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Navigating the role of bio-security measures in managing infectious diseases in Dairy and Piggery farms

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Introduction:

Bio-security can be defined as a plan that identifies potential pathways for the introduction and spread of disease in a zone or compartment, and describes the measures, (in accordance with the recommendations in the Terrestrial Code. if applicable to mitigate the disease risks in all activities revolving around domestic, captive/exotic and wild animals and their products. Bio-security measures can help tackle the problem of contacting a new disease and avoiding a catastrophic foreign animal diseases or an endemic disease not only in animals but also in humans. Endemic diseases like digital dermatitis, Johne's disease, contagious mastitis, enzootic bovine leukosis in bovines and Classical swine fever, African swine fever (ASF), Porcine reproductive and respiratory syndrome virus, Taenia solium, Pseudorabies, Foot and mouth disease, Swine influenza A, Japanese encephalitis are of concern in swine herds every year causes great economic losses to dairy and piggery farmers. India's food animal production system requires bio-security at all levels which comprises of on farm bio-security, bio-security international borders against trans-boundary diseases, bio-security at interstate borders and tourism related bio-security. But the biggest problem lies in planning the perfect bio-security plans. How to plan the appropriate measures and actions in preventing these diseases is a question that farmers still ask. Timely bio-security measures are required to be adopted to maintain and improve the health and security of the livestock farms. Also bio-security practices are specially designed to be adapted when emerging diseases are discovered. Hence, recognition of specific bio-security and bio containment protocols are of utmost importance. Therefore, in this article we will discuss about the various components and appropriates steps in designing and implementing various bio-security measures in swine and dairy farms

Major components of bio-security programme

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There are three main components of an effective bio-security measures which includes

a) Isolation,

b) Resistance,

c) Sanitation and

a) Isolation :

Routine screening, inspecting the newly added herd and appropriate quarantine measures should be followed to protect the healthy animals in the farm from the apparently healthy animals. These steps form the foundation for isolation. The idea behind quarantining healthy animals is to eliminate the asymptomatic carriers in disseminating the infectious carriers as they can remain in pre- patent period of diseases and spreading the infections organisms to other animals, especially when stressed or housed adjacent to susceptible animals.

b) Resistance:

Resistance refers to the immunity status in the animal herd. Genetic, nutritional, environmental, pharmacological and immunological practices play an important role in increasing animal immunity or in other words increasing one's resistance to infection. Antibiotics and immunizations are the primary tools in controlling infectious diseases in the livestock farms. Vaccines play a major role in FMD and BVD control. Good bio-security measures surpasses to be the most effective plan in preventing emerging and re emerging diseases infectious dairy farms.

c) Sanitation:

Sanitation is the combined process of removal of persistently infected or carrier animals and also disinfection of any potentially contaminated equipment or facilities. Regular disinfection of partitions, floors, and other objects that can serve as fomites or harbor pathogens should be important part of the bio-security plan or else infectious materials may re enter the herd and can create havoc in livestock farms causing substantial economic loss to the livestock farmer.

Modes of transmission of infectious diseases

Some common modes of diseases transmission in cattle and swine herds are through

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- Direct Contact
- By Semen
- Prenatal and venereal routes are also important routes as modes of disease transmission.
- Airborne Transmission
- Visitors On Farms, Vehicles and other Fomites
- Infected Feed including Swill Feeding, And Drinking-Water, Infected Milk, Urine, Manure And Bedding, Birds, Bats, Rodents, Feral And Wild Pigs And Stray/Domestic.
- Animals And Arthropods are also a common routes of transmission of infectious diseases
- All these potential sources of infections can make biosecurity measures a very intimidating experience if the objective is to prevent all sources of disease entry all the time.

Bacterial and viral diseases in Dairy farms

Some of the cattle diseases with zoonotic potential includes anthrax, brucellosis, cryptosporidiosis, dermatophilosis, Escherichia coli, giardiasis, leptospirosis, listeriosis, pseudocowpox, Q fever, rabies, ringworm, salmonellosis, tuberculosis, and vesicular stomatitis.

