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A Guide to Healthy Poultry Production

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Ethiopian Institute of Agricultural Research

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1. INTRODUCTION

Poultry plays an important role in poverty alleviation, nutrition and food security. Poultry are one of farm animals that can be raised under different husbandry conditions which ranging from scavenging to closed system. The scavenging system which is the major production system in the country is composed of chicken of different age and sex in the same environment. These birds are allowed to scavenge for available field resources in their area freely. Based on the level of biosecurity poultry production system can be categorized in to four sectors. Sector one is known of its high biosecurity level and use of sophisticated technology while in sector two the biosecurity measures can be moderate to high. The above two are commercial in characteristics. Sector three is those commercial production systems with low to minimal biosecurity measures implementation and products from this sector may enter live bird markets. The last sector is village/backyard production which comprises more than 95%

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Ethiopian poultry production system. This production system is characterized by minimum to no biosecurity measures, poor housing, poor management and poor availability of veterinary service in the areas. A low emphasis was also given to the sector due to loss occurred during periodic occurrence of an outbreak and poor productivity of the chickens.

Poor biosecurity measures and improper management can be source of loss in poultry production system. The loss can be due to direct loss of the bird or due to poor productivity of improperly managed chicken. Health and productivity of chickens can be improved by good feeding, implementation of biosecurity measures and good management. Proper implementation of biosecurity measures, vaccination and health management are the core ideas of this guide. Therefore the objective of this guiding document is

- To show the major constraints that hinder poultry production system

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- To show basic biosecurity measures that can be implemented easily in all existing production system.
- To guide point to consider prior, during and post vaccination

1.1 Current challenges in the Ethiopian poultry production

1.1.1 Poor genetic makeup

The majority of Ethiopian chickens are low producing indigenous chickens which are mainly scavengers. These chickens are believed to have poor genetic makeup which mainly related with the presence of many endemic diseases in the country makes them to spend most there potential for immunity production for various diseases. So the above futures make them good in disease resistance even if their productivity is very poor. The other major constraints in this production system are the

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long production cycle of chicken which relate to the natural incubation they perform and the brooding time that they spend to raise their chicks and high chick mortality caused by disease condition and predations. From various studies conducted in the country the productivity of the chickens are vary depending on the ecotype of the chicken and the management conditions that they are raised. National Poultry research is currently working on improvement of local ecotype as local chicken improvement program. The research objective is improvement of poultry production for village production system.

1.1.2 Poor quality and availability of feeds

Local chickens are low in productivity because of low inputs they gain from scavenging. The country produces a wide range of ingredients suitable for poultry feeding. There are varieties grains and protein sources which can be used as feed ingredient for chicken. Even if many feedstuffs were produced in the country it doesn't mean the quality and quantity of these ingredients are

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available everywhere. The country is facing the problems of feed shortages for poultry production. The main reasons behind this shortage of feed are the crop production in the country is traditional and it is not commercial and the other reason is; most poultry feedstuffs are also used for human Diet in the country therefore to guarantee availability of poultry feedstuffs in the country the production should be surplus than human need. Therefore Even though some poultry feed plants are available in and around Debre Zeit, most of them are not preparing quality poultry feeds due to known and unknown reasons.

1.1.3 Capacity and organizational problems

In the country there are so many research out puts generated from different research centers. But the main challenge is they are not well organized and are not communicated well to end users and policy makers and enforcement bodies. Therefore many research outputs which have the capacity to change the productivity of Ethiopian poultry sector are stay in the shelf of those

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research centers and universities. This is the main problems for poultry development in the country. Many Feed, health and other technologies are available in the shelf of many research centers, universities and NGOs around the country.

In problems related with capacity; the national poultry research case team and regional multiplication centers have the capacity to produce 72 million of egg per year which is very small to supply 80 million Ethiopian people. The capacity of commercial producers is also very small in relation to the demand. Commercial producers' capacity is affected by poor sustainability of improved breed supply. Therefore capacity building should be a priority in the country.

1.1.4 Health

Contagious diseases are major diseases that can be easily introduced in poultry flock through contaminated materials and sick birds. This is the main reason why experts suggested that poultry producers should not buy

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chicken from live bird market or from uncertified or unknown sources, especially during outbreaks of diseases. When it is important to purchase chicks from outside source it is important to quarantine the chicks for two weeks in a shed or cage. The same structure can be used for the isolation of sick birds if quarantined chicks are not available there. In serious disease conditions poultry farmer should isolate or kill sick and must ask veterinarian for help. After serious of investigation the farmer should give drugs or/and implement management measures recommended by the vet. Dead birds (or parts from dead birds) should be burned or buried deep enough (about 1 m) to prevent dogs and other animals from digging them up and spread the disease. If there are many sick animals, the cause of the disease must be well identified and characterized before introducing new birds or birds should be vaccinated prior to disease outbreak. In general it is important to implement an appropriate biosecurity measure which can be easily implemented in the production system.

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Vaccination is one of the means to prevent disease in the flock. Vaccination of chicken using available vaccine (like Newcastle disease, fowl typhoid and fowl Pox vaccine) in the area is necessary to prevent disease and mortality in scavenging system. All birds must be vaccinated against those vaccines. But it is not a common practice in most developing countries like Ethiopia. In Ethiopia there are some irregular vaccination programs against Newcastle disease in village system but they were not successful due to so many issues such as lack of awareness, poor veterinary service and farmer's perception towards vaccination.

