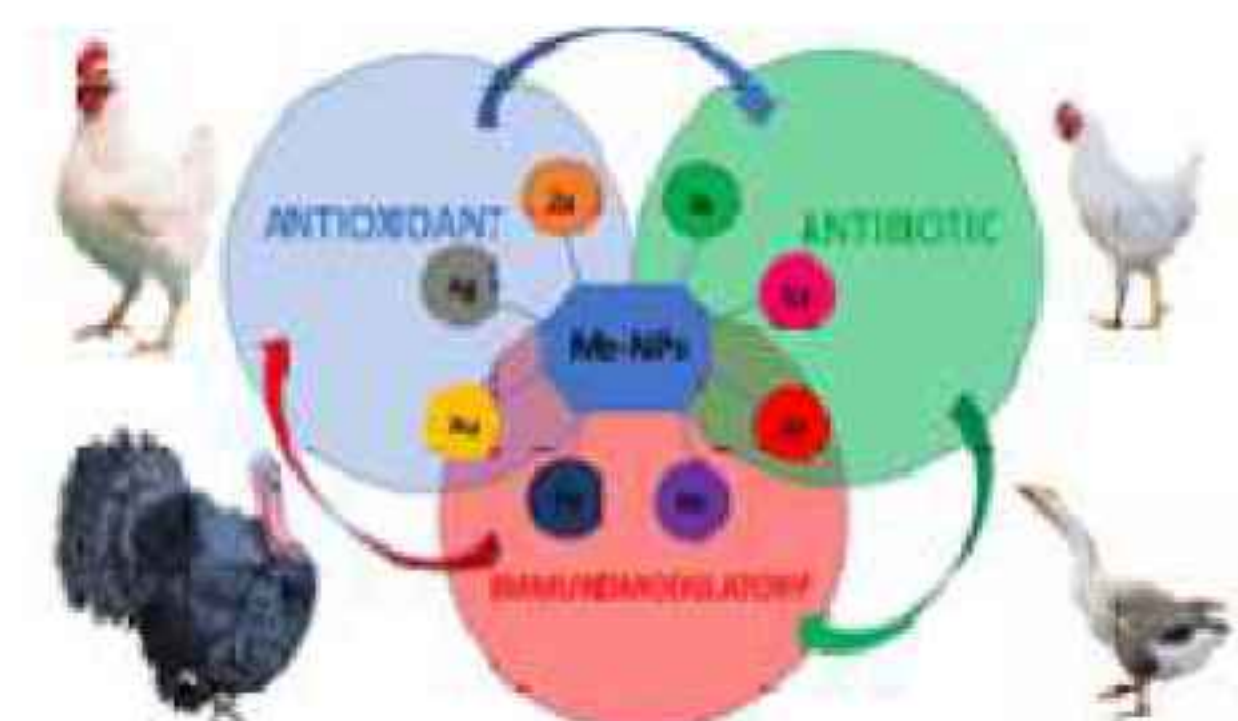
Visitors and vehicles can act as carriers of infectious agents. Therefore, entry of visitors should be restricted, and all vehicles entering the farm should be disinfected properly (FAO, 2023). Footbaths containing disinfectants should be placed at the entrance of poultry houses.

3. Cleaning and Disinfection

Regular cleaning and disinfection of poultry houses, feeders, drinkers, and equipment are essential to reduce microbial contamination. Proper litter management also helps in reducing pathogen load and ammonia accumulation.

4. Rodent and Insect Control

Rodents, flies, and wild birds are important vectors for disease transmission in poultry farms. Effective pest control measures should be adopted to prevent contamination of feed and water.



5. Vaccination Programs

Vaccination is an important component of poultry biosecurity. Proper vaccination schedules help protect birds against common infectious diseases such as Newcastle disease, Marek's disease, and infectious bursal disease (Tizard, 2018).

6. Proper Disposal of Dead Birds and Waste

Dead birds and poultry waste should be disposed of scientifically through deep burial, composting, or incineration to prevent environmental contamination and disease spread.

7. All-in All-out System

The all-in all-out system involves rearing birds of the same age group together and completely cleaning and disinfecting the shed before introducing a new flock. This practice reduces disease carryover between batches.

Importance of Nutritional Intervention

Proper nutritional management:

- Enhances disease resistance.
- Improves feed efficiency and growth.
- Reduces stress and mortality.
- Maintains gut health and microbial balance.

Major Nutritional Interventions

1. Balanced Protein and Energy: Adequate dietary protein and energy are essential for optimum growth and egg production.

2. Vitamin Supplementation: Vitamins play critical roles in metabolism and immunity.

- **Vitamin A** maintains epithelial integrity and enhances immune function.
- **Vitamin E** acts as an antioxidant and

improves resistance against oxidative stress.

- **Vitamin C** helps poultry birds tolerate heat stress and environmental challenges.
- **Vitamin D** is essential for calcium metabolism and bone development

3. Mineral Supplementation

Minerals such as zinc, selenium, calcium, phosphorus, and copper are important for enzyme activity, skeletal development, and immunity. Selenium and zinc also function as antioxidants and enhance disease resistance.

4. Probiotics and Prebiotics

Probiotics are beneficial microorganisms that improve intestinal microbial balance, while prebiotics stimulate the growth of beneficial gut bacteria. Their supplementation improves nutrient utilization, feed conversion ratio, and immune response.

5. Phytogetic Feed Additives

Phytogetic additives such as garlic, turmeric, oregano, and neem possess antimicrobial, antioxidant, and anti-inflammatory properties. These natural feed additives are increasingly used as alternatives to antibiotic growth promoters.

6. Organic Acids

Organic acids help maintain gut pH and inhibit pathogenic bacteria such as *Salmonella* and *Escherichia coli*. They also improve nutrient digestibility and gut health.

7. Mycotoxin Binders

Mycotoxins present in contaminated feed negatively affect poultry health, immunity, and productivity. The use of mycotoxin binders helps



reduce toxin absorption and improve performance.

Role of Nutrition in Disease Prevention

Biosecurity and nutrition should be implemented together for effective disease prevention and sustainable poultry production. Proper nutrition strengthens the immune system and reduces disease incidence in poultry birds. Deficiency of essential nutrients can lead to poor growth, decreased egg production, weakened immunity, and increased mortality.

Stress conditions such as high environmental temperature, vaccination, transportation, and disease outbreaks increase the nutritional requirements of birds. Supplementation of vitamins, electrolytes, antioxidants, and probiotics during stress conditions improves recovery and performance.

Conclusion

Biosecurity and nutritional intervention are two essential pillars of modern poultry production. Effective biosecurity measures help prevent the introduction and spread of infectious diseases, while proper nutritional management enhances immunity, gut health, and production performance. The integration of scientific hygiene practices, vaccination, balanced nutrition, and feed supplementation contributes significantly to sustainable and profitable poultry farming. In the present era of emerging diseases and antibiotic resistance, preventive healthcare through biosecurity and nutritional strategies has become increasingly important for the poultry industry.

References

1. FAO (2023). *Biosecurity for Highly Pathogenic Avian Influenza Control*. Food and Agriculture Organization.
2. Tizard, I. (2018). *Veterinary Immunology*. 10th edition. E-book.

Continuation of page 20

dependence on antibiotics, helping combat antimicrobial resistance.

➤ Improved Food Safety

Disease-free poultry products are safer for consumers and contribute to public health.

➤ Protection Against Zoonotic Diseases

Biosecurity helps prevent diseases such as avian influenza and salmonellosis that can be transmitted from birds to humans.

➤ Sustainable Poultry Production

Effective biosecurity ensures long-term productivity, environmental protection, and farm sustainability.

Challenges in Implementing Biosecurity

- ❖ Lack of farmer awareness.
- ❖ Inadequate infrastructure.
- ❖ High initial investment.
- ❖ Poor compliance with biosecurity protocols.

Conclusion

Biosecurity is an essential component of modern poultry farming serving as a cost-effective and practical approach to prevent disease outbreaks, improving productivity, safeguarding public health, and ensuring the sustainability of the poultry industry. Implementation of strict and comprehensive biosecurity measures across all farming stages is crucial for maintaining optimal production, bird health and to flourish as a successful and profitable poultry enterprise.

BIOSECURITY MEASURES IN POULTRY FARM

Biosecurity is the best defense to protect poultry from diseases, reduce economic losses, and ensure food safety.

- 1. FARM LOCATION & DESIGN**
 - Locate farm in a disease-free area
 - Avoid human-animal contact
 - Proper fencing and secure perimeter
 - Proper waste disposal
- 2. ACCESS CONTROL**
 - Restrict entry to authorized persons only
 - Monitor visitor logs
 - Use gates and gates locks
- 3. PERSONAL HYGIENE**
 - Wear clean clothes and shoes
 - Wash hands with soap and water
 - Use hand sanitizer
- 4. VEHICLE CONTROL**
 - Restrict entry of vehicles
 - Disinfect vehicles before entering the farm
 - Regular vehicle maintenance
- 5. CLEANING & DISINFECTION**
 - Clean farm, sheds, equipment, and surroundings regularly
 - Remove litter, manure, and dead birds promptly
 - Use effective disinfectants regularly
- 6. FEED & WATER SAFETY**
 - Use quality feed and clean water
 - Store feed in a dry, clean, and protected area
 - Clean water lines and containers regularly
- 7. WASTE MANAGEMENT**
 - Dispose waste properly and safely
 - Use appropriate biosecurity measures
 - Keep the farm environment clean
- 8. DISEASE, INSECT & WILD BIRD CONTROL**
 - Control rodents, insects, and wild birds
 - Monitor and control disease outbreaks
 - Use appropriate biosecurity measures

ALWAYS FOLLOW ALL-IN, ALL-OUT SYSTEM - KEEP GOOD RECORDS - MONITOR FLOCK HEALTH EARLY
BIOSECURITY TODAY, HEALTHY FLOCK TOMORROW

VACCINATION OF CHICKEN IN POULTRY FARM

Vaccination is one of the most effective ways to prevent infectious diseases and maintain a healthy flock.

- IMPORTANCE OF VACCINATION**
 - Prevents diseases that cause death
 - Reduces mortality and economic losses
 - Helps to control and eliminate diseases
 - Improves productivity and flock health
- COMMON DISEASES**
 - Newcastle Disease (ND)
 - Infectious Bursal Disease (IBD)
 - Infectious Bronchitis (IB)
 - Fowl Pox
 - Marek's Disease
 - Avian Influenza (AI) (When applicable)
- VACCINATION SCHEDULE (Example)**

Age	Vaccine
1 day old	Marek's Disease (MD)
5-7 days	Newcastle Disease (ND) (Live)
14 days	Infectious Bursal Disease (IBD)
21 days	Newcastle Disease (ND) (Inactivated)
28 days	Infectious Bronchitis (IB)
As advised	Avian Influenza (AI) (When applicable)
- GOOD VACCINATION PRACTICES**
 - Use appropriate vaccine and dose
 - Follow proper storage
 - Follow proper handling
 - Follow proper disposal
- ROUTES OF VACCINATION**
 - Eye drop
 - Oral (drinking water)
 - Subcutaneous (SC)
 - Intramuscular (IM)
- POINTS TO REMEMBER**
 - Store vaccines in refrigerator (2-8°C). Do not freeze unless specified.
 - Use clean, cold, and cool drinking water for vaccination.
 - Avoid direct sunlight while administering vaccines.
 - Use the correct dose and route as specified.
 - Monitor higher failure rate after vaccination.
 - Dispose of used vials, needles, and syringes safely.
- RESULT**
 - A well-vaccinated flock remains healthy, grows better, and gives more profit.

