

Mitigating managerial risks in poultry farms by securing the biosecurity

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Biosecurity is a strategic and integrated approach for analyzing and managing relevant risks to human and animal life and associated risks to the environment. Biosecurity yet seems to be simple but complex phenomena. Bio-exclusion (to preclude the introduction of disease into the farm) and Bio-containment (to stop the spread of disease within the farm) are the two main targets of biosecurity. Cleaning and disinfection in combination pave for effective decontamination and are the key components in routine biosecurity in poultry farming. Decontamination kills or reduces bacteria, virus, parasite, and molds. Vaccination, drinking water sanitation and implementation of biosecurity protocols is the key to the success of any poultry farming. Consistency in following biosecurity rules throughout the year (i.e. production cycle) is very important. Biosecurity program implementation comes at a little cost when compared to the costs associated with a disease outbreak. Biosecurity is a necessary expense and can make a difference between success and failure in a poultry operation. An effective biosecurity program gives vital support to poultry health programs while reducing the need to use antibiotics to a minimum simultaneously. Auditing and periodic modifications of biosecurity protocols are the most mandatory issues.

Key words: Biosecurity, Emergency disease control, Poultry farms

BIOSECURITY is the efficient use of common sense hygiene procedures in preventing the adverse effects of a disease. The efficient biosecurity system always comprises of two parts i.e. internal biosecurity and external. External is about controlling traffic and prevention of introduction of disease into the farm and it accounts for 70%. While water sanitation, shed disinfection, shed distance, internal moments, carcass and waste disposal mark the internal biosecurity measures and this is mainly to prevent the spread of pathogen within the farm. Another aspect of biosecurity is that animal health management that minimizes the incidence of disease spread for the public health and food safety. Every farm operates on two levels of biosecurity: Level 1- routine protocols being implemented on daily basis, and Level 2- high-risk biosecurity protocols in the event of outbreaks.

Possible sources of infection

- The introduction of equipment from another farm
- Feed and chick delivery vehicles, and vehicles for lifting of farm birds
- Improper disposal of used litter
- Visitors, interchanging of farm personnel within the farm, veterinarians, company personnel
- Improper litter, manure and carcass disposal
- Backyard poultry, wild birds, rodents and other wild activity
- Opened water sources nearby farms
- Replacement of birds
- The introduction of chicks from contaminated hatcheries
- Contaminated vaccines, and
- Contaminated feed and water

Understanding the potential sources of infection in a farm is essential to deploy its curtailing measures. Accordingly, operations should focus on establishing three disease barriers on their farm:

Physical barrier- keeping disease

and its vectors from making contact with the animals. All these operations must aim to minimize the risk of introduction of disease or contaminants by contractors, suppliers, visitors, company and health care personnel, personal

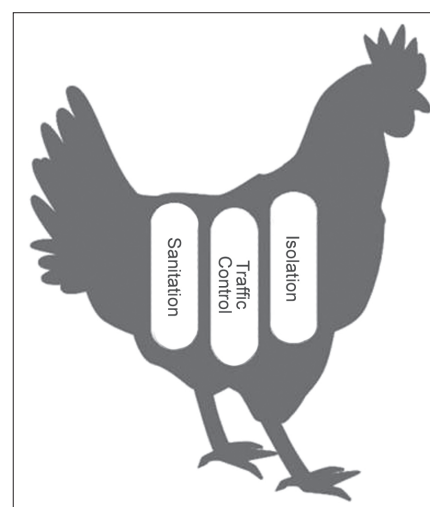


Fig. 1. Three biosecurity pills for a poultry farm.

movements, rodents, and vermin.

Chemical barrier- killing the disease whenever possible by way of sanitation,

Logical barrier- ensuring farmers establish the correct management processes to minimize disease risk.