2. POULTRY HEALTH MANAGEMENT

Poultry health management is a key in all production system. Health management means a system of preventive medicine that accounts factors influencing the health status of the flock and put it at risk. Health management includes keeping physiological, nutritional and environmental wellbeing of the flock. To manage

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healthy flock it is important to identify poultry health status. For proper health management it is recommended that:

- ✓ Birds should vaccinate regularly for endemic disease in the area.
- ✓ Proper cleaning and disinfection should be guaranteed.
- ✓ Traffic should be limited not to bring pathogen to the farm.
- ✓ Must change and wear protective clothing when working in a poultry house.
- ✓ There should be an isolation pen for disease and newly introduced birds.
- ✓ In time of disease incidence materials used by diseased bird should be disinfected or disposed properly.
- ✓ Dead birds have to be buried or burnt in the area found far from the poultry houses.

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2.1 Poultry Health Status Determination

The determination of the health of any avian species depends upon careful observations and following a systematic procedure of examination. Many diseases are more easily treated if detected early. The key to early detection is, knowing what to look for in sick chicken.

Observations

Observations are one of the key aspects of determining health in chicken. When entering an area where chickens are kept, observe the premises carefully. This is important and the first step in determining bird health. Check for signs of vermin such as wild birds or rodents. These can be important sources of disease entry (such as bacteria and parasites) into a flock. In addition to vermin, check feed and water sources. This is also important. Look for signs of vermin contamination, height of water sources, amount of feed in feeder, if the sources are clean and if the food and water containers are in working order. Sick birds may only seek out feed or water on a

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limited basis, and if the sources are not working correctly, the condition of the birds can worsen due to malnutrition. Also observe any litter used in the area to make sure it is not wet. In addition, check roost areas for cleanliness and if manure is dry. This can be especially important in the control of flies, since wet litter and manure are potential fly breeding areas.

Observe production parameters such as egg production, weight loss, mortality, number of sick birds, fertility, egg hatchability, etc. A careful observation of these parameters may enable you to "catch" a disease in the early stages before it becomes a serious problem.

The next observation should be the birds themselves. Observing the birds before you catch them is extremely important. It allows you to make a general assessment of their condition. Some points to observe include behaviors (such as eating and drinking), attitude, gait, feathers (are they ruffled?) and personality of the bird in the group (fearful, aggressive, alert). Most diseases cause a change in attitude or behavior, which can be

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detected by close observation. After close observations of the birds and checking the area for indications of possible problems, the next step is to catch and restrain a bird or birds for examination.

Examinations

To accurately determine the health of a bird, examine it carefully. A preliminary examination of the general condition of the bird can be done while observing the bird. Examination of birds includes a detailed examination of the various body parts for problem. Below are some body parts to be examined.

Eyes – Examine the eyes for areas of discoloration, scars, accumulations and discharges. Examine the eyelids at the same time for swelling, reddening and accumulations or dry rusty areas.

Nostrils – The bird's nostril is an important part of the body that should be examined. The examination include checking for swelling, discharges, odors, change in symmetry, discolorations, accumulations and texture of

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the nostril and surrounding skin. Listen for any sounds from the nostrils.

Beak – Check the beak externally for damage, discolorations, accumulations, shape, length, texture and alignment

Oral Cavity – Check the oral cavity for accumulations, discolorations, odors, discharges and growths. In addition, it is important to check the cleft in the upper palate of the oral cavity and it is a direct communication with the respiratory tract. Thus, any accumulations, discharges, etc., in this region may be from the respiratory tract.

Respiration – Normal respiration in a healthy bird is barely noticed; however, abnormal respiration is indicated by open mouth breathing and tail bobbing. After catching a bird and allowing it to rest, determine if the bird is having difficulty breathing. If tail bobbing or open mouth breathing continues, it is likely that an infection is present in the lungs, air sacs or both.

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Skeletal System – The skeletal system can be affected by infectious diseases, but in many instances, bone changes are due to nutrient problems or trauma. A twisting or other deformation of the keel bone, vertebrae, etc., can be detected easily while the bird is being handled. The bones of the wings, feet and legs are usually checked when those areas are examined.

Wings – wings should be examined for swellings, fractures, discoloration of feathers or skin, bone deformation and wing paralysis.

Legs – Before catching, observe the legs for use. It is also important to check the nails on the toes for excessive wear or length, which may indicate either disuse or overuse of a leg and/or a toe.

Plumage – Examine the general condition of the feathers. Check for damage, color changes, condition, evidence of soiling, frayed feathers, new feathers (blood feathers), parasite damage, etc. A bird that is sick will usually have unkempt feathers which may be soiled with feces.

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Vent – This region is primarily examined to make an assessment of the health of the gastrointestinal tract. In this area, check for parasites, soiling of the feathers, evidence of laying eggs, diarrhea, swelling, reddening, blood from the vent, abnormalities, etc. The feces are usually checked as part of the premises evaluation.

2.2 Routes for Disease & Pathogen Transmission

Disease can be transmitting from diseased flock to healthy flock through different routes. Major means of disease transmission are showing similarity in different production systems. Here below are some major means of general disease transmission routes.

- ✓ Unrestricted movement of chicken from one production area to the other
- ✓ Improper disposal of dead bird
- ✓ Direct and indirect contact with wild birds
- ✓ Wild and domestic animals which have an access to the farm
- ✓ Insects, rodents and domestic birds

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- ✓ Human activity and materials, feed and water used in the farm

2.3 Disseminate infectious disease in the flock

Identifying the major routes of disease transmission is not enough to manage chicken disease in the flock. There for it is important to identify how disease causing agents disseminate in the flock once they enter to the farm. Disease causing agents can be in different place in our environment and fomites used in the farm. But to cause a disease in the flock this disease causing agents must be found in a required amount to cause disease (infective dose). When a bird is getting infected by a pathogen it should pass immunity system of the bird to cause clinical infection. Nevertheless, that organism is reproduced in the bird then shed in greater numbers from the infected bird into the environment through body excretions, including feces, urates from the kidneys, or moisture droplets from the respiratory system. Pathogenic agents in the excretion will contaminate the materials and the surroundings in chickens environment and it will be

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transmitted to other birds in the flock, the bird becomes infected and the cycle continues. As the pathogenic organism passes from bird to bird, its numbers in the environment multiply rapidly.