A HEALTHY FLOCK TODAY, A BETTER TOMORROW!



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Scientific Overview of Immuity+ : An Advanced Immuno modulatory Formulation

At Annual General Meeting for FY 2025–2026, held at Hotel Ramada Encore in Indore, Vetline, a division of Simfa Labs Private Limited, announced the launch of Immuity+, a scientifically developed solution aimed at strengthening poultry immunity and improving overall flock health. The key officials present at the product launch included Director Mr. Dilraj Singh Bhatia, Executive Director Mr. Sumeet Singh Bhatia and Dr. Amit Kumar Patra, General Manager (Sales & Marketing) who played a major role in presenting the product and outlining its benefits.

The growing need to enhance disease resistance in poultry while minimizing antibiotic dependence has accelerated the development of scientifically designed immunomodulatory products. Immuity+ is a novel formulation developed to support poultry immune competence through a synergistic combination of nutritional and bioactive components.

Formulation and Mechanistic Insights

Immuity+ comprises a precise blend of Beta glucan, Nucleotides, MOS, Alpha-monolaurin, organic trace minerals (such as zinc and selenium), nutritional and antioxidant molecules. Each component is selected based on its established role in immune regulation and gut health.

Nutritional nucleotides and essential amino acids support rapid cell repair, enhance protein synthesis and immune function by reducing the energy burden of de novo synthesis during stress. Antioxidants reduce oxidative stress, preserving the functional integrity of immune cells, while organic trace minerals contribute to enzymatic defence systems and lymphocyte proliferation.

Immuno-physiological Effects

Immuity+ is designed to influence both innate and adaptive immune responses. It enhances the

functional activity of macrophages, heterophils and natural killer cells, and supports humoral immunity by promoting antibody synthesis. Additionally, the formulation contributes to improved gut integrity and supports the gut-associated lymphoid tissue (GALT), which plays a central role in avian immune defence.

Performance and Health Outcomes

Scientific evaluations suggest that supplementation with Immuity+ results in:

- Increased resistance to infectious diseases
- Lower morbidity and mortality rates
- Improved feed conversion efficiency
- Enhanced growth performance in broilers and sustained productivity in layers

Application and Compatibility

Immuity+ can be administered via feed or drinking water and is compatible with standard vaccination



protocols and nutritional programs. Its flexible application makes it suitable for broilers, layers, and breeder flocks across various production systems.

Conclusion

Immuity+ is a science-based solution to keep poultry healthy. It works by improving nutrition and supporting gut health, which helps birds build stronger natural immunity. The product reflects Vetline's commitment to providing sustainable and effective healthcare solutions for modern poultry production, supporting improved performance, productivity, and long-term farm profitability.



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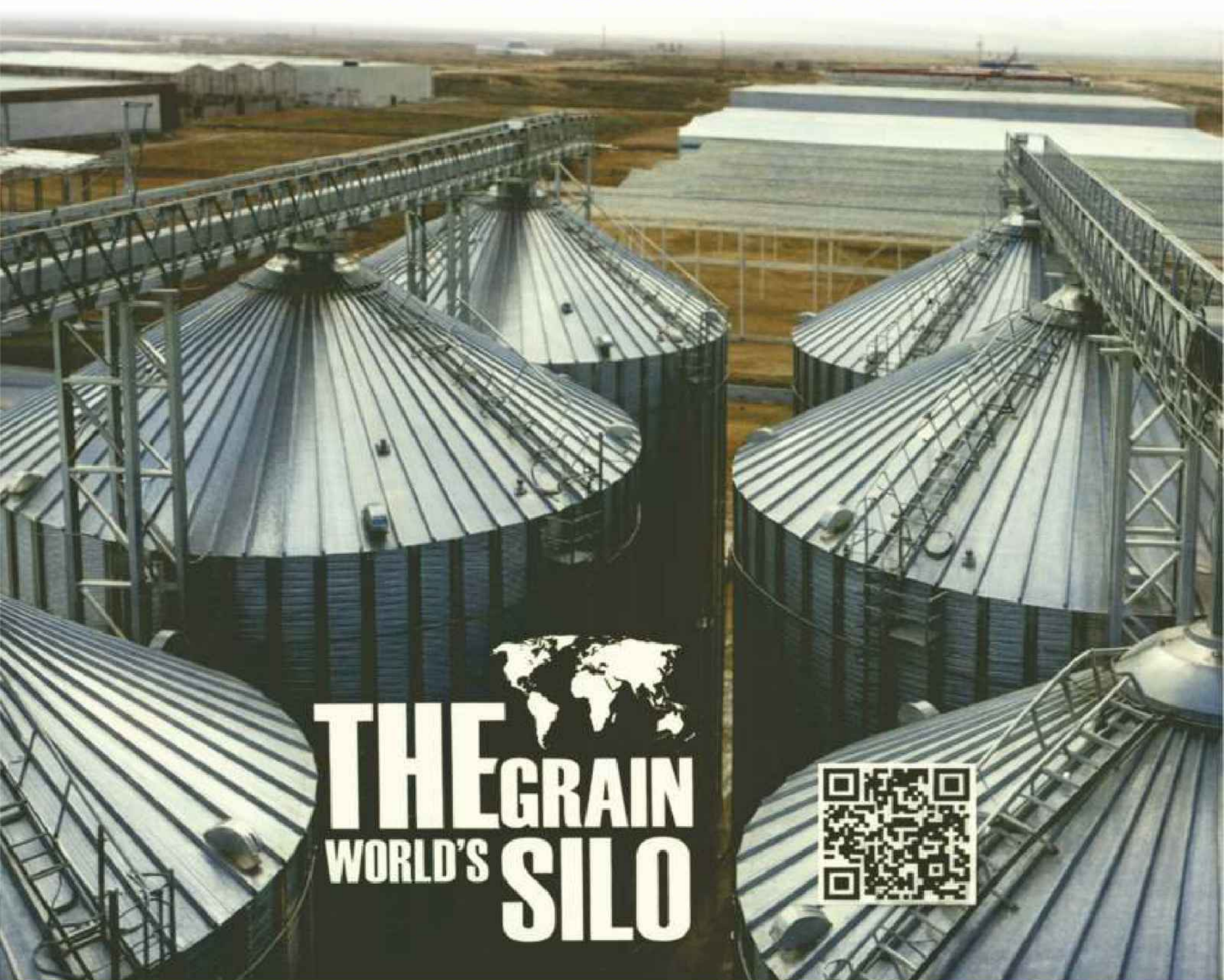


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Artificial Insemination in Poultry : Advanced Concepts, Applications and Future Perspectives



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Introduction

Artificial insemination (AI) is one of the most significant reproductive biotechnologies used in poultry production. It involves the collection of semen from selected males and its deposition into the female reproductive tract without natural mating. AI has become indispensable in elite

breeding programs, commercial turkey production, conservation of indigenous poultry genetic resources, and reproductive research. Modern poultry breeding relies heavily on AI for accelerating genetic gain, improving fertility, reducing breeding costs, and facilitating advanced reproductive technologies.

Physiological Basis of Artificial Insemination

The avian reproductive system possesses unique anatomical and physiological characteristics. Following insemination, spermatozoa are stored in specialized sperm storage tubules (SSTs) located at the uterovaginal junction. These structures enable long-term sperm survival and gradual release, allowing hens to remain fertile for several days after a single insemination. Understanding sperm transport, storage, capacitation-like processes, and fertilization mechanisms is essential for optimizing AI programs.

Need and Importance of AI in Poultry

Artificial insemination maximizes the use of superior males, improves fertility in heavy breeds, supports pedigree breeding, reduces the number of males required, facilitates disease control, and assists conservation of endangered breeds. It is especially important in turkeys where natural mating efficiency is poor due to large body size.

Semen Collection and Evaluation

Semen is commonly collected by the abdominal massage technique. Following collection, semen quality is assessed through volume, concentration, motility, viability, morphology, membrane integrity, acrosomal status, and microbial contamination. Advanced laboratories employ Computer Assisted Sperm Analysis (CASA), flow cytometry, fluorescent staining, and molecular biomarkers for fertility assessment.

Table1. Characteristics and the mean chemical

Characteristics and Components Cockerel	0.2-0.5
Ejaculate volume (ml)	3000-7000
Sperm concentration ($\times 10^6$ /ml)	
Sperm/ejaculate ($\times 10^9$)	0.06-3.5
Motile sperm (%)	60-80
Morphologically normal sperm (%)	85-90
Protein (g/100 ml)	2.8
pH	7.2-7.6
Fructose (mg/100ml)	4
Sorbitol (mg/100ml)	0-10
Inositol (mg/100ml)	16-20
Glycerylphosphorylcholine (GPC) (mg/100ml)	0-40

components of semen in cockerel

Semen Dilution and Preservation

Semen extenders provide nutrients, osmotic balance, buffering capacity, and protection against