Emergency disease control (EDC)

In the event of an outbreak of an emergency disease or serious endemic disease, high-risk biosecurity procedures should be implemented. To prepare for a local outbreak of an emergency disease, such OIE Listed notifiable disease, production units should to be prepared before. Senior poultry veterinarians, poultry research institutes, and state veterinary universities can be consulted to develop the conceptual framework for unforeseen disease conditions. Upon suspicion of an infectious disease, especially HPAI, in a poultry flock, a set of guidelines that are to be enacted by producer must be set in order to limit the spread of disease between barns and, most importantly, the spread of disease off the farm to other poultry operations.

Farm biosecurity standards

- The farm should be located at least 2 km away from neighboring poultry farm and 1 km away from the main road in a well-drained area. Low lying and water logging areas and areas inhabiting mountains or hills must be avoided.
- All the building structures must be constructed in a rodent proof mode right from the basement.
- Fencing of farm perimeter with at least 15 feet height to prevent illegal entry into the farm.
- Farms must be accompanied with 2 main gates to have dedicated entry for vehicles and personnel.
- Vehicle parking area must be at least 100 feet away from poultry houses.
- Dip vats or vehicle dips at the farm entrance of at least 10 feet length so as to allow the complete rotation of vehicle tyre in that and gets contact with the disinfectant. Preferably high pressure sprays equipped with disinfectants will

Table 1. Some important factors to consider in designing a biosecurity program

Farm location, Farm design Houses	Backyard poultry, Timely vaccination,
Equipment and vehicle cleaning Repairs and maintenance of facility Traffic control (people, vehicles) Cleaning and disinfecting products Alert signs Water quality and sanitation Nature of disease agents	Proper dress code for farm personnel, All-in All-out system, Down time, Medication with supportive and antibiotics (at preventative dose rate), Mechanisms of disease transmission, Health status of flock & bird immune system competence Shower Mortalities/culls disposal
Sign-in/sign-out log book, Feed quality and sanitation, Sanitation of feeding and watering systems, Wild birds/rodents/pet animal Litter management	Mixed types of fowl and Monitoring programs

Source: Adapted from Butcher and Yegani, 2008

avoid the chance of their exposure to sun light and increases the efficacy of disinfectant.

- Foot dips at the entrance of each bird shed and related buildings in necessary which should be atleast 1.5 feet and depth of 0.3 feet to allow boots or shoes to be dipped in the foot bath.
- Disposal or compost pit must be located not less than 100 m near to farm premises.
- Vegetation buffers for environmental compliance should not be compromised. At least 3m wider area must be kept free off from debris.
- All weather roads to allow seepage of rain water and to prevent spreading of microbes by vehicles and footwear.
- For breeder farms, hatchery facility must be at least 500 m away from themain farm in an isolated facility.
- Feed mill and feed bag storage must be constructed away from bird houses and not less than 100 m and 100 feet respectively to avoid intrusion of rodents.
- Sheds bearing similar age groups must ideally be separated for at least 15 m to allow proper ventilation and avoid disease transmission.
- Young and adult sheds must be demarcated with a boundary of 50-100 m distance to avoid possible disease transmission from adult to young.

Personnel biosecurity standards

- Personnel working in the farm must not rear any backyard, pet, and other commercial birds and also not be a part-time employee in other poultry farms.

- Rides to and from work should be limited to employees working on the same farm.
- Visits to sheds are in the flow of younger to adult stocks and not vice versa.
- A working dress code comprising of themask, head cap, gum boots and apron for persons linked to the farm would be beneficial.
- For and ideal rodent control in place, regular rodenticides must be placed in and around the sheds. Rodenticides must be changed periodically. Zinc phosphide is generally being more commonly available, 10 g of zinc phosphide is mixed with 150 g of commercial poultry feed mash accompanied with 2-3 raw beaten eggs to attract the rodents to consume more is sufficient per hectare of area.