Bio-security program implementation helps us to prevent or, at the very least, minimize the number of organisms entering and leaving the farm. Because we know that pathogenic organisms can leave and enter our farm/flock easily and can cause many damages.

3. HEALTH MANAGEMENT IN SCAVENGING SYSTEM

3.1 Daily activities and observation

In scavenging system Farmers should spend some time to look after their birds. Observation of chicken every time will help them to detect disease in its early age, nutritional status or other problems may be discovered, and the necessary precautions will be taken. Knowing each hen in the flock will also help farmers to choose eggs from the best hen for hatching, so that the chicks

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may inherit her good qualities. In flock with high flock density a farmer may encounter problems with hens pecking and cannibalism and this can be overcome by increasing access to green fodder. Record keeping should be practiced on poultry production in order to know successes and problems early. Routinely chicks show the same characteristics in their daily activity, they scavenge early in the morning and late in the afternoon and also they lay eggs later in the morning and rest in the noon. To overcome problem of predators they prefer to sit high.

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Picture 1. Birds spending a day to prevent predator

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3.2 Identification of Bio-security Risks

Housing:

Housing for village poultry varies from none to simple structures which may or not be attached to the main living house of the owner. In many cases owners share the same house with chickens. This would expose the owner to infection if zoonotic diseases are introduced in the area. Therefore Separate shelter should be provided for the night at least. If the owner can afford, village poultry should be housed but with a run for the day and should be given supplementary feeds that can meet their requirement. (Shortening brooding time to increase productivity (hay box))

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Picture 2. Alternative housing for chickens made from locally available material

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Husbandry:

The husbandry of this system is characterized by flocks of multi-age groups and there is a mixture of various breed of poultry such as exotic hybrids and local chicken together. The poultry are usually on free range with very little if any supplementary feeding. Water is not normally provided. Subsequently birds drink dirty water which is also drunk by wild birds and other animals. All these practices predispose birds to infection. Lack of confinement allows direct contact between poultry and wild birds and chicken houses are not wild bird proof and rodent control programs are nonexistent in almost all villages. To overcome this problems Keeping together poultry of different ages and different breeds is advisable but it cannot be avoided hence it is recommended that farmers raise only one type of birds (if there is a trained to raise different types of birds). Free range practices cannot be avoided, but farmers must improve feeding of the poultry by providing supplementary feeds and clean water in clean containers arranged for them.

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Picture 3. Commercial drinker

Health Management:

The commonest and the most serious disease among village chicken, is Newcastle disease which causes up to 100% mortality. Vaccination practice for ND and any other disease in village poultry is not common except in some campaigns by ministry of agriculture in some areas of the country. Sick birds are not separated from the healthy ones and owners use local medicinal plants or

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human medicines like Chloramphenicol (CAF) and tetracycline for treatment which may or may not be effective. Whenever there is threat of disease, the owners normally sell most of their flock including the sick birds. Sick birds may be salvaged by cooking and eating them or feeding them to the pets. Dead birds are thrown away to village waste disposal areas or water sources or given to the dogs. The litter from the shelters is swept away in the compound. The chicken shelters are not cleaned regularly if at all. Therefore health management is thus very poor. There must be new research development in the strategies of village vaccination strategies and farmers must be advised to vaccinate against economically important diseases that are common in the area, and have a strategies for village production system, particularly ND. Vaccination against ND must be done on a regularly basis. Sick birds must be isolated and treated and not sold or eaten. Dead birds must be disposed of properly and not eaten. Litter must be composted if in large amounts before using it as a fertilizer. It is also better to use an appropriate medicines

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formulated for poultry rather than using drugs intended for human.

There are two biosecurity measures that should be implemented to manage healthy scavenging poultry production system.

Introduction of new stock: Purchase or gift of poultry and animals from farms with unknown history is common. Isolation and quarantine of newly introduced birds are not implemented in the countries village poultry production system before being introduced to the flock and these can cause transmission of disease. It is advisable to confine the new birds for at least 2 weeks and observe for any sickness before mixing with old flock.

Contacts with chickens: Children do play with chickens and other poultry which is dangerous to their health, when the chickens are sick or when highly pathogenic disease like Highly Pathogenic Avian Influenza (HPAI)

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infection and other zoonotic pathogens will present in the community.

3.3 Simple rules for better management

The farmer must receive training in poultry rearing. The proper training on management of chicken should be given to producers who engage in poultry rearing. These are some simple rules that can change chicken production through improve management. A clean house with a perch inside is the primary necessity in raising chicken in a good environment. The house should be cleaned periodically in order to prevent occurrence of disease through contaminated environment. The chicks also need an access to clean water and nutritionally rich food which meets their daily nutritional requirement. A vaccination program which developed in a given locality should be based on the availability of the disease in the area and in relation to the advice that the farmer get from local vaccinators or veterinarians. Owners of the bird should monitor his birds in daily bases for any changes observed on them. These changes can be related with

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production parameters such as growth and egg production, health or any other biological changes seen on them. Isolation of sick birds is the first to procedure that should be conducted by farmers when they face a diseased bird in the flock. Then after isolating the chicken it is better to report to the veterinary office in the nearby clinic or kill the bird before the disease disseminate to others birds in the flock and report disease to veterinarian in order to get means of prevention for the remaining flocks. The available feed resource in the area and the availability of space to keep them at night are the main driving forces in the management of flock size in the production system therefore it is important to limit flock size based on the above factors.

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Picture 4. Isolation pen made from locally available materials

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The other main activity which improves productivity of the flock is periodically monitoring of production performance of chicken and culling of unproductive chicken from the flock. After selection productive and unproductive chicks from the flock Provide nests for layers and check nests for eggs two times a day. Separation of chicks from adult birds is also the other main management intervention to improve production in village production system.