VHBRO-MN

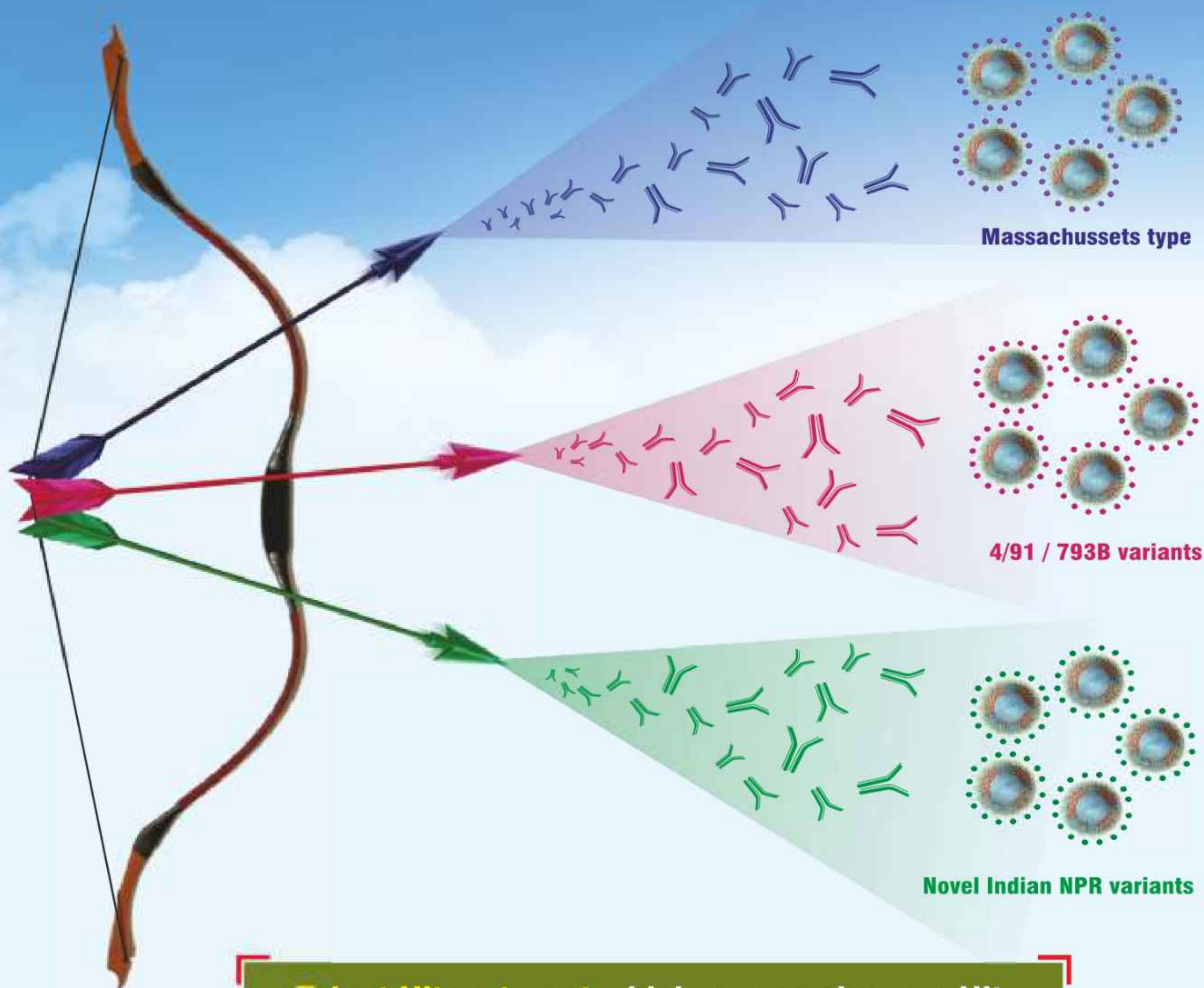
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oxidative damage. Common components include glucose, fructose, buffers, antioxidants, antibiotics, and cryoprotectants. Short-term liquid storage and long-term cryopreservation are increasingly used in genetic resource conservation programs.

Artificial Insemination Techniques

AI is performed using sterile insemination tubes or syringes. The frequency and dose vary depending on species, age, fertility status, and production objectives. Accurate timing relative to oviposition is critical for maximizing fertility and hatchability.

Factors Affecting Fertility

Male age, female age, semen quality, insemination dose, environmental temperature, nutrition, disease status, oxidative stress, and management practices significantly influence fertility outcomes. Heat stress is particularly detrimental due to its adverse effects on spermatogenesis and sperm viability.

Applications in Genetic Improvement

AI facilitates progeny testing, line breeding, crossbreeding, genomic selection, and dissemination of superior germplasm. It enables rapid multiplication of elite genetic material and contributes to sustainable poultry breeding programs.

Biotechnological Advances

Recent advances include sperm cryopreservation, vitrification, proteomics, transcriptomics, metabolomics, fertility biomarkers, nanoparticle-based extenders, gene editing technologies, and integration with genomic selection programs. These developments are expanding the role of AI beyond conventional breeding.

Role in Conservation Biology

AI is a valuable tool for preserving rare and indigenous poultry breeds. Cryobanks containing semen from valuable genetic lines help safeguard biodiversity and support future breeding and restoration programs.

Challenges and Future Prospects

Major challenges include variability in semen quality, cryopreservation-induced sperm damage, labor-intensive procedures, and the need for skilled personnel. Future research is focused on precision reproduction, artificial intelligence-assisted fertility prediction, advanced semen extenders, and molecular fertility markers.

Table 1. Advantages and Limitations of Artificial Insemination

Aspect	Advantages	Limitations
Genetic Improvement	Rapid dissemination of superior genes	Requires technical expertise
Economics	Fewer breeding males needed	Initial infrastructure costs
Disease Control	Reduced mating-related disease spread	Poor hygiene may reduce fertility
Research	Supports advanced reproductive studies	Labor intensive
Conservation	Useful for germplasm preservation	Cryopreservation challenges



Figure 1. Simplified workflow of artificial insemination in poultry.

Key Research Areas for Veterinary Scientists

- Sperm physiology and sperm storage tubules
- Oxidative stress and antioxidant protection
- Cryopreservation and semen banking
- Genomics and fertility-associated genes
- Nanotechnology in semen extenders
- Proteomics and metabolomics of avian spermatozoa
- Precision poultry breeding and reproductive biotechnology

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Monsoon Litter Management in Poultry: The Key to Better Bird Health and Performance

Authors: Dr. C.S. Bedi, Dr. Himali Kishor Gotarane, Dr. Nithin Reddy, Dr. Arun Kumar Guybro Animal Health Pvt. Ltd.

Monsoon season is one of the most challenging periods for poultry farmers. While the reduction in temperature helps relieve heat stress, the accompanying rise in humidity creates serious problems inside poultry sheds, particularly in litter management. During rainy months, litter tends to absorb excess moisture from the environment due to poor evaporation, water leakage, drinker spillage, and inadequate ventilation. As a result, the litter becomes wet, compact, and unhealthy, creating unfavourable conditions for bird health and farm performance.

Litter is much more than just bedding material in poultry farming. It directly influences the shed environment, bird comfort, air quality, and disease pressure. Healthy litter should remain dry, loose, and friable. However, under monsoon conditions, excessive moisture rapidly deteriorates litter quality and leads to caking, creating conditions that adversely affect both birds and farm productivity.

Birds consume a considerable quantity of water throughout their production cycle, and only a small proportion is retained for growth, egg production, and metabolic functions. Nearly 70–75% of the water consumed is eventually returned to the environment through droppings and respiration. During monsoon, increased humidity significantly reduces the rate at which this moisture evaporates from the litter. Consequently, moisture accumulates within the bedding material, resulting in wet, compact, and caked litter.

As litter moisture increases, microbial activity also intensifies. Poultry excreta contain uric acid, which is naturally broken down by microorganisms present in the litter. During this decomposition process, nitrogen-containing compounds are converted into ammonia gas. High litter moisture, warm temperatures, and alkaline litter pH accelerate ammonia production, causing ammonia concentrations to rise rapidly within the poultry house.

Ammonia accumulation is one of the most significant consequences of poor litter management. Elevated ammonia levels irritate the eyes and respiratory tract, damage the lung surface, and increase susceptibility to respiratory infections. Continuous exposure negatively affects feed conversion, weight gain, immunity, and vaccine response. In fast-growing broilers, chronic respiratory stress may also contribute to a higher incidence of ascites. Birds exposed to poor air quality often appear less active, more stressed, and exhibit inferior overall performance.

Apart from ammonia-related effects, prolonged contact with wet litter causes several physical lesions in broilers. Footpad dermatitis is among the most common problems, where moist litter damages the skin of the footpads, leading to painful lesions and ulcers. Wet litter also contributes to hock burns and breast blisters, especially in fast-growing birds that spend considerable time resting on the litter surface. These conditions negatively affect bird welfare, carcass quality, and farm profitability.

Wet litter also serves as an ideal environment for the multiplication of harmful bacteria, fungi, coccidial oocysts, flies, and darkling beetles. This increases disease pressure and compromises farm biosecurity. In layer farms, poor litter quality further contributes to respiratory stress, dirty eggs, poor eggshell quality, and reduced production performance. Darkling beetles and flies can also act as carriers of important poultry pathogens, facilitating disease transmission within the farm.

Maintaining dry and healthy litter during monsoon is therefore essential for optimum poultry performance. Proper litter management helps improve air quality, reduce pathogen load, minimize ammonia release, and enhance bird comfort. This is where **Liiteron Plus** plays an important role in poultry farm management.

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Liiteron Plus is a specially developed poultry litter conditioner designed to maintain healthy litter under challenging environmental conditions. It works by acidifying the litter and helping control excess moisture, thereby reducing ammonia release and improving overall shed hygiene. By creating an unfavourable environment for pathogens, it helps control bacteria, fungi, parasites, and fly larvae commonly associated with wet litter conditions.

An important advantage of **Liiteron Plus** is its ability to improve litter dryness during periods of high humidity. By acting as a bedding drier, it helps maintain loose and friable litter consistency, preventing excessive caking and moisture accumulation. Better litter condition directly contributes to healthier footpads, cleaner birds, improved comfort, and lower environmental stress.

Liiteron Plus also helps control ammonia and hydrogen sulphide, resulting in improved air quality inside the poultry shed. Better air quality supports healthier respiratory systems, improved feed intake, better weight gain, and enhanced flock

performance. In addition, the product helps reduce fly larvae and darkling beetle populations, supporting overall farm hygiene and biosecurity.

Monsoon management in poultry farming is not only about controlling diseases but also about maintaining a healthy shed environment from the ground level upward. Healthy litter acts as the first line of defence against ammonia, pathogens, and moisture-related stress. Ignoring litter quality during rainy seasons can silently reduce profitability through poor growth, reduced production, increased disease risk, and higher mortality.

By helping maintain dry, hygienic, and ammonia-controlled litter, **Liiteron Plus** provides poultry farmers with an effective solution to tackle monsoon challenges confidently. Proper litter management with Liiteron Plus ultimately contributes to healthier birds, better performance, cleaner sheds, and improved profitability throughout the monsoon season.

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Poultry is one of the fastest-growing and most economically significant sectors of animal agriculture worldwide. It plays a crucial role in providing affordable, high-quality animal protein through meat and egg production, thereby contributing significantly to global food security, nutrition, and rural livelihoods. Over the past few decades, rapid advancements in poultry genetics, nutrition, housing systems, and disease management have substantially increased production efficiency. However, alongside these developments, the poultry sector continues to face persistent challenges from a wide range of infectious diseases caused by viruses, bacteria, fungi, and parasites. These diseases not only affect bird health and welfare but also result in substantial economic losses due to increased mortality, reduced growth

BIOSECURITY IN POULTRY : A BIRD'S EYE VIEW

rates, poor feed conversion efficiency, decreased egg production, treatment costs, and restrictions on national and international trade.

Poultry production systems are particularly vulnerable to infectious disease outbreaks because of high stocking densities, intensive management practices, and frequent movement of birds, personnel, equipment, and vehicles between farms. Pathogens such as avian influenza virus, Newcastle disease virus, infectious bursal disease virus, *Salmonella* spp., *Escherichia coli*, *Mycoplasma gallisepticum* and various fungal organisms can rapidly spread within and between flocks, causing severe production and economic consequences. Recent outbreaks of highly pathogenic avian influenza (HPAI) have further highlighted the vulnerability of poultry production systems to transboundary animal diseases and underscored the need for effective preventive measures. Traditionally, vaccination and therapeutic interventions have been the primary approaches used to control poultry diseases. Vaccines against Newcastle disease, Marek's disease, infectious bursal disease, infectious bronchitis, and avian influenza have significantly contributed to improved flock health and

productivity. Nevertheless, vaccination alone cannot completely eliminate disease risks because vaccine efficacy may be influenced by factors such as improper administration, antigenic variation of pathogens, environmental stress, and inadequate flock management. Furthermore, the widespread use of antimicrobial agents for disease prevention and treatment has raised concerns regarding antimicrobial resistance (AMR), which poses a significant threat to both animal and public health.