Anthrax is a deadly bacterial disease caused by Bacillus anthracis, which forms spores that survive for years in the environment. Cattle, sheep, and goats being the most susceptible of contracting anthrax, but other farm animals, as well as wildlife and humans, can contract the disease. The major routes of contracting this virus is by Oral ingestion of soil contaminated with anthrax spores, People develop anthrax when the organism enters a wound in the skin, is inhaled in contaminated dust, or is eaten in undercooked meat from infected animals. Biting flies can transmit the bacterium, which results in redness and swelling at the bite site.

Brucella can affect a wide variety of animals including cattle, pigs, sheep, goats, horses, and dogs. Brucella organisms can be present in birthing tissues or fluids (aborted

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fetuses, fetal fluids, placentas, and vaginal discharges), and also in milk, urine, blood, and semen. Transmission among cattle is through ingestion of birthing fluids and milk and in utero.

Pseudocowpox is virus that spread from cow to cow by milkers and milking equipment, and causes small raised sores that later scab. Humans acquire pseudocowpox by direct contact with infected cows, and can develop painful scabby sores on the hands and arms.

Q fever is caused by the bacterium Coxiella burneti and causes abortions in cattle, sheep, and goats. Animals acquire Q fever through contact with reproductive fluids and milk from infected animals. Humans are usually infected when they are assisting the birthing process and are exposed to reproductive fluids.

Salmonella are bacteria that are shed in the feces of infected animals., including cattle. Infection occurs as a result of the ingestion of contaminated feed, water, or grass. The bacterium can live for months to years in the environment, especially in wet and warm conditions.

Cattle are infected by Bovine tuberculosis though inhaling or ingesting the Mycobacterium bovis. The bacterium is shed through respiratory secretions, feces, and milk of infected animals. Mycoplasma bovis can be spread through contact with respiratory carrier.

Vesicular stomatitis is a viral disease, producing blister-like sores on the mouth and feet of infected animals. The disease is transmitted by flies or direct contact. People acquire the virus by direct contact with infected animals.

Clostridial diseases such as blackleg disease, malignant edema, black disease, enterotoxemia, and redwater disease has generally very poor prognosis, and the first sign of the disease may be death. Because treatment success is rare, proper emphasis is placed on preventive measures. The clostridial organisms are the normal flora of cattle and become only a problem with food stress, injury, management changes, parasitism, or other unusual conditions that create a favorable growth environment and produce strong toxins..

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Johne's disease is caused by bacteria called Mycobacterium avium (subspecies paratuberculosis) or M. avium subsp. Paratuberculosis which can be transmitted in milk, manure and also transmitted to a fetus in the uterus. Calves are often infected by swallowing manure from the environment or from contaminated colostrum.

BVD is most common in young cattle between the ages of 6 and 24 months. BVD is caused by the bovine viral diarrhea virus (BVDV), which is a member of the pestivirus genus The BVD virus can be transmitted through placenta from the dam to a fetus through contact with feces of infected animals, insect vectors like flies.

Rabies is an acute, progressive viral encephalomyelitis (swelling of the brain and brain tissues) that principally affects carnivores (meat eating mammals) and bats. The disease is fatal once signs appear.

Contagious mastitis **(**Staph aureus, Stretp. Agalactiae) can be spread through contact with infected milk at the time of milking. Bovine leukosis virus can be contacted through blood of infected cattle. E.coli, rotavirus through contact with manure from infected cattle. Leptospirosis through contact with infected urine.

Bacterial and viral diseases in swine farms

Classical swine fever is one of the most feared and most important transboundary devastating viral disease of both domestic and wild pigs. Classical swine fever (CSF) is caused by a pestivirus of the family Flaviviridae. It is also known as hog cholera and pest-e-porcine etc. The CSF virus is found in all tissues and transmitted mostly by the oro nasal routes such as blood secretion, excretion of affected animals and contaminated feed and water are the common sources of infection.

ASFV is caused by the virus Asfarviridae. ASFV is spread in swine herds through close contact between animals and it is not airborne. ASF is a good example of a tick-borne virus; its control requires knowledge of both the arthropod and the host's behaviour. Flies are attracted to organic matter, such as manure and carcasses, and can mechanically spread pathogens

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Foot and mouth diseases in pig are one of the important viral diseases having economic impact. Three FMD virus serotypes, O, A and Asia I, are endemic in India. Food and mouth disease virus is transmitted via infected semen and milk of infected animals, contaminated equipment, motor vehicles and insects.