Operational standards

Biosecurity involves each and every farm practice right from feeding to carcass disposal that ultimately targets to prevent or reduce the disease burden on the farm and in brief as follows:

- Operational Biosecurity starts right from the intelligence of procuring mycoplasma and Salmonella free chicks from a certified hatcheries.
- The majority of broiler production systems follow built up litter protocols where the litter already used for theprevious flock will be used for subsequent rounds (say around 10), therefore the house will get a real cleaning and disinfection only after several batches. Even though the all-in-out system, elimination of mycoplasma and infectious bursal disease virus are

difficult because once contaminated these organisms become established in the production facilities and able to infect continuously the incoming healthy batches.

- Dead bird disposal is the most neglected protocol that is currently being practiced across small and medium sized farms where no proper measures are involved. Even in the absence of appropriate disposal pits, carcasses can be sprayed evenly with disinfectant then lime and packed in a tight disposal bags and proceed for disposal at least 500 m away from the flock. Incineration is the most appropriate form; recently solar based incinerators of various capacities have been developed.
- Poultry house sanitation plays a crucial role in the control and prevention of pathogenic infectious diseases. A good sanitation program can benefit the grower by optimizing bird performance while lowering the incidence of contaminated flocks. Any number of best management practices, treatments, or disinfectants can

comprise a sanitation program. However, if used improperly, sanitation procedures can adversely affect disease prevention, thus, lowering bird.

- **Ensuring quality water for healthy poultry:** Continuous access to the sanitized drinking water is essential to minimize the impact of a disease outbreak on a farm. For water systems equipped with pipelines, periodic use of descaling agents can improve water quality. Sanitizers must also be changed periodically to increase the efficiency. Acidified copper sulfate, citric acid, sodium bisulphite and 5-10% acetic acid (vinegar) also improves feed efficiency and gut health in commercial broilers on daily use. Also checks the growth of fungi, yeast and aerobic bacteria in the water. Potassium monopersulphate based disinfectants (triple salt) cum water sanitizers are beneficial. Besides oral administration, when applied as a spray, it minimizes the virus concentrations in the immediate microenvironment in the shed. These are extremely useful in the

event of avian influenza (LPAI, HPAI), IBD, ND, ILT etc. The dose for spray is almost twice that of drinking water and can be increased accordingly depending on disease situation.

Biofilm presence on the farm is the most hurdle task for the implementation of biosecurity. Biofilm is a combination of microorganisms, polysaccharides, mineral and metals. Microorganisms contain bacteria, viruses, fungi, and yeast. Medication and vaccination can be less efficient with biofilm and therefore its absence must be ensured before providing them through water. Using antibiotics in a combination of biofilm, fungi become predominant and cause mycotoxicosis in poultry. Chlorine is ineffective in cleaning biofilm and oxidation with peroxides or mechanical destroying is essential. Triple salt sanitizers at thrice the recommended dose rate for drinking must be used to mitigate biofilm in pipelines.

Efficient use of disinfectants: Careful selection of effective disinfectant decides the success of operational biosecurity protocols. Effectiveness at a range of temperatures in realistic farming conditions must be thought off before using a disinfectant. Farmers must be confident that their selected disinfectants will remain active in high and low temperatures. Some disinfectants lose significant activity in winter conditions – especially aldehydes, such as formaldehyde. Disinfectants are used mainly at entry points (dipvats/wheel dips and footbaths) to avoid entry of infection. The majority of Indian poultry farms have these structures in a well-designed manner making the disinfectants exposed to the environment. Excessive sunlight and temperature could make these disinfectants losing their activity. Installation of disinfectant spray systems even though costly will yield beneficial results. On another hand, excessive heat accelerates the decomposition of hypochlorite disinfectants. Under modern farm conditions, expecting higher disinfectant efficacy is an ambitious project because organic matter such

Table 2. Guide for suitable usage of disinfectant during specific disease condition