As a result, increasing emphasis has been placed on preventive management strategies, particularly biosecurity, as a sustainable and cost-effective means of disease control. Biosecurity refers to a comprehensive set of management practices, physical barriers, and operational procedures designed to prevent the introduction, establishment, and spread of infectious agents within and between poultry populations. It encompasses measures aimed at reducing pathogen transmission through birds, humans, equipment, feed, water, rodents, insects, and other potential sources of contamination.

Biosecurity is widely regarded as the first and most important line of defence against infectious diseases in poultry

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production systems. Effective biosecurity programmes integrate farm isolation, traffic control, sanitation, cleaning and disinfection, quarantine procedures, pest management, health monitoring, and proper disposal of waste materials. Studies have demonstrated that farms implementing strict biosecurity protocols experience lower disease incidence, reduced mortality rates, improved productivity, and enhanced profitability compared with farms where biosecurity practices are inadequate.

In addition to improving flock health and production efficiency, biosecurity plays a vital role in safeguarding public health. Several poultry-associated pathogens, including *Salmonella*, *Campylobacter* and avian influenza viruses, possess zoonotic potential and can be transmitted from birds to humans through direct contact or contaminated poultry products. Consequently, effective biosecurity measures contribute significantly to food safety by minimizing the risk of pathogen contamination throughout the poultry production chain. Therefore, biosecurity should be considered a fundamental pillar of modern poultry production systems, essential for ensuring animal health, public health, economic sustainability, and long-term industry growth.

What is biosecurity?

Biosecurity is a comprehensive set of management practices, preventive measures, and operational procedures designed to prevent the introduction, establishment, spread, and

transmission of infectious disease agents within and between animal populations. In poultry production, biosecurity refers to all strategies implemented to protect poultry flocks from exposure to pathogenic microorganisms such as viruses, bacteria, fungi, and parasites. These measures are aimed at minimizing the risk of disease outbreaks and maintaining optimal flock health throughout the production cycle (WOAH, 2024). In recent decades, biosecurity has become one of the most important components of modern poultry farming due to the increasing intensification of poultry production and the growing threat of emerging and re-emerging infectious diseases. Poultry farms are particularly susceptible to disease transmission because of high bird densities, continuous movement of personnel and equipment, and interactions with wildlife, rodents, insects, and other potential disease carriers. Consequently, the implementation of effective biosecurity measures is essential for protecting poultry health, improving production efficiency, ensuring animal welfare, and maintaining food safety standards (Swayne *et al.*, 2020). The primary objective of biosecurity is disease prevention. Unlike treatment-based approaches that focus on controlling diseases after they occur, biosecurity aims to stop pathogens from entering poultry farms in the first place. Preventing disease introduction is considerably more economical and effective than managing an

outbreak once infection has become established within a flock. For this reason, biosecurity is often regarded as the cheapest and most effective disease-control tool available to poultry producers (Mohammed, 2024). The economic benefits of biosecurity include reduced mortality rates, lower veterinary and medication costs, improved feed conversion efficiency, enhanced growth performance, increased egg production, and greater overall farm profitability. Effective biosecurity programmes incorporate several key components, including farm isolation, traffic control, cleaning and disinfection, quarantine procedures, pest management, proper disposal of dead birds, feed and water quality management and routine health monitoring. These measures collectively create multiple barriers that reduce opportunities for pathogens to enter and spread within poultry production systems. For example, restricting visitor access, disinfecting vehicles and equipment, maintaining rodent control programmes, and implementing all-in-all-out production systems can significantly reduce the risk of disease transmission (Australian Government, 2009). Biosecurity also plays a critical role in maximizing the effectiveness of vaccination and medication programmes. Vaccines stimulate protective immunity against specific diseases; however, their success depends largely on minimizing exposure to infectious agents. Similarly, medications are more effective when birds are maintained in a

clean and healthy environment with reduced pathogen pressure. Therefore, poultry must be provided with conditions in which disease challenges are controlled to a level where vaccination and therapeutic interventions can achieve their full benefits. Without adequate biosecurity, even well-designed vaccination programmes may fail to provide complete protection against disease outbreaks. Furthermore, biosecurity contributes significantly to public health protection. Several poultry pathogens, including *Salmonella* spp., *Campylobacter* spp. and avian influenza viruses, possess zoonotic potential and can be transmitted from poultry to humans. By reducing the prevalence and spread of these pathogens within poultry populations, biosecurity helps ensure the production of safe and wholesome poultry products for consumers (FAO, 2020).

Biosecurity is commonly described as the cornerstone of the disease-control triangle, which consists of biosecurity, vaccination, and good management practices. These three elements work together to maintain flock health and productivity. Among them, biosecurity forms the foundation upon which all other disease-control measures depend. Without effective biosecurity, the success of vaccination, medication, nutrition, and management programmes can be severely compromised. Therefore, the adoption of stringent biosecurity protocols is essential for sustainable poultry production, disease prevention, food safety, and long-term

economic success in the poultry industry.

Levels of biosecurity

Biosecurity programmes in poultry production are generally categorized into two levels based on the degree of disease risk and the intensity of preventive measures required. These levels are designed to provide a systematic approach to disease prevention and control, ensuring that poultry flocks remain protected under both normal operating conditions and periods of heightened disease risk. The implementation of these biosecurity levels helps reduce the likelihood of pathogen introduction, minimizes disease transmission, and enhances the overall health and productivity of poultry flocks.

Level 1: Routine Biosecurity Procedures

Level 1 biosecurity comprises the routine preventive measures that are implemented daily on poultry farms. These procedures form the foundation of any effective biosecurity programme and provide a high degree of assurance that infectious agents will not be introduced into poultry production systems. Routine biosecurity practices are designed to minimize opportunities for disease transmission between poultry houses, production areas, and farms. Consistent application of these measures is essential because even minor lapses can allow pathogens to enter and spread within a flock.

Documentation and Employee Training

Proper documentation and

continuous training of farm personnel are critical components of routine biosecurity. All employees working within poultry production areas should receive regular training regarding disease prevention, hygiene protocols, emergency response procedures, and farm-specific biosecurity measures. Training ensures that workers understand the importance of biosecurity and their role in preventing disease transmission. Detailed records should be maintained for bird health, mortality, vaccination schedules, visitor access, cleaning and disinfection activities, feed deliveries, and disease surveillance programmes. Accurate documentation facilitates traceability and assists in identifying potential sources of disease outbreaks.

Facility Standards

Facility standards are established to control access to poultry production areas and prevent contact between poultry and potential disease carriers. Poultry houses should be designed and maintained in a manner that excludes livestock, wild birds, rodents, insects, and other animals capable of transmitting infectious diseases. Secure fencing, controlled entry points, bird-proof housing structures, and rodent-proof feed storage facilities are essential elements of facility biosecurity. Proper drainage systems, waste management practices, and vegetation control around poultry houses further reduce opportunities for pathogen survival and transmission.

Personnel Standards and Procedures

Human movement is one of the most significant risk factors for disease introduction into poultry farms. Therefore, strict personnel standards and procedures must be implemented to reduce disease spread through employees, visitors, veterinarians, and service personnel. Access to poultry houses should be restricted to authorized individuals only. Farm workers should wear dedicated protective clothing, footwear, gloves, and hair coverings while working within poultry facilities. Handwashing stations, footbaths, and sanitation points should be strategically located throughout the farm. Visitor logs should be maintained, and unnecessary visits should be minimized to reduce disease risks.

Operational Standards

Operational standards include routine management practices that support flock health and disease prevention. These practices encompass cleaning and disinfection of poultry houses, equipment, and vehicles; maintenance of feed and water quality; proper carcass disposal; pest control programmes; litter management; and regular health monitoring. All-in-all-out production systems should be adopted whenever possible to reduce pathogen persistence within poultry facilities. Regular flock inspections help identify disease problems at an early stage, allowing prompt intervention before significant losses occur.

Species-Specific Biosecurity Requirements

Different poultry species may

require specialized biosecurity measures due to variations in disease susceptibility, management practices, and production systems. For example, breeder flocks, broilers, layers, ducks, turkeys, and backyard poultry operations each present unique disease risks and management challenges. Species-specific biosecurity protocols should address these differences and be tailored according to the epidemiological characteristics of diseases affecting particular poultry populations. Additional precautions may be necessary for breeder operations because of the potential for vertical transmission of certain pathogens through eggs.

Level 2: High-Risk Biosecurity Procedures

Level 2 biosecurity measures are implemented when there is an increased risk of disease introduction or during outbreaks of serious endemic or exotic diseases. These enhanced procedures provide an additional layer of protection beyond routine biosecurity and are intended to prevent disease spread during emergency situations. High-risk biosecurity measures are particularly important during outbreaks of highly pathogenic avian influenza, Newcastle disease, or other notifiable poultry diseases.

Action Plan for Suspected Emergency Animal Diseases

Every poultry farm should maintain a comprehensive emergency response plan outlining procedures to be followed when a disease

outbreak is suspected. The plan should include disease recognition guidelines, reporting procedures, isolation measures, communication protocols, and contingency arrangements. Rapid identification and reporting of suspected cases are critical for preventing widespread disease transmission. Employees should be trained to recognize clinical signs of important poultry diseases and understand their responsibilities during disease emergencies.

Enhanced Facility Controls

During periods of increased disease risk, additional facility controls should be implemented. Farm access may be further restricted, entry points reduced, and additional disinfection barriers established. Vehicle movement should be carefully monitored, and all vehicles entering the farm should undergo thorough cleaning and disinfection. Temporary exclusion zones may be established around affected areas to minimize disease spread.

Personnel Restrictions

Personnel movement should be minimized during high-risk situations. Only essential staff should be allowed access to poultry facilities, and strict hygiene protocols must be enforced. Employees may be required to avoid contact with other poultry operations and comply with additional decontamination procedures. Visitor access should be suspended unless absolutely necessary.

Enhanced Operational Procedures

Operational activities should be modified to reduce disease transmission risks. Increased frequency of cleaning and disinfection, intensified pest control programmes, enhanced flock surveillance, and stricter waste management procedures may be required. Feed, water, and litter supplies should be carefully monitored to ensure they remain free from contamination.

Standard Operating Procedures (SOPs)

Well-developed Standard Operating Procedures (SOPs) provide clear instructions for implementing biosecurity measures consistently and effectively. SOPs should describe specific procedures for cleaning and disinfection, bird handling, visitor management, emergency response, carcass disposal, disease reporting, and outbreak containment. Regular review and updating of SOPs ensure that biosecurity programmes remain effective and aligned with current scientific knowledge and disease risks.

The successful implementation of both Level 1 and Level 2 biosecurity measures is essential for maintaining poultry health, protecting farm profitability, ensuring food

safety, and preventing the spread of infectious diseases within the poultry industry.