3.4 Biosecurity in Live-bird Open market

Live-bird markets are a common practice in the country. In most part of the country people buy live birds and take them to home, bars and business places to be slaughter. There is a practice of giving slaughter service in few market places of Addis Ababa. These slaughter facilities attached to the markets are not well constructed. The killing of poultry, de-feathering and, dressing of the carcass is all done in the same area manually. Personnel handling birds are not well protected from potentially infected birds and inedible by-products are disposed in

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the same system with other domestic solid wastes. The open markets provide conditions for the zoonotic disease transmission and evolution of infectious disease agents. At a live market, there is poor hygiene; there is lack of cleaning and disinfection of facilities, equipment and personal protective garments. It is common practice to hold poultry over several nights until they fetch a buyer. Live markets may also be a source of infection to farm poultry if the farmer takes back to the farm, the unsold poultry which would have mixed with others in the live market. Open markets could be considered as one of the bio-security risk areas as sick or disease incubating birds bought and slaughtered at home could transmit infection to other farm birds and/or humans. To prevent a possible transmission highly contagious disease, poultry producers and dealers must also use biosecurity precautions at live-bird markets. The following measures are recommended to mitigate the above gaps.

- ✓ People engaging in live-bird marketing and slaughter service should get training on the

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importance of personal hygiene, cleaning and disinfection.

- ✓ Holding poultry cages on top of one another should be separated by waste tray in the middle.
- ✓ When taking live birds to the market they should be in good (healthy) condition.
- ✓ Purchasing of chicken door to door should be stopped.
- ✓ If there are unsold chicken that returned to home from the market they should be kept separately from other birds in the household.
- ✓ If slaughtering is practiced as mentioned above, people working on it should wear proper personal protective materials.
- ✓ There must be proper disposal of carcasses, feathers and other hazardous wastes.
- ✓ Drivers and any poultry riders should be educated and advised to clean all equipment, crates, and vehicles before returning them to the farm (if there is any)

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- ✓ The slaughtering houses should locate separately from live bird market.

4. HEALTH MANAGEMENT IN COMMERCIAL PRODUCTION SYSTEMS

Commercial poultry production system in the country is in its infant stage. The system is hindered by so many factors (see Current challenges in the national poultry production). This can be solved and the sector can contribute its part for the economy of the country and nutritional requirement of the people if proper modifications are taken.

4.1 Hygiene management

Hygiene is a set of practices performed for the preservation of health and prevent the spread of disease in the flock. Hygienic management is the key to improve production and productivity. Good hygiene is an essential management task. The principle is to maintain

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clean sheds, surroundings and equipment which will not favor contamination. A clean shed improves health and limits growth and availability of pathogenic organisms. It is also true that clean shed surroundings reduce vermin and fly loads. This is important not only for litter and manure management but also for biosecurity.

4.2 Litter materials and management

Litter is the material used as bedding in poultry houses. It is important to absorb moisture from the dropping and make flock environment clean and comfortable to the chickens. It also makes the floor easy to manage. There are different litter materials that can be used in the poultry houses. The commonly used litter materials in the country are wood shavings, straws of different plants, sawdust. Litter should be soft, cheap, dried, light with low thermal conductivity. Litter should be checked regularly for moisture, bad smell and excess gas. If excess moisture is observed throughout the house it shows that the house need to ventilate well or there is abnormality in the flock or they flock is taking too much water. Therefore the

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problem should be identified and the appropriate measures should be taken. If it happens in a specific location of the house the litter in that area should be changed and the problem which is causing it should be fixed. After use the litter material is comprises of the litter material, spilled feed, droppings and some feathers. Therefore it should be disposed in a proper way by burying, burning or composting in a pit. If it is not disposed properly litter can also be source of infection to the flock. The recommended depth for litter is between 10 and 20 cm. Sawdust can result in high dust levels and respiratory problems.

4.3 Bio-security

Poultry health management is the emerging issue along with bio-security measure. Chickens are major causes of zoonotic diseases transmission chain. The food from livestock sources need to be free from disease causing agents to safe guard public health. Farm to fork chain must be clean and hygienic. Therefore, bio-security is foremost important to poultry farmers. It reduces losses

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in long terms. It promotes organic farming in rural area. Bio-security measures, poultry farm management and organic farming become sustainable development cycle in rural area. In order to obtain hygienic poultry production, livestock market, processing activities and farm should follow bio-security to make hygienic environment.

Bio-security refers to measures taken to prevent or control the introduction and spread of infectious agents to a flock. Such infectious agents, whether they cause clinical or subclinical disease, significantly reduce the productivity, profitability and long term financial viability of a poultry operation. Bio-security is about managing risk to meet the objectives stated above. When undertaking the risk assessment underpinning the farm-specific bio-security measures, it is important to take into account all factors that may impact on the bio-security of the production area. These factors should include location and layout of property and production area, source of water supply, disease status of the district, proximity to other production areas with avian species,

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presence and type of wildlife. These interactions include bird pick-ups, servicemen, industry personnel, contractors and deliveries of day-old chicks and feed. Bio-security has three major components: isolation, traffic control and sanitation. Whenever there is import of new chicks from abroad, it shall be quarantined for three weeks in respective farms. Sick birds shall be kept in isolation. Different age and sex groups shall be placed separately to minimize the risk of disease spread. Poultry health management and treatment procedure shall better organize by means of isolation. The possible breakdowns in bio-security norms and introduction of new birds and traffic pose the greatest risk to bird health. Therefore, properly managing these two factors should be a top priority in a farm. In order to assess how much bio-security is practical in a farm, following factors such as economics, common sense and relative risk should be considered.