Porcine reproductive and respiratory syndrome virus (PRRSV) can be persistently spread through infected pigs blood, saliva, milk, colustrum, urine faeces as well as contaminated semen.

Pasteurella multocida is one of the most important bacterial pathogens of respiratory spreads through

Exudative epidermitis (EE) also known as greasy pig disease is an acute generalised disease of pigs caused by Staphylococcus hyicus (Sompolinsky, 1950). Transmission of infection is by pig to pig contact, usually from piglet to piglet, infection can come from the sow at birth. Indirect infection can take place when infection survives on the rough surfaces of pen furniture.

Tuberculosis (TB) is an infectious, granulomatous disease caused by acid-fast bacilli of the genus Mycobacterium, Infection is oral or by the respiratory route. In most cases it follows the consumption of infected tissue, infected cow's milk or water, food or bedding, but can be by direct contact with infected pen mates or with contaminated pen furniture.

The most common routes of infection of Campylobacteriosis to humans are assumed to be consumption of contaminated raw or undercooked meat and milk.

Porcine circovirus is being continuously shed through semen, oral, nasal route. Pseudorabies is a contagious, infectious, and communicable viral disease of livestock. The pig is the only natural host. Indirect transmission can occur by inhalation of aerosolized virus or ingestion of contaminated water.

These diseases continue to re-emerge as a result of biosecurity and /or vaccination failures. There is no direct treatment for the infection. Antibiotic treatment of secondary bacterial infections may be necessary. Immunization generally provides adequate protection against clinical disease.

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Biosecurity measures for prevention of diseases in Dairy and swine farms

a) Quarantine facilities

- The isolation area (or facility) should be located in the most remote possible place on the dairy and piggery farms, preventing direct and indirect contact with resident animals.
- By practicing 3 – 4 weeks quarantine for newly purchased stock, including bulls and boars. Off-premises animals should be isolated for 3-4 weeks to allow enough time for manifestation of clinical signs of disease that the animals may have acquired recently prior to introduction to the dairy.
- New animals should be tested for highly problematic diseases such as BVD brucellosis, tuberculosis, Johne's disease and trichomonosis.
- All diagnostic tests should be performed prior to introducing the animals onto the farms A specific testing protocol should be designed for infectious diseases where incoming animals are tested prior to arrival and if pregnant, their offspring should be tested at birth to prevent retaining PI calf (persistently infected).
- Allotment of trained personnel to handle animals in the isolation area, but only after all other chores on the farms have been completed by those personnel.
- Following thorough disinfection measures regularly at the farm
- Preventing access of own stock to contaminated surface water

b) Prior Inspection:

Visual inspection of feedstuffs and regular water quality testing is necessary to make sure it is safe for animals to use.

c) Entry to farms:

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By restricting entry of visitors inside the farm and wearing of uniform and footwears for visitors. Educating personnel in basic hygiene and disinfection will help prevent introduction of disease agents from outside sources.

d) **Feeding feed refusals to calves should be avoided:** Adopting stringent environmental friendly waste disposal measures can help strengthen the bio-security measures.

e) **Proper disposal of carcasses should be strictly maintained in the farm:** Following disease or deadly injury, dead animals should be buried, composted or burned.When unusual deaths of animals occur, veterinary services should be informed so that they can take immediate actions to control any outbreak of disease. Local authorities must prevent and control the illegal trade of dead animals, which could have a serious impact on consumers' health and confidence in pork products.

f) **Immunization & Vaccination**

Calves should be vaccinated 3-4 weeks before grouping. When using killed vaccines, the booster dose should be given 3-4 weeks before grouping. Vaccination before a disease outbreak occurs and quarantines all new arrivals and observes them for 30 days.

g) Breeding and replacement heifers and bulls should be immunized when 6–8 months of age, before breeding, and yearly thereafter. Purchase animals from diseases free herds/location. Use boar semen from disease free sources

h) **Properly planning the farmimg facilities :**

- Zoning and compartmentalization are disease management strategies which help in bio-security plan. Establishing disease free zones with neighbouring backyard farms

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- Establish animal populations with distinct health status