Types of biosecurity

Biosecurity can be classified into three types including:

- **Conceptual biosecurity:** Farm locations fall under this category.
It is best that you build a farm in an isolated area at least 3 km(s) away from poultry in case of breeder farms and 1.6 km (s) in case of commercial layer and broiler farms. Proper distance should be maintained between breeder and grow out farms and facilities such as hatcheries and feed mill.
- **Structural biosecurity:** It consists of buildings, layouts and amenities that ward off intruding wildlife and raptors.
- **Fencing and gating of farm area** should be done in a proper way to prevent unwanted visitors.
- **Water quality** should be tested regularly for minerals, chemical contamination and bacterial load.
- **Proper area** should be made for storing the feeding stuff of the poultry flocks.
- **Proper disposal practices** should be followed

regarding disposal of dead birds.

- Housing should be designed very carefully in such a way so that it is safe from any sort of rodents or any other disease-causing organisms which might harm the poultry.
- Poultry feed stuffs, litter material and equipment should be stored in a area separated from the live bird area in order to prevent contamination.
- A three-meter boundary of land around the building must be kept free of all vegetation to prevent rodent and wildlife activity.
- **Operational biosecurity:** It includes cleaning, sanitation and work practices that followed by farm workers and employees.
- Equipments used are cleaned and sanitized along with decontamination of houses etc.
- Operational manuals should be made and updated timely stating all the activities carried out in the farm including emergency practices as well.
- Maintaining visitor's record.
- A well-established integrated pest control programme to control



rodents and pests through mechanical, chemical or biological means.

- In small scale egg production unit follow all-in-all-out-system. If so not possible pullets should be obtained from a source free of vertically transmitted diseases. Recycling of egg packaging materials etc. should be decontaminated at the point of entry of farm.
- Routine monitoring of the health status of flock by periodic antibody assays and post mortem examination of dead birds should be done.
- Regular and appropriate program for disease diagnosis and vaccination schedule should be implemented.
- Regular culling of unproductive, unhealthy birds should be monitored and practiced.

Management factors in disease prevention

1. **Isolation** Farms should be located away from other poultry operational practices and wild bird's habitats. New birds shall only be introduced after proper quarantine into the flock. Birds of different age groups should be reared in different houses or rather practice all-in-all-out-system. Proper layout of the housing should be designed keeping in mind proper ventilation, proper platforms, placement of feeders and waterers in the group.
2. **Litter management** : Wet litter is a potential source of disease transmission.

Maintaining proper litter conditions and monitoring them regularly is a must.

3. **Quality checks** : Ensuring the appropriate preventive care is taken to prevent mycoplasmosis, salmonellosis, infectious bursal disease and Marek's disease. It may be ensured that the received chicks are healthy and within normal weight range.
4. **Proper nutrition** : A good balanced feed should be prepared keeping in mind the nutritional requirements of the birds in order to maintain their good immune status. Adding coccidiostats and vitamin & mineral supplements should be made a point.
5. **Water quality** : Water is the most essential and basic resource which should be taken care of both microbial and chemical quality should be tested before supplying it. Presence of faecal material will add to presence of coliform organisms thus affecting bird health.

Benefits of biosecurity

- ✓ Reduction in outbreaks of disease.
- ✓ Lowered mortality rates.
- ✓ Improved growth and feed efficiency.
- ✓ Reduction in treatment costs.
- ✓ Increased farm profitability.
- ✓ Better food safety and public health protection.

Way Forward

With the increasing intensification of poultry production and the emergence of new disease threats, strengthening biosecurity

practices has become more important than ever. Poultry farms should adopt a proactive approach by implementing standardized biosecurity protocols, regular disease surveillance, strict sanitation measures, and continuous staff training. The use of modern technologies such as digital monitoring systems, rapid diagnostic tools, and automated disinfection systems can further enhance disease prevention and early detection.

Greater collaboration among farmers, veterinarians, researchers, industry stakeholders, and government agencies is essential for effective disease control and emergency preparedness. Awareness programmes and extension activities should be promoted to improve compliance with biosecurity measures, particularly in small-scale and backyard poultry sectors. By integrating strong biosecurity practices with good management, vaccination, and nutrition programmes, the poultry sector will be able to cope up with disease risks, improve productivity, safeguard public health and ensure sustainable and profitable poultry production in the future.





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Abstract

Poultry farming is one of the fastest-growing sectors of livestock production worldwide. The success of poultry production largely depends on proper management practices, among which housing plays a vital role. Poultry housing systems directly influence bird health, welfare, productivity, behaviour, and economic returns. In recent years, poultry welfare has gained considerable attention due to increasing public concern regarding ethical animal production practices. Different housing systems provide varying degrees of comfort, environmental control, hygiene, behavioural freedom, and

DIFFERENT HOUSING SYSTEMS AND THEIR IMPACT ON POULTRY WELFARE

production efficiency.

The major poultry housing systems include free-range, semi-intensive, deep litter, slatted floor, slat-cum-litter, and cage systems. Each system has specific advantages and disadvantages related to bird welfare and management. Welfare issues commonly associated with poultry housing include space restriction, behavioural deprivation, feather pecking, skeletal disorders, stress, poor air quality, and disease susceptibility. Although intensive systems improve productivity and management efficiency, they may compromise natural behaviour and welfare if not properly managed.

This article critically reviews different poultry housing systems and their impact on poultry welfare. It also discusses major welfare concerns associated with modern poultry production and suggests scientific management practices to improve the welfare and productivity of poultry birds. The review emphasizes the need for balanced production systems that ensure both economic sustainability and ethical treatment of birds.

Introduction

Poultry production is an important component of the agricultural economy and

contributes significantly to global food security by providing eggs and meat rich in high-quality protein. With the growing human population and increasing demand for poultry products, modern poultry farming has become highly intensive and technologically advanced. Along with increased productivity, concerns regarding animal welfare have also emerged as an important issue in poultry science.

Housing is one of the most essential components of poultry management because it determines the environment in which birds live throughout their production cycle. Proper housing protects birds from adverse weather conditions, predators, and diseases while ensuring adequate space, ventilation, feeding, watering, and comfort. A good housing system promotes better growth, reproduction, feed efficiency, and disease resistance.

Poultry welfare refers to the physical and mental well-being of birds under human care. Welfare is influenced by several factors such as housing design, stocking density, air quality, lighting, litter condition, nutrition, and management practices. Birds should be able to express natural behaviours such as scratching, perching, dust bathing, nesting, and foraging. When birds are unable to perform these

activities, stress and behavioural abnormalities may occur.

Modern poultry farming uses different housing systems depending on production objectives, climatic conditions, land availability, and economic considerations. While some systems provide greater behavioural freedom, others focus mainly on maximizing productivity and management efficiency. Therefore, understanding the welfare implications of different housing systems is essential for sustainable and ethical poultry production.

Details of the Subject Matter

Classification of Poultry Housing Systems

Poultry housing systems are broadly classified into the following categories:

1. Free-Range System
 2. Semi-Intensive System
 3. Intensive System
- Deep Litter System
 - Slatted Floor System
 - Slat-Cum-Litter System
 - Cage System

1. Free-Range System

Definition

In the free-range system, birds are allowed to roam freely outdoors where they can search for natural feed resources such as grasses, insects, seeds, and worms. Birds may also receive supplementary feed and shelter.

Characteristics

- Birds have access to outdoor grazing areas.
- Natural sunlight and exercise are available.

- Minimal confinement is practiced.
- Common in rural and backyard poultry farming.

Advantages

- Birds can express natural behaviours freely.
- Better muscle development and stronger bones due to exercise.
- Reduced feed costs through scavenging.
- Lower incidence of stress-related behavioural disorders.

Disadvantages

- Lower production efficiency compared to intensive systems.
- Increased exposure to predators and adverse weather conditions.
- Higher risk of parasitic and infectious diseases from wild birds.
- Difficult flock management and monitoring.

Impact on Poultry Welfare

The free-range system is generally considered the most welfare-friendly system because birds experience greater behavioural freedom and reduced confinement stress. Birds can perform activities such as dust bathing, scratching, and foraging naturally. However, environmental challenges such as predation, disease exposure, and climatic stress may negatively affect welfare if proper management is lacking.

2. Semi-Intensive System

Definition

The semi-intensive system combines features of both free-

range and intensive systems. Birds are confined during part of the day and allowed outdoor access during the remaining period.

Characteristics

- Birds stay inside shelters during the night.
- Outdoor runs are provided during daytime.
- Moderate land area is required.
- Suitable for small- and medium-scale farming operations.

Advantages

- Better balance between productivity and welfare.
- Birds receive opportunities for exercise and behavioural expression.
- Improved protection from predators compared to free-range systems.
- Partial scavenging reduces feed costs.

Disadvantages

- Requires higher labour and management.
- Outdoor runs may become contaminated with droppings and pathogens.
- Greater land requirement than intensive systems.

Impact on Poultry Welfare

The semi-intensive system offers moderate to high welfare standards because birds have some degree of behavioural freedom while still benefiting from controlled management. However, overcrowding and poor sanitation in outdoor areas may create welfare concerns.

3. Intensive System

Definition

In intensive systems, birds are completely confined within poultry houses and depend entirely on supplied feed and water.

Characteristics

- High stocking density.
- Scientific feeding and environmental control.
- Suitable for commercial poultry production.
- High production efficiency.

Advantages

- Efficient use of land and resources.
- Better disease monitoring and management.
- Improved feed conversion efficiency and productivity.
- Easier collection of eggs and manure management.

Disadvantages

- Restriction of natural behaviours.
- Increased stress due to overcrowding.
- Greater risk of behavioural disorders and injuries.
- High initial investment costs.

Impact on Poultry Welfare

Although intensive systems improve economic efficiency, they often compromise behavioural welfare due to restricted movement and limited environmental enrichment. Welfare conditions depend greatly on management practices such as stocking density, ventilation, lighting, and litter quality.

Types of Intensive Housing Systems

A. Deep Litter System

Definition

In the deep litter system, birds are reared on a floor covered with absorbent litter materials such as straw, wood shavings, sawdust, or paddy husk.

Features

- Litter depth generally ranges from 8–12 inches.
- Litter must be stirred and maintained regularly.
- Commonly used for broilers and layers.

Advantages

- Provides comfort and insulation.
- Allows scratching and limited natural behaviour.
- Lower housing cost compared to cage systems.

Disadvantages

- Wet litter can lead to ammonia accumulation and respiratory problems.
- Increased risk of footpad dermatitis and breast blisters.
- Requires proper litter management.

Welfare Implications

The deep litter system provides moderate welfare benefits because birds can move freely and express some natural behaviours. However, poor litter quality and overcrowding can negatively affect bird health and welfare.

B. Slatted Floor System

Definition

Birds are reared on raised slatted floors made of wood, plastic, or metal materials.

Features

- Droppings fall through the slats.
- Cleaner environment compared to litter systems.
- Reduced contact between birds and faeces.

Advantages

- Improved sanitation and hygiene.
- Reduced labour requirement for cleaning.
- Lower disease transmission risk.

Disadvantages

- Foot and leg injuries are common.
- Reduced comfort for resting birds.
- High construction cost.