New birds represent a great risk to bio-security because their disease status is unknown. They may have an infection or be susceptible to an infection that is already

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present in birds that appear normal (healthy carriers) in a farm. While all-in/all-out management system is not feasible for many breeding farms, it is possible to maintain a separate pen or place to isolate and quarantine all new, in-coming stock from the resident population. Isolation pens should be as far from the resident birds as possible. At least 3 weeks of quarantine is preferable; 4 weeks is better. Observation of birds for any signs of illness shall be observed regularly. Diagnostic blood tests for infectious diseases shall perform at this time. Avoid putting new birds, including baby chicks, in contact with droppings, feathers, dust and debris left over from previous flocks. Some disease-causing organisms die quickly; others may survive for long periods.

Footwear should be disinfected at each site. Disinfectant footbaths may help to decrease the dose of organisms on boots. But, because footbaths can be hard to correctly maintain it is a good idea to have a supply of cleanable rubber boots or strong-soled plastic boots for visitors. It

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is advisable to wash hands after handling birds in isolation or birds of different groups. It is mandatory to disinfect drinkers and feeders on a regular basis. Plan periodic clean-out, clean-up and disinfection of houses and equipment, at least once in each production cycle of poultry bird. Use this time to institute rodent and pest control procedures. Remember that drying and sunlight are very effective in killing many disease causing organisms.

Poultry farmers are facing a lot of problems due to high cost of feed and medicine, emerging new diseases and lack of bio-security measures. Backyard poultry raisers and small entrepreneurs will feel burden of bio-security. Bio-security is a means of recommended practices in the farm premises, which costs some extra investment initially however it will be cheaper in long run. Bio-security is necessary to control disease in effective way. The treatment and prophylactic measures and its cost involvement shall be reduced.

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Poor or absent disease control strategies and inadequate management practices result in high levels of baseline mortality due to predators (e.g. rodents, snakes, small carnivores) or infectious diseases (e.g. Newcastle Disease (ND), salmonellosis, Gumboro disease or fowl typhoid). Poultry production contributes significantly to incomes and home food consumption in rural areas of many developing countries. Raising and consumption of chicken are sometimes linked with socio-cultural factors such as religion or festivities, and to economic factors at farm and national levels.

Bio-security consists of a set of management practices which, when followed, collectively reduces the potential for the transmission and spread of disease-causing organisms onto and between sites, animals and humans that are initially free from the diseases causing agents. Bio-security comprises two main elements - bio-containment (prevention of spread of the virus from infected premises) and bio-exclusion (measures to exclude infectious agents from uninfected ones). Bio-

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security is the normal way to avoid unnecessary contact between animals and microbes, infected animals and healthy ones. Bio-security also applies to public health measures that will reduce the contact between animals and humans.

As the name biosecurity implies it also can be defined as freedom from danger represented by biological agents. The biological agents that present "danger" to the poultry industry are, of course, those microscopic organisms that include viruses, bacteria, and parasites. The viruses, bacteria, and parasites that we are concerned with are pathogenic organisms that require a host in which to grow and reproduce, particularly those that require the avian species as a host. According to the above concept of Biosecurity, biosecurity program is a series of protocols that are designed to reduce the "danger" of biological agents to poultry flocks under our care.

Bio-security is of much importance in poultry production. Strict bio-security measures in addition to vaccinations are strategic prevention and control

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policies adopted to control some contagious poultry diseases as vaccinations alone are not enough to control them under field conditions. Good husbandry practices such as adequate feeding, housing and stocking to avoid overcrowding, good ventilation, proper disposal of wastes, cleaning and disinfection of poultry premises help to keep out infections and their spread.

4.4 Farm Management Bio-security Concerns

Farm management is the essential component of putting the standards into practice. If all aspects of management are handled to their optimum, then farm biosecurity will be a success. All the technology put into place then managed incorrectly, however, will be equivalent to not having biosecurity measures in place. Farm management is a collection of programs, procedures, and rules that are put into place to activate an overall biosecurity program.

Housing Requirements: The walls should be constructed taking into account the weather conditions and comfort of birds. The floors should be made of smooth plastering

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to allow easy cleansing. The distance between chicken houses within a single age farm should usually be about 20–25 meters. Human and animal movement must be controlled. The chicken house also must be located away from the living house. Ideally, poultry house should be located at the backyard and fenced. The design of the chicken house must be such that it will keep the wild birds away from the chicken flocks. The house should be constructed with easily cleanable materials and design should consider prevailing weather conditions. Trees and shrubs should be selected to minimize wild bird attraction. The area around sheds must be kept free from debris and vegetation should be mown regularly. The production area should be adequately drained to prevent accumulation and stagnation of water likely to attract water fowl, especially in the areas around sheds.

All In - All -Out policies: If the replacement stock is usually imported from abroad it supposedly a disease-free source. This can be achieved through enforcing importer to get a veterinary import permit with a certificate that the importation is from disease free

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source. Day old chick distributors have to inform farms about the history of the flock through certificating about past diseases in the parent flock and also the vaccination history of both the parents and newly hatched birds. In large poultry operations, all-in/all-out management styles allow simultaneous depopulation of facilities between flocks and allow time for periodic clean-up and disinfection to break the cycle of disease.

Cleaning and disinfection after depopulation: Following depopulation at the end of a production cycle, all litter must be removed and poultry buildings/houses must be thoroughly cleaned and disinfected. It is important that all equipment, drains, pipes and fans are thoroughly cleaned and disinfected. All surplus feed must be removed. The farm must apply rodent and other pest control measures before re-stocking.