Disease	Appropriate Disinfectant of choice
Coccidiosis	Sodium hydroxide and ammonium salts
Aspergillosis	Phenols, *Enilconazole spray (1.5 g/10 so. feet), *Copper sulfate (1:2000)
Candidiasis	1% Sodium hydroxide, 5% solution of Iodine*
Chlamydiosis	3% Hydrogen peroxide* (lime should not be used)
<i>Staphylococcus</i> infections	More than 7.5% Sodium chloride solution spray
Clostridial infection	Formalin (reduces number but not completely eliminate infection)
Mycoplasmosis	Phenol, Formalin and Beta proiolactone. However, regular cleaning and disinfection is recommended.
Infectious coryza	0.25% Formalin
Ornithobacterium infection	20% Glutaraldehyde based solution, 1% Sodium chloride, 0.1% Benzalkonium chloride solution.
<i>E. coli</i> infection	8.5% Sodium chloride* solution prevents growth
Pullorum disease	1:1000 Phenol, 1% Potassium permanganate, 2% Formalin
Lymphoid leucosis	Sodium dodecyl sulphate, ethyl ether detergents
Marek's disease	Complete dust reduction and disinfection with multi combinations.
Avian encephalomyelitis	Formaldehyde fumigation, Betapropiolactone
Egg drop syndrome	1% Phenol, 1:1000 Formalin, 0.5% Glutaraldehyde solution
Chicken infectious anaemia	Higher concentrations of iodine and hypochlorite disinfectants
Infectious bursal disease, Ranikhet disease, Avian Influenza, Infectious bronchitis and Infectious Laryngotracheitis	Higher concentrations of *triple salt containing Potassium monopersulphate, Hydrogen sulphate, Potassium sulphate

*Can be used in presence of birds also

as soil, manure, blood etc. reduces its effect and protects organisms too. Nowadays chlorine and citric acid-based disinfectants are becoming less effective and that needs to be replaced with commercial ones containing multiple combinations.

Periodic change of disinfectants is utmost important because they may evoke resistance on surface bacteria including biofilm. For example adaptation, to didecyl, dimethyl ammonium chloride (DDAC) increased the minimum inhibitory concentrations (MIC) of antibiotics in *E. coli* and *Salmonella* bacterial strains.

- **Ensuring the stress-free:** Stress and its impact on triggering subclinical diseases always go unnoticed and too often underestimated. Freedom from hunger, thirst, space congestion merged with minimal handling and gradual introduction of light will ensure a stress-free environment in early chick's life thereby having a better startup.
- **Achieving maternal eternity in the newly hatched chick:** The strategies to assist the development of the immune system and in consequence, the development of the ideal immune response is fundamental to guarantee the control of diseases in the field with a lowest metabolic cost which will reflect in better productivity. Vaccination is the best way of obtaining prompt high and homogenous levels of maternally-derived antibodies (MDA). The higher and more uniform the MDA level, the longer the protection in the progeny. In broilers, the rapid development of immune systems is critical. Breeder vaccination decides the immune success of its progeny. A breeder without vaccination also passes some of the maternal antibodies but of low concentration. Killed vaccines bring the desired titer in the hen and subsequently in the chick. Exposure to immune enhancers in the initial days especially during vaccination may help to develop solid immunity. The combination of vitamins, minerals, and amino acids should be the choice. In the event

of any outbreak of unknown cause, judicious use of immune-stimulants will reduce the mortality, however, during LPAI infections their usage must be restricted to avoid further mortality due to *cytokine storm* in chicken.