Welfare Implications

Although sanitation is improved, slatted floors may cause skeletal problems and foot lesions. Limited opportunities for scratching and dust bathing reduce behavioural welfare.

C. Slat-Cum-Litter System

Definition

This system combines slatted flooring with litter flooring. Usually, part of the floor area contains slats while the remaining area is covered with litter.

Features

- Commonly used for breeder flocks.
- Nest boxes are placed in the litter area.
- Combines hygiene with comfort.

Advantages

- Better hygiene compared to deep litter alone.

- Allows some natural behaviour.
- Improved reproductive performance in breeders.

Disadvantages

- Higher construction and maintenance costs.
- Fly breeding may occur if waste management is poor.

Welfare Implications

This system provides balanced welfare conditions because birds have access to both comfortable litter areas and cleaner slatted areas. Proper management is essential for maintaining hygiene and bird comfort.

D. Cage System

Definition

In the cage system, birds are confined in wire mesh cages arranged in rows or tiers.

Features

- Commonly used for commercial egg production.
- Efficient space utilization.
- Easier feeding, watering, and egg collection.

Advantages

- Better egg cleanliness and sanitation.
- Reduced feed wastage.
- Lower labour requirement.

Disadvantages

- Severe restriction of movement.
- Birds cannot perch, forage, nest, or dust bathe.
- Increased skeletal weakness and osteoporosis.
- High levels of stress and frustration.

Welfare Implications

The cage system is considered one of the least welfare-friendly housing systems because it severely restricts natural behaviour and movement. Long-term confinement may lead to behavioural abnormalities, feather pecking, skeletal disorders, and chronic stress.

Major Poultry Welfare Issues Associated with Housing Systems

1. Space Restriction - Insufficient floor space prevents

normal movement and increases stress, aggression, and skeletal weakness.

2. Behavioural Deprivation -

Birds are unable to perform natural activities such as scratching, dust bathing, perching, nesting, and foraging.

3. Feather Pecking and Cannibalism -

Overcrowding and stress may increase aggressive pecking behaviour, causing feather damage and injuries.

4. Bone Health Problems -

Lack of exercise in confined systems leads to osteoporosis, fractures, and poor skeletal development.

5. Stress and Fear -

Poor housing conditions, improper handling, and high stocking density increase stress levels in birds.

6. Poor Air Quality -

Ammonia accumulation due to poor ventilation causes respiratory irritation and reduced productivity.

7. Thermal Stress -



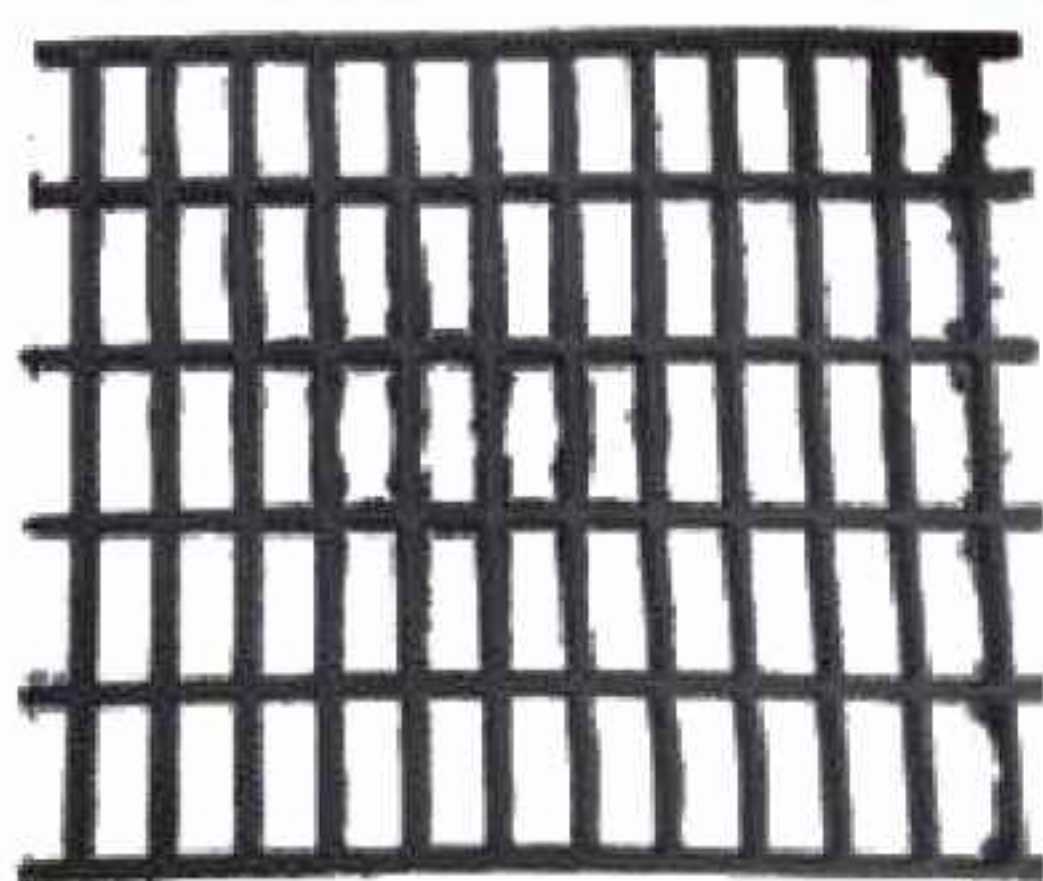


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temperatures negatively affect feed intake, immunity, growth, and egg production.

8. Disease Susceptibility

Poor hygiene and overcrowding increase the spread of infectious diseases and parasites.

9. Social Stress - Competition for feed, water, and space may lead to bullying and social hierarchy problems.

Comparative Evaluation of Housing Systems

Among all housing systems, free-range systems provide the highest degree of behavioural freedom and natural living conditions. Semi-intensive systems also offer relatively good welfare standards while maintaining moderate productivity. Deep litter and slat-cum-litter systems provide balanced conditions when managed properly.

Intensive systems, particularly conventional cages, improve production efficiency and ease of management but often compromise bird welfare. Therefore, modern poultry production is gradually moving towards welfare-friendly

alternatives such as enriched cages, aviary systems, and improved environmental enrichment practices.

Conclusion

Housing systems have a profound impact on poultry welfare, productivity, health, and behaviour. Each system possesses specific advantages and disadvantages depending on management objectives, economic considerations, and production scale. Free-range and semi-intensive systems promote natural behaviour and better welfare, whereas intensive systems maximize productivity and management efficiency.

Among intensive systems, deep litter and slat-cum-litter systems are comparatively more welfare-friendly than conventional cage systems. However, welfare concerns such as overcrowding, behavioural restriction, poor air quality, stress, injuries, and skeletal disorders remain major challenges in commercial poultry production.

Scientific housing management practices, including proper ventilation, adequate space allowance, environmental enrichment, litter management, and disease control, are essential for improving poultry welfare. Sustainable poultry production should aim to achieve a balance between economic profitability and ethical treatment of birds.

Recommendations

1. Adequate floor space should be provided to minimize overcrowding and stress.
2. Environmental enrichment such as perches, nesting boxes, and scratching materials should be introduced.
3. Proper ventilation systems must be maintained to reduce ammonia accumulation and improve air quality.
4. Regular litter management should be practiced to prevent wet litter and disease outbreaks.
5. Welfare-friendly housing systems such as enriched cages and aviary systems should be encouraged.
6. Farmers and poultry workers should receive proper training regarding poultry welfare management.
7. Regular health monitoring and strict biosecurity measures should be implemented.
8. Further research should focus on developing sustainable and welfare-oriented poultry housing systems.

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VIP's 3rd National Symposium Charts Roadmap for a Resilient and Future-Ready Poultry Industry Bengaluru, 11th June 2026

Vets in Poultry (VIP) successfully hosted its 3rd National Symposium 2026 at the Sheraton Grand, Rajajinagar, Bengaluru, bringing together leading poultry industry stakeholders, veterinarians, academicians, researchers, policymakers, entrepreneurs, students, and international delegates to deliberate on the future of India's poultry sector.

Held under the theme **"Future Ready Poultry: Managing Risks, Maximizing Resilience,"** the symposium served as a premier platform for scientific exchange, strategic dialogue, and industry collaboration, focusing on strengthening the resilience, sustainability, and global competitiveness of Indian poultry.

Welcoming the gathering, **Dr. C.B. Pathak, Vice President, VIP**, highlighted the evolution of VIP into a vibrant technical platform committed to advancing

poultry science, veterinary excellence, and industry development. He emphasized the importance of collective action in addressing emerging challenges and unlocking future growth opportunities.

Dr. Santosh Ire, Secretary, VIP, reflected on the organisation's journey as a national technical body dedicated to empowering poultry veterinary professionals through knowledge sharing, continuing education, networking, and scientific advancement.

In his presidential address, **Dr. Ajay Deshpande, President, VIP**, noted that the poultry industry stands at a critical juncture where innovation, risk management, and collaboration will define future success. He stressed that building resilience across the value chain is essential to navigating evolving disease threats, market dynamics, consumer expectations, and technological disruption.











Delivering the keynote address, Prof. (Dr.) K.C. Veeranna, Vice-Chancellor, Karnataka Veterinary, Animal and Fisheries Sciences University, underscored the critical role of education, research, and innovation in shaping the future of the poultry sector. He called for stronger academia-industry partnerships, skill development initiatives, and the adoption of emerging technologies.

Prof. (Dr.) P.K. Shukla, President of the Indian Poultry Science Association, Chairman of FSSAI Scientific Panel-13, and former Joint Commissioner (Poultry), Government of India, delivered a special address emphasizing science-based decision-making, robust biosecurity frameworks, quality assurance systems, and supportive policy interventions to enhance India's global poultry competitiveness.

The symposium's Chief Guest, Mr. Arjun Devaiah Theethamada, CEO of Abhimanyu Academy, South Asian

Games Gold Medallist, and nine-time National Champion, inspired participants by drawing parallels between competitive sports and entrepreneurship. He highlighted resilience, discipline, adaptability, and continuous learning as essential attributes for sustained success in a rapidly changing world.

Promoting Protein Awareness Through Youth Engagement

A key highlight of the event was the successful conclusion of VIP's 1st National Short Video Competition, designed to engage students in promoting protein awareness and scientific communication.

The competition encouraged young participants to advocate for protein security and highlight the nutritional importance of eggs and chicken as affordable, high-quality protein sources while countering misinformation through evidence-based messaging.





The winners were:

- Mr. Kankatav Siddheshwar Dinkar – Rs. 25,000
- Mr. Chilkuri Manish Reddy – Rs. 20,000
- Ms. Kumari Sanjana – Rs. 15,000
- Mr. Ishan Barik – Rs. 15,000

Special Recognition was awarded to Mr. Shiva Holikeri.