Routine cleaning and Ground maintenance procedures: It is a procedure important to hinder the introduction of disease agents and contaminants into poultry sheds and

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enclosures and reduce the attraction of rodents and birds to production areas. The procedures are as follow:

- ✓ Feed spills must be cleaned up as soon as practicable. Feed attracts birds and rodents to the production area.
- ✓ Grass on and around the production area must be kept cut—long grass attracts rodents and favors the survival of viruses and bacteria.
- ✓ Footbaths must be inspected daily (e.g. for excessive organic matter) and the contents replaced as required to achieve an adequate concentration of suitable disinfectant according to the recommendations.
- ✓ The production area must be adequately drained to prevent accumulation and stagnation of water, especially in the areas around sheds and range areas.
- ✓ Repair and maintenance contractors who have had contact with poultry or other birds that day or keep birds at their home must not

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enter sheds and/or ranges populated or ready to be populated with birds unless (a) it is an emergency and (b) they have showered from head-to-toe and changed clothes and boots and wear a hair covering.

- ✓ Routine maintenance should be conducted, where possible, between batches prior to final disinfection where a batch system is practiced.
- ✓ Tools taken into the production area must be cleaned before entry into sheds and must be free of dust and organic matter.

Traffic Control: this includes both human as well as the vehicular traffic. It comprises of traffic onto the farm and the traffic patterns within the farm. These are entry condition for visitors

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- ✓ The production area must have a perimeter fence or otherwise well-defined boundary (defined biosecurity zone).
- ✓ If there are other live stocks grazing in the area then the production area must have a fence that can prevent them.
- ✓ There should be appropriate signage which restricts trafficking in the area such as g Bio secured Area, No Entry Unless Authorized etc.
- ✓ Entering of personal vehicle should be restricted
- ✓ People who dispose dirt and dead bird from poultry houses should not get contact with the flock or people working in poultry houses.
- ✓ All poultry housing must be designed and maintained so as to prevent the entry of wild birds and limit the access of vermin as far as is practical.
- ✓ Drainage—the production area should be adequately drained to prevent accumulation

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and stagnation of water likely to attract water fowl, especially in the areas around sheds.

- ✓ Visitors must not keep poultry, caged birds or pigs at home. If we believe that the visit is very important the visitor must not be in contact with other production systems in the last 48 hours.
- ✓ If the person is in contact with other avian species in the past 24 hours he should take a full shower and wear a protective cloth before entering the premises.
- ✓ Visitors should always wear a protective clothing and boots whether they visit other farms or not.
- ✓ Visitors must sanitize hands before entering sheds.

Pest Control: Pests are active and passive disease transmitting vectors. Minimizing pest populations will reduce the risk of disease transmission. An appropriate vermin control plan must be developed and

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implemented. To achieve this. Premises should be maintained in a manner that minimizes pest infestations and Rodent and insect control programs that are designed to reduce existing pest populations and prevent further establishment of new pests must be documented.

Rodent control: It is important to construct Rodent proof buildings and repair visible damage as it occurs. The feed storage also should be rodent proof. Clean up feed spills immediately and use baits and trapping based on activity and seasons. Dispose of rodent carcasses immediately. Carcasses should be handled while wearing gloves and disposed of so as to prevent access by pets or wildlife, such as by incineration. Finally Document the rodent control program in a Standard Operation.

Insect control: It is mandatory to eliminate or control fly-breeding areas especially in warm weather. It is also advisable to remove mortality from the barn at least once a day and dispose of in an acceptable manner. Apply insecticides as necessary and if spraying is used for flies, clean up all dead flies regularly.

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Wild Bird Control: First Screening of all openings into the barn, while trees may be used for dust control on the exhaust side of a barn, the number and type of trees used should be limited and Eliminate any unnecessary trees and shrubbery that is close to the barns.

Protection of Feed and Water from Contamination: Contamination from the external environment may introduce and/or transmit disease. Therefore; Premises should be maintained in a manner that minimizes environmental contamination including, but not limited to, the proper storage of feed, the elimination of water leaks, the maintenance of water quality and generally good housekeeping measures such as the removal of debris.

Isolation of new flock: If there is in-coming of new stock they should be isolated from the rest of the flock. During the period of isolation monitoring programme should be instituted. New stock should only be placed in facilities which have been de-stocked and thoroughly cleaned and disinfected. The isolation facilities should be placed

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as near as possible to the farm entrance, and separate from other poultry buildings. The staffs and equipment must be separated to be used when handling isolated stock. If not, the isolated stock should be handled last and attendants should always wash and change into clean overalls and boots before and when moving between flock buildings

Protective clothing and footwear: If clean overalls and footwear are not always worn when entering poultry farms introduction of infection onto the farm, or spread around the farm could occur through personnel or visitors' clothes, footwear or hands.

Limitation and control of access to poultry flocks: poultry sites should be fenced with a controlled entry point.

Pressure washers, brushes, hoses, water and disinfectant: in commercial poultry production system this equipment should be available for proper disinfection and sanitation measures. Tap water, brushes,

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disinfectants are the only required in small scale and semi commercial production system.

Cleaning and disinfection of crates, containers and other equipment before and after use:

Use of plastic equipment in the farm is very important because it is easily washable but equipment made from wooden and paper materials like egg trays are not washable therefore it is difficult to clean them.

Cleanliness of farm, equipment and surroundings: is an important component of farm management. It include cleaning of the farm and its surroundings, including access routes, parking areas, yards, areas around buildings and storage areas should be kept clean and tidy and well maintained so as to avoid wild birds and animals being attracted onto the site and entering farm buildings and stores.

Restriction of movement of equipment: No equipment should be moved into different poultry buildings without cleaning and disinfecting first.

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Restricted contact between poultry, wild birds and other animals: Restriction of contact between poultry and wild birds, other livestock, dogs, cats and rodents should be strictly observed by avoiding accumulation of standing water, removal of spilled feed and maintenance of buildings to ensure that wild birds do not nest or roost in them. Feed stores and containers must be sealed to prevent animals and wild birds contaminating feed. Livestock and pets should not be kept at or near the farm. Workers should not raise poultry at their homes.