- **Mitigating antimicrobial resistance:** Antimicrobial resistance was started as an emerging risk in poultry and story still continues even after several years. Global antimicrobial consumption in livestock including poultry per 10 Km² is estimated to be 7-8 mg in India. Curbing Antibiotic use in real field conditions does not seem to be practical always because of high infection pressure in broiler and layer farms. However, antibiotic use and days can be reduced by supplementing them with probiotics and immune stimulants. Strategies minimizing the antibiotic reductions in the farm must be aimed at i) Good farming management and hygiene practices, ii) Targeting only affected birds for therapeutic purpose, iii) Adequate and nutrition and gut health. Use of competitive exclusion products, probiotics and prebiotics and essential oils which can also reduce the risk of infection in the farms. Despite several herbal alternatives proved to have antibacterial effects, considering the infectious pressure and bird's susceptibility complete replacement of antibiotics is questionable. However, complementing herbals with antibiotics for the therapeutic purpose would reduce the antibiotic dose thereby solving the issues to some extent. It is observed that biosecurity protocols reduced the antibiotic use and antibiotic treatment days have declined by 29%.
- **Establishment of proper gut health:** Optimizing gut health must be the prime most focus in poultry (broilers especially) to avoid future disease risk. Lessening the time gap between the hatch and first exposure to feed in chick life is essential for the development of intestinal tract and so better able to resist any disease challenges in later life. Monitoring and evaluation of

intestinal integrity index (I2). The generated I2 score reflects the daily weight gain, FE and allows any changes in poultry health protocols. Integrating organic acids with pre and probiotics will help to reduce the gut thickness, establishing and stabilizing normal microbiota would increase gut absorptive and digestive functionalities. Short chain fatty acids (SCFA's) as preservatives in feed prevents spoilage by molds and mycotoxins, reduces the enteropathogenic bacterial load in feed, as an acidifier supports gastric HCl production, increase feed retention time in the proven trichlorus, optimize digestive function and supports lactic acid bacteria and competitive exclusion in the gut.

- **Vaccines and vaccination:** Vaccination is the last line of defense while eliminating the source of infection and cutting off the routes of transmission are the first line and second line respectively which are associated with biosecurity. Therefore vaccination must always be complemented with biosecurity measures. The choice of vaccine to be administered depends on the type of bird being vaccinated, history of breeder's vaccination and infection pressure in the farm. Protocols vary from region to region as per the endemic situation of a particular disease. The unwanted introduction of new vaccination protocol may incur additional cost and chance of increasing the likelihood of infection in future. Optimization of vaccination, medication and disinfection protocols may reduce the cost of production almost by ₹ 40/bird.

In ND risk areas, modified vaccination protocols are being used where ND killed vaccine is administered on day old or within 3 days post hatch apart from living vaccination. It is expected to stabilize the long lasting immunity in broilers till marketing age.

Of various live vaccines administered, water vaccination is most commonly employed in field situations because this provides less

chance for handling birds thereby stress in layers. In broilers, individual vaccination of chick through ocular or nasal route is also being practiced in several pockets of the country. Protection of virus particles from heat, ultraviolet rays, chlorine, sanitizers, organic matter, and moisture is extremely important. Treatment with skim milk powder before vaccination is aged and common practice till now. Skim milk powder of ten forms clumps in the water and therefore must be mixed with warm water of 60°C before final dissolution. Skim milk and other stabilizers bind chlorine and metallic ions thereby making vaccine virus free and available for the bird. In litter sheds, dirt in bell drinkers, mixing of litter, feces and birds secretions with vaccinated water changes its pH and reduces its efficiency. Several water dyes are available commercially which indicates the uptake of vaccinated water. As a rule of thumb for 1,000 broilers, 1,000 doses of vaccine should be dissolved in as many liters of water as the age of the birds in

days. This is the minimum volume and it can be doubled if climatic or other reasons justify it. Ideal length of water-withdrawal for vaccination of broilers is 1-1/2 hours. The ideal time for consumption of vaccinated water is 2-3 hours. Vaccination early in the morning is recommended since this is the time when birds will exhibit peak activity and therefore peak water consumption.

“Never Compromise on
Biosecurity Protocols”

SUMMARY

Biosecurity is a strategic and integrated approach for analyzing and managing relevant risks to human and animal life and associated risks to the environment. Biosecurity yet seems to be simple but complex phenomena. Bio-exclusion (to preclude the introduction of disease into the farm) and Bio-containment (to stop the spread of disease within the farm) are the two main targets of biosecurity. Cleaning and disinfection in combination pave for effective decontamination and are the key components in routine biosecurity in

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