Technical Sessions Address Key Industry Priorities

The symposium featured expert-led sessions covering critical areas shaping the future of the poultry industry:

- Future of Indian Poultry – Growth, Markets & Trade by Mr. K.G. Anand, General Manager, Venkateshwara Hatcheries Pvt. Ltd.
- Farm Productivity & Operational Excellence by Dr. Ajay Deshpande, President VIP and Founder & Director, Siddhivinayak Poultry Breeding Farm and Hatcheries, Pvt. Ltd.
- Consumer Perception, Branding & Market Expansion by Mr. Sameer Agarwal, Managing Director, Shalimar Group
- Poultry Health, Biosecurity & One Health by Dr. Gowthaman, Associate Professor, Veterinary College and Research Institute, Salem
- Human Capital & Industry Transformation by Mr. Ashok Kumar, Managing Director, MAA Integrators

The sessions explored emerging opportunities in exports, feed economics, precision farming, branding, disease management, digital transformation, and workforce development.

Industry Leaders Discuss the Path from Survival to Scale

One of the most engaging segments of the symposium was the panel discussion on **“Future Ready Poultry – Survival to Scale,”** moderated by Prof. (Dr.) P.K. Shukla.

The distinguished panel brought together leaders from across the poultry value chain to discuss sustainability, scalability, farmer profitability, exports, innovation, biosecurity, and leadership.

A common theme emerged from the discussion: the future growth of Indian poultry will depend on scientific management, resilient supply chains, technology adoption, farmer empowerment, skilled manpower, and stronger collaboration among industry stakeholders.

Panellists emphasised that while the sector has demonstrated remarkable resilience, the next phase of growth will require data-driven decision-making, sustainable nutrition strategies, improved traceability, enhanced disease surveillance, and greater alignment with global standards.

Panel Discussion – Quotable Quotes

Moderator – Prof. (Dr.) P. K. Shukla

“The future of Indian poultry depends on scientific





management, policy support, biosecurity excellence and strong industry-academia collaboration. Sustainability and scalability must progress together."

Mr. O. P. Singh "Technology adoption and operational efficiency are no longer optional but essential for sustainable poultry growth. Integrators must focus on innovation-driven productivity."

Mr. Valsan Parameswaran "India has immense potential to emerge as a significant poultry exporter. Quality standards, traceability and global market preparedness will be key drivers of future success."

Dr. Vishal Singh Rawat "The next phase of poultry development will be led by data-driven decision making, precision farming and smart production systems that improve profitability and resilience."

Mr. T. Srinithi "Feed accounts for the largest share of production costs. Sustainable nutrition strategies and supply chain stability will play a crucial role in protecting industry margins."

Dr. Mahesh P.S. "Strong regulatory support, disease surveillance and coordinated stakeholder efforts are essential to safeguard poultry growth and farmer confidence."

Ranpal Dhanda "Farmer sustainability must remain at the center of industry growth. A resilient poultry sector can only be built when farmers are empowered with

knowledge, technology and fair returns."

Mr. Divya Kumar Gulati "Feed quality and innovation will continue to shape poultry performance. The industry must focus on efficiency, sustainability and responsible resource utilization."

Mr. Uday Singh Bayas "Industry associations have a vital role in uniting stakeholders and addressing common challenges. Collective action is necessary for long-term sectoral progress."

Dr. Jeetendra Varma "Global poultry trends indicate increasing emphasis on animal welfare, biosecurity and sustainability. India must align with global best practices while maintaining competitiveness."

Dr. Meganathan "Regional poultry sectors offer immense growth opportunities. Strengthening grassroots veterinary support and farmer education will accelerate inclusive development."

Dr. Damodar Pattath "Health management remains the foundation of poultry success. Prevention through biosecurity and proactive disease monitoring is always more effective than treatment."

Dr. Swati Karki "Consumer expectations are evolving rapidly. Innovation, transparency and science-based communication will define the future relationship between producers and consumers."

Mr. Naveen Pasupathy "Entrepreneurship and value-





chain integration will create the next generation of poultry leaders. Agility and innovation will be critical for scaling businesses successfully."

Concluding Session Summarising the key take aways, Prof. (Dr.) Ajit Ranade, Advisor, VIP, emphasised the importance of translating insights into actionable outcomes and commended the industry's readiness to embrace innovation and tackle future challenges collectively.

The symposium concluded with a vote of thanks by Major (Dr.) Vinod Kumar, who acknowledged the contributions of speakers, delegates, sponsors, exhibitors, media partners, industry associations, academic institutions, and the VIP organizing team.

Looking Ahead

The 3rd National Symposium reaffirmed the poultry sector's commitment to scientific excellence,

innovation, and collaboration. The event concluded with a shared vision of building a resilient, sustainable, and globally competitive poultry industry capable of meeting future challenges while capitalising on emerging opportunities.

About Vets in Poultry

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For more information on this press release, please contact Dr. Santosh Ire (+91 9850979652, vetsinpoultry@gmail.com)

Vets in Poultry (VIP)

Connecting Knowledge Strengthening Poultry Building the Future





France Based IDENA's Complex Phytogenic Animal Nutrition Products Through Feed Development has led to Higher Productivity and Better Animal Health - *Ricky Thaper*

Improving livestock health has been recognized by producers as an important sustainability effort which improves efficiency and reduces productivity losses in the animal husbandry sector. The roadmap recognized the importance of livestock to 1.7 billion farmers worldwide and offered proven pathways for addressing its climate footprint including better genetics, feed, and animal health. Keeping this vision in mind, several companies have been working towards boosting animal health and productivity through development of innovative products keeping into consideration the unique needs of countries across the world. Since its creation in 1995, France based global major in animal nutrition IDENA group has developed products keeping into account the nutritional needs of poultry, dairy, and piggery. **The key focus of the IDENA is to introduce innovative additives and pre-mixes which boost the poultry and livestock feed and increase performances of poultry and livestock in the farms.**

Photo-1

At IDENA, head-quartered in SAUTRON, Pays de la

Loire, France, there are experts who are passionate about developing products which promote animal growth and welfare. IDENA's technical and sales teams, often in the field, offers tailor-made advice to improve the formulation of products and optimise their effectiveness depending on the needs of the customer.

Photo-2

IDENA has also developed a complete range of nutritional specialties to improve the feed efficiency of animals fed in organic farming systems and these products are all approved by official organic farming certification bodies. IDENA has a range of poultry products, among them; **IDAFIX+** (a large spectrum powerful mycotoxin binder), **FORCIX PY** (Prevention of the risk associated with Eimeria together with Necrotic Enteritis), **FORKEY LS** (Prevention of the risk associated with Histomonas in Turkeys), **EVOPERF** (Digestive comfort and performance), **PONTIPLUS** (Supporting hen productivity and longevity by maintaining laying rate and improving egg quality and breeders' eggs hatchability). All these poultry products are based on the results of extensive





scientific research, particularly into the action of plant extracts and essential oils. The issues studied relate mainly to make better use of the nutrients supplied and managing the risks of parasites and bacteria amongst the poultry birds. In poultry, IDENA focus is on gut health, mineral balance, feed efficiency, and resilience of birds under commercial conditions. IDENA solutions combine R&D, field validation, and practical formulation expertise to ensure both technical efficiency and economic viability.

Photo-3 and Photo-4

The 2000s saw the internationalisation of the



Group's activities. The company offers its services to hundreds of customers, both feed manufacturers and players in the animal sector, spread across France to more than 60 countries spanning five continents. It has succeeded in establishing its fundamentals and convictions in the animal nutrition market, developing them and continuing to build on them. **110 people are currently cooperating at IDENA, with Mr. Renaud Domitile as CEO and Mr. Massoud Aoun as General**

Manager. The commercial team is led by Mr. Franck Vaillant, Commercial Director, with 6 Regional Export Managers to cover the 5 continents. Team of experts from the group also carry out on-farm audits to better adapt the formulation and use of additives to the context of each livestock farm. Six people are offering technical support for poultry: Mrs. Anne MAHIEU, Nutritionist-Head of Poultry Department, Dr. Jean-Marie WATIER- Vet Poultry Specialist, Ms. Amandine CANIN-Poultry Nutritionist Engineer, Mr. Khalil AOUAD, Poultry Nutritionist Engineer, and Mr. Bohdan BODNAR, Poultry Nutritionist



Engineer, and also Mr. Renaud Domitile, CEO which is recognized worldwide for his nutrition expertise. **The company's annual revenue was around Euros 50 million in 2025.**

The mission of the IDENA company is to market natural alternatives to conventional additives in order to reduce the use of antibiotics and preserve their effectiveness (antibiotic resistance). These alternatives are made up of phytogenic, bioactive and active ingredients derived from lactic

fermentations through IDENA's sister company STI BIOTECHNOLOGIE which has developed a unique range of Postbiotics. Following a specific inactivation process, STI Biotechnologie manufactures, among other products, a postbiotic solution, available in powder and liquid form. **METALAC promotes digestive comfort, enhances animal welfare, and improves the animals' immune status.** The company has numerous scientific publications: This research is continuing with a postdoctoral fellowship in collaboration with the University of Rennes, supervised by Monogastric Product Manager Maeva JEGOU. Under the leadership of Director Christophe TANGUY, the Asia-Middle East region is

managed by David CHEREL, based in China.

Photo-5 and Photo-6

With the future collaboration with Distributors in India, IDENA group has great plans to expand its presence in India, which has the world's biggest livestock population said Mr. Renaud Domitile, CEO. The India poultry market is driven by strong demand for affordable animal protein and rapid industry structuring. However, it remains a highly competitive and price-sensitive market, where solutions must combine technical performance with clear economic return added Mr. Khalil AOUAD, Poultry Nutritionist Engineer.

Photo-7

Mr. Franck Vaillant, Commercial Director said



through IDENA product innovation, India's poultry and livestock sector will be immensely benefited to better feed and increase in productivity because of improvement in animal health. IDENA's strength compared to most of its competitors lies not only in the fact that the company offers a range of innovative phytogenic products designed to improve feed efficiency and livestock performance, but that this offering is backed by extensive expertise in animal nutrition, feed formulation and livestock management, which IDENA's teams make available to their partner clients. **For further information about IDENA poultry, dairy and piggery products, kindly visit IDENA Website: <http://www.idena.fr/>**



INFAH National Seminar Charts a New Blueprint for India's Animal Health and Nutrition



Policymakers and Industry Leaders Convene in New Delhi to Drive Regulatory Harmony, Innovation, and Manufacturing Leadership

NEW DELHI — June 12, 2026 — The Indian Federation of Animal Health Companies (INFAH) successfully hosted its landmark National Seminar today at the India Habitat Centre, New Delhi.

Anchored in the theme **"Reimagining Animal Health & Nutrition in India: Driving Ease of Doing Business, Innovation & Leadership,"** the seminar brought together a gathering of

animal healthcare and livestock ecosystem.

The seminar underscored INFAH's core mission, *"Healthy Animals, Healthier India,"* demonstrating the critical link between high-standard veterinary healthcare, rural farmer prosperity, national food safety, and public health. Key discussions focused on advancing ease of doing business through modern regulatory frameworks, collaborative governance, and scalable technological innovation.

Fostering Regulatory Vision & Ease of Doing Business



policymakers, leading veterinary scientists, corporate leaders, and academic stalwarts to map out a resilient growth trajectory for the country's

The technical programme was opened by Dr. Vinayak Surve, Joint Secretary, INFAH, reaffirming INFAH's guiding mission: "Healthy Animals, Healthier India." This was followed by a welcome



address by Dr. Manoj Sood, General Secretary and a national perspective presentation by Mr. Vijay Teng, President, INFAH. Mr. Teng outlined the sector's macroeconomic contributions and set strategic benchmarks for the sector's growth.