Use clean, fresh and potable water and hygiene: Only potable water should be used as drinking water for the birds. Water pipes must be flushed through. All equipment such as feeders, laying cages and the drinkers must be cleaned regularly. Standing water in and around farm buildings must be drained

Farm wastes: Damaged eggs and dead birds should be disposed of promptly and properly. Litter and manure must be composted first before disposal.

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Collection of Dead Birds: Dead birds must be collected regularly from the property. Frequency of collection will be determined by factors such as size of chicken and climatic conditions. Collection area must be as far as practical away from the production area so that there is low risk of contamination of the farm. Also all containers used for collecting dead birds must be washed and disinfected before returning them to the production area.

Documentation and training: it is the first procedure which is important to ensure awareness of all production area employees in all relevant biosecurity requirements. In this phase staff must get training in the relevant parts of the biosecurity measures. In order to achieve the intent of the standards it is essential that producers and employees understand the reasons for the standards and their ability to affect the level of biosecurity attained on the premises.

- ✓ An on-farm biosecurity training program must be in place.

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- ✓ On-farm biosecurity training is an on-going requirement with the need to update farm personnel and train new personnel at regular intervals.

4.5 High Risk Bio-security Procedures

During the time of an outbreak there might be high risk of a disease to the farm and individuals in the farm. Therefore it is important to implement high level biosecurity in time like this. Therefore the following action plans must be clearly stated.

- ✓ Action plan at the time of suspected emergency animal disease

A farm should have clear guidelines for emergency poultry disease. Emergency poultry disease are characterized by an increased mortality, decreased productivity; an increased incidence of disease etc. therefore the action plan should include whom to inform and first line measures that should be taken to overcome such kind of problems. Common measures are restricting

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movement of birds from and to the farm, restricting of farm material and personnel movements and can be as high as total depopulation and complete closure of the farm.

✓ Action plan for facilities

All gates must be kept locked, Shed doors must be locked at night, Facilities for the cleaning and disinfection of equipment coming on and off the production area must be in place.

✓ Action plans for personnel to the farm

No visitors are to enter the production area unless absolutely essential. Repairs and maintenance should not be considered as routine work, only emergency work to be carried out.

✓ Operational

In case of essential visits a complete change of clothes, footwear, hair covering and breathing protection is required. It is also important to keep used clothing and

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other used personal protection equipment on the property. Any vehicle which must enter the property must be washed and disinfected before and after going onto the property (e.g. feed trucks). No birds or litter to be moved on or off properties until disease status is clarified. If a major outbreak should occur, further measures will be stipulated by the processor and/or the state's chief veterinary officer.

5. POULTRY VACCINATION

Protecting poultry against disease involves more than simply administering preventive vaccines. Disease prevention is a complex and multifaceted process. Vaccine quality is commonly blamed when a disease occurs; however, there are usually other factors responsible. Commercial poultry farms have continued to increase in size and more birds and farms are located in different geographic area of the country. In these cases, the existing vaccination programs are often not adequate to provide protection against disease challenge.

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It is clear that no single vaccination program will be suitable for all farms in all areas. Thus, poultry producers and technical advisors must recognize that vaccine recommendations may change as new information regarding bird immunity and disease is discovered.

Vaccines are used to prevent or reduce problems that can occur when a poultry flock is exposed to field disease organisms. Vaccinations should be thought of as insurance. Like insurance, there is a price to be paid for the protection against a potential threat. Costs include price of the vaccine, time spent designing the vaccination schedule and paying for the crew that administers the vaccines. Another major cost for vaccination, which is rarely considered, is due to the losses from vaccine reactions from the live type vaccines and local tissue reactions associated with the inactivated vaccine injections. Diseases are ubiquitous, and where there are concentrations of commercial poultry their effects can be devastating. The primary strategy for controlling disease should not be vaccination but measures to prevent the

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disease from entering the premises. Prevention efforts must focus on new management systems, products and practices that help block entry of infectious disease and that improve the innate or inherent resistance of the bird. Vaccines can be the next line of defense when the diseases occasionally breach the premises due to failures in biosecurity. The effects of the disease can be minimized if the birds have immunity because of prior vaccination.

Only necessary vaccines should be included in the program because total cost can be expensive. Thus, the decision to vaccinate must be based on the risk of infection in an area. If the risk of a particular disease is low, it makes little sense to vaccinate against it because costs may outweigh the benefits.

5.1 Vaccination Program

Each region typically has its own specific diseases. Thus it is not wise to try to develop a "one size fits all" or international vaccination program. In areas with a high

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density of poultry production, small flocks in close proximity to commercial flocks, or where farms have poor biosecurity and management practices, more comprehensive and intensive vaccination programs may be necessary. It is not a sustainable approach if poultry producers extensively use vaccines to control disease in the absence of a sanitation program.

If the vaccination program is not well studied and executed, the result will be more damaging than the benefit to birds. When introducing any live vaccine into an area, it is imperative to ensure that the vaccine is needed. Haphazardly introducing new vaccines, and new strains of vaccines, into an area is irresponsible and may result in a new disease in the area if the vaccine is able to spread and increase in virulence over time. When administering vaccines to flocks, records must include details on vaccine type, lot number and expiration date. In addition, details on chicken ages, route of administration and person administering the vaccine could be valuable when investigations are conducted at

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a later time. Without detailed records, it is often not possible to determine that a vaccination problem has occurred.

5.2 Administration & Handling of the Vaccine

A well designed vaccination program will not be effective if the vaccine is damaged by improper handling prior to administration. Live vaccines can be inactivated when exposed to adverse conditions. Store and handle vaccines as recommended by the manufacturer. Once a vaccine is reconstituted, the "time clock is ticking" for it to be used. Certain live vaccines, such as for Marek's disease, are extremely fragile and failure to follow the manufacturer's recommended handling practices will result in the inactivation of the virus prior to administration.

5.3 Vaccination Failures

A vaccination failure occurs when, following vaccine administration, the chickens do not develop adequate

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antibody titer levels and/or are susceptible to a field disease outbreak. The following are common factors responsible for vaccine failures in commercial poultry.

5.4 Vaccine Administration Deficiencies

Improper vaccine administration of the vaccine is the most common cause of vaccine failure in poultry. Prior to application of the vaccine, the details of the whole process must be well planned. This includes ensuring that the crew is trained in handling and applying the vaccine. The results of proper vaccination will be improved disease control and performance of the poultry. Poor distribution of live vaccine administered by mass application methods, including water or spray route, may result in chickens being "missed" in parts of the house. Relying on replication of the vaccine virus in chickens and then horizontal transmission of the vaccine from bird to bird is risky. This usually results in excessive or rolling reactions of long duration, increased intensity and delayed immunity in the flock. Birds missed with killed vaccines will result in chickens with no protection,

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as inactivated vaccines will not spread from bird to bird. Live vaccines administered by drinking water can be destroyed before they are able to infect the bird if water sanitizers have not been removed prior to addition of the vaccine. Vaccines that are administered by intramuscular or subcutaneous route can also fail if vaccinators do not deliver the vaccine to the appropriate vaccination site. A routine monitoring program of examining random birds in the flock to ensure vaccine is being injected correctly is advised. It cannot be assumed that because each chicken is being individually injected each will be vaccinated. In many cases, 10% to 15% of the birds may be missed!

Review labels on the vaccine vials and check them against the vaccination schedule prior to vaccination. Errors in vaccination are relatively common and in most cases are simply wastes of vaccine. In other cases, serious problems may result. For example, pox vaccine has mistakenly been confused with NCD vaccine and given

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by eye drop route which resulted in pox lesions in the eyes with substantial losses.

Maternal Antibodies

The immune status of the breeder flock can have an effect on the success of progeny vaccination. If the breeder flock has high levels of circulating antibodies which pass to the progeny through the egg, they may interfere with the replication of live vaccine viruses as they would for field challenge viruses. This will decrease the immune response to the vaccine because it is not stimulating the immune system as long and to as great an extent.

Stress

Vaccination is a stress. A bird being inoculated with a live vaccine is actually being infected with a mild form of the disease. Stress may reduce the chicken's ability to mount an immune response. Stress could include environmental

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extremes (temperature, relative humidity), inadequate nutrition, parasitism and other diseases. Vaccination of sick birds is not advisable because their immune systems are already functioning at diminished capacity. Presenting these birds with a live virus vaccine often results in reduced immune response and an excess reaction because they are unable, in many cases, to develop a response to even the milder vaccine virus. A basic rule for vaccination is to always delay vaccination until the birds are healthy.

Timing

Chickens may also already be incubating the disease at the time of vaccination. Despite proper administration, the birds become diseased because time is needed for antibody production to reach protective levels. Following first exposure to a live virus vaccine, antibody type G is detected approximately four to five days following exposure. Additional days are required for titers to reach protective levels.

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Immunosuppression

The status of the immune system of the flock must also be considered when vaccinating. Chickens may be immunosuppressed due to infection with IBD, Chicken Infectious Anemia (CIA) or Marek's disease viruses or from consumption of feed with high levels of mycotoxins. The term immunosuppression refers to circumstances where the non-cellular (antibody) and cellular components of the immune system are not functioning properly. This may result in the development of limited protection from vaccination and an excessive vaccine reaction including morbidity and mortality.

Management Practices

Poor management practices in poultry flocks may contribute to vaccine failures. If infectious disease agents are allowed to build up in successive flocks without prior decontamination, it is possible that the challenge dose of a particular infectious agent will be large enough so that

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a normally effective vaccination program will be overwhelmed.

Vaccine Quality

To allay concerns about vaccine quality, purchase only from reputable pharmaceutical companies whose products are manufactured under stringent quality control practices.

Vaccine Modifications

Commercial poultry companies may try to reduce costs by eliminating vaccines or administering partial doses. The decision to vaccinate is based on a risk analysis assessment. If the disease is not present, do not vaccinate. If it is a risk, the vaccine must be administered according to the recommendations of the manufacturer. When partial doses are given, birds will not get enough vaccine to properly stimulate their immune system. The result will be decreased resistance to disease. Use of vaccines

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that have been excessively attenuated can lead to a lack of immunogenicity and enhanced susceptibility to field challenge. The proper vaccine must be selected based on local conditions. Levels of maternal antibodies would neutralize milder vaccines. Conversely, vaccines that are not sufficiently modified may result in prolonged reactions and increased susceptibility to secondary bacterial infections, such as of *E. coli*.

Vaccine Strain/Serotype

Many diseases are caused by agents that consist of several different strains/serotypes. In some cases, the vaccine may not contain the proper strains or serotypes of organism required to stimulate protective immunity against the agent causing the field challenge. Although the vaccine is administered properly and uniform/adequate antibody titers are present, the chickens still contract the disease. In some cases, the field strain of an organism is of high virulence and the vaccine strain selected for the program highly attenuated. In this

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situation, the flock may be effectively immunized, but the immunity is insufficient to protect against disease completely.

5.5 Common routes of vaccination

Vaccine should be administered in a proper route to prevent vaccination failure and occurrence of adverse reaction due to improper route. The common mistake that was observed in the country in previous years was administering Fowl pox vaccine in wing veins (it should be given in the wing web). The other common mistakes made were trying to vaccinate chicken by water without making them to thirst and giving vaccines which should be given by sub-cutaneous route via drinking water were observed.

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Table 1. The common routes of vaccines

Type of vaccine	Route of administration	Location of the organ
Marek's	Sub cutaneous	Around the neck
HB1	Ocular	Single/Double eye
Lasota	Ocular/drinking water	Single/Double eye or mouth
Fowl-typhoid	Sub cutaneous	Around the neck
Fowl-pox	Wing web	Wing



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