Delivering the keynote on the regulatory roadmap, Dr. Praveen Malik, CEO of Agrinnovate India and former Animal







Husbandry Commissioner (Govt. of India), highlighted the need for a seamless government-industry partnership. Dr. Malik detailed how proactive and transparent governance is turning administrative ease into commercial reality, enabling rapid market launches for vital veterinary therapeutics.

Addressing National Priorities: Disease Mitigation and Food Security

Emphasizing systemic public health resilience, Dr. J.P.S. Gill, Vice Chancellor of GADVASU, delivered a

keynote on national disease mitigation. Dr. Gill outlined actionable approaches to reduce the livestock disease burden and championed a comprehensive 'One Health' framework to counter antimicrobial resistance (AMR) and zoonotic vulnerabilities.

A major highlight was the felicitation of Dr. Naveena B. Maheswarappa, Animal Husbandry Commissioner at DAHD, following his election as Chairperson of the FAO COAG Subcommittee on Livestock. In his address, *"India's Opportunity*



through Reform & Innovation," Dr. Naveena presented a roadmap demonstrating how the animal health industry serves as an engine for GDP growth and *Atmanirbhar Bharat*.

Dr. Raghvendra Bhatta, Deputy Director General (Animal Sciences) at ICAR, presented animal nutrition as a strategic national priority, outlining how optimized livestock health and nutrition

publication highlights that while India's livestock sector's steady annual growth rate is over 5%, prevalent infectious diseases remain a critical productivity challenge. In 2025, total antibiotic consumption reached 1,075 tons, reflecting a 5.7% growth over 2024's 1,017 tons. Fluoroquinolones were found to be the country's most utilized antimicrobial class. Overall annual industry usage



enhances productivity, secures consumer food safety, and directly elevates smallholder farmer incomes across rural India.

Publications Launch and Multi-Sectoral Policy Dialogues

During the event, Dr. Arun Atrey and Dr. Nitin Bhatia, alongside senior dignitaries, officially released INFAH's comprehensive report on Indian animal healthcare antibiotic usage in 2025.

Distributed as part of official delegate kits, the

has grown at a stable five-year CAGR of 2.8%. This full report is available for download from the official INFAH website.

Following a global macro-perspective virtual address by Carel du Marchie Sarvaas, Executive Director of HealthForAnimals, the seminar moved into four technical policy panel sessions:

Policy Session 1: Regulatory Framework for Animal Health Drugs and Biologicals – Chaired by Dr. Naveena B. Maheswarappa and co-chaired by





Dr. Arun Atrey, with panellists Dr. Rubina Bose, Dr. Aruna Sharma, Dr. P. Dhar, Dr. M. Kalaivani, Dr. Vijay Makhija, and Dr. Sanjay Gavkare. The session examined science-based regulatory alignment with CDSCO, DAHD, IVRI, and IPC for fast-tracked, compliant approvals.

Policy Session 2: Animal Health and Nutrition as a National Priority – Chaired by Dr. Ashis Kumar Samanta (ADG, ICAR) and co-chaired by Mr. Deepak Khosla, with panellists Dr. N.K. Mahajan, Dr. Gagan

Garg, Dr. Hundal, Mr. Pradeep Sharma, Mr. Arun Sharma, and Dr. Raja Mukherjee. Discussions centred on BIS standards and enhanced livestock nutrition.

Policy Session 3: From Reform to Leadership – Chaired by Dr. Praveen Malik and co-chaired by Dr. Yash Goyal, with panellists Dr. Sindura Ganapathi, Dr. Annie Jacob, Ms. Pushpa Vijayaraghavan, Mr. Gaurav Marathe, and Mr. Rajaram Narayanan. The session built an industrial blueprint to accelerate





infrastructure development and high-value domestic manufacturing under 'Make in India'.

Policy Session 4: Innovation and Focus on Ayurveda and Phytogenics – Chaired by Dr. Ashok

Kumar (Former ADG (AH), ICAR) and co-chaired by Dr. Anup Kalra, with panellists Dr. Raman Singh, Dr. Hari Kumar, Dr. Shivi Maini, and Dr. Divya Divakaran. The session pioneered integration of traditional





Indian scientific knowledge with modern validation methods for global export excellence.

The seminar culminated in a Valedictory Session and a Vote of Thanks delivered by Dr. Nitin Bhatia, who acknowledged the collective commitment of government ministries, academic institutions, and private organizations in advancing veterinary standards across India.

About INFAH

The Indian Federation of Animal Health Companies (INFAH) is the apex industry body representing the

animal health, therapeutics, and biologicals sector in India. Dedicated to its mission of *"Healthy Animals, Healthier India,"* INFAH bridges government bodies, research institutes, regulatory authorities, and industry to advance world-class veterinary care, ease of doing business, and science-based nutrition.

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EGG DAILY AND MONTHLY PRICES OF JUNE 2026



Name Of Zone / Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	Average
NECC SUGGESTED EGG PRICES																															
Ahmedabad	575	575	575	575	575	575	580	580	580	585	590	595	610	620	620	620	620	620	630	640	640	640	640	645	655	660	660	670	675	675	616.67
Ajmer	515	515	520	525	535	545	548	548	551	555	559	565	585	601	605	595	590	595	600	600	595	580	590	620	620	620	620	625	630	635	579.57
Barwala	518	518	518	518	525	531	534	534	542	546	549	559	575	597	602	602	602	602	602	602	602	602	602	602	610	614	614	614	614	614	575.47
Bengaluru (CC)	620	620	620	620	620	625	625	630	630	635	640	650	665	680	690	695	700	705	705	705	705	705	705	705	705	705	710	710	710	710	671.67
Brahmapur (OD)	570	570	570	560	570	580	585	590	590	600	605	615	630	636	640	640	640	640	645	645	650	650	650	650	660	660	665	665	665	665	623.37
Chennai (CC)	635	635	635	635	635	640	640	645	645	650	655	670	680	690	700	705	710	715	715	715	715	715	715	715	715	715	720	720	720	720	684.00
Chittoor	628	628	628	628	628	633	633	638	638	643	648	663	673	683	693	698	703	708	708	708	708	708	708	708	708	708	713	713	713	713	677.00
Delhi (CC)	545	545	545	545	555	555	555	555	565	570	570	585	601	620	620	620	620	620	620	625	625	625	625	625	640	640	640	640	640	640	599.20
E.Godavari	545	545	545	535	540	545	550	555	560	565	570	580	595	610	620	625	625	625	625	625	625	625	625	625	630	635	640	640	640	640	597.00
Hospet	560	560	560	560	560	565	565	570	570	575	580	590	605	620	630	635	640	645	645	645	645	645	645	645	645	645	650	650	650	650	611.67
Hyderabad	555	555	555	555	555	555	560	565	570	575	580	590	600	610	620	625	630	635	635	635	635	635	635	635	635	640	645	650	650	650	605.67
Jabalpur	560	560	560	560	565	575	575	575	575	585	585	595	610	620	630	630	630	630	630	640	640	640	640	645	645	655	655	660	660	660	613.00
Kolkata (WB)	620	620	610	610	620	625	630	635	640	645	650	665	680	685	695	700	700	700	700	700	700	700	700	700	705	710	715	715	715	715	673.50
Ludhiana	519	519	519	519	519	532	534	534	534	546	546	551	565	595	598	598	598	598	598	600	600	600	600	600	602	616	616	616	616	616	573.47
Mumbai (CC)	620	620	620	620	620	620	625	630	635	640	645	650	660	670	680	690	700	705	710	710	710	710	710	710	710	710	715	720	720	720	673.50
Mysuru	630	630	630	630	630	635	635	640	640	645	650	660	685	700	710	712	714	720	720	720	720	720	720	720	720	720	725	725	725	725	685.20
Namakkal	570	570	570	570	570	575	575	580	580	585	590	600	610	620	630	635	640	645	645	645	645	645	645	645	645	650	650	650	650	650	615.83
Pune	620	620	620	620	620	620	625	630	635	640	645	650	660	670	680	690	695	700	705	705	705	705	705	705	710	715	720	725	725	725	673.00
Raipur	555	555	555	555	555	555	560	565	570	575	580	590	610	610	640	640	640	640	640	640	640	640	640	640	640	640	650	650	650	650	608.67
Surat	595	600	600	600	600	600	605	605	605	610	610	615	625	635	645	650	650	655	660	665	665	665	665	665	675	680	690	700	700	700	641.17
Vijayawada	580	580	580	570	570	585	600	600	600	600	610	620	650	650	660	660	665	670	675	675	675	675	675	675	675	675	680	680	680	680	639.00
Vizag	545	545	545	535	540	545	550	555	560	565	570	585	600	615	625	630	630	630	630	635	635	635	635	635	635	635	640	640	640	640	600.17
W.Godavari	545	545	545	535	540	545	550	555	560	565	570	580	595	610	620	625	625	625	625	625	625	625	625	625	630	635	640	640	640	640	597.00
Warangal	557	557	557	557	557	557	562	567	572	577	582	592	602	612	622	627	632	637	637	637	637	637	637	637	637	642	647	652	652	652	607.67
Prevailing Prices																															
Allahabad (CC)	571	571	576	576	581	586	586	586	590	600	600	605	624	643	643	648	648	648	648	657	657	657	652	652	667	671	671	671	671	671	627.57
Bhopal	555	555	555	540	550	560	560	565	570	580	585	590	600	610	630	630	615	630	630	630	630	630	630	640	650	660	660	660	660	660	607.33
Indore (CC)	540	540	540	550	560	570	570	570	575	580	581	590	610	625	630	620	615	615	625	625	625	610	625	650	650	650	650	660	660	660	605.70
Kanpur (CC)	548	548	557	557	567	567	567	567	567	576	576	590	600	614	614	614	614	614	614	624	624	624	624	624	638	638	638	638	638	638	600.63
Luknow (CC)	557	563	563	563	567	567	567	567	567	576	576	583	583	605	617	623	623	633	633	633	633	633	633	633	650	657	657	657	657	657	611.57
Muzaffarpur (CC)	580	580	580	580	585	590	595	595	600	605	610	620	640	655	660	660	660	660	660	660	660	660	660	650	650	655	670	675	675	675	634.50
Nagpur	600	600	600	590	580	580	605	605	620	625	625	625	640	650	650	665	675	675	675	660	660	675	650	650	660	670	670	695	695	700	642.33
Patna	580	580	580	580	585	590	595	595	600	605	610	620	640	655	660	660	660	660	660	660	660	660	660	650	650	655	670	675	675	675	634.50
Ranchi (CC)	595	595	595	590	590	600	600	609	609	609	610	629	652	652	657	657	657	657	657	657	657	657	657	657	676	676	676	676	676	676	638.70
Varanasi (CC)	570	570	570	570	573	583	583	583	583	593	593	593	610	627	633	640	640	640	640	640	650	650	643	643	650	660	667	667	667	667	620.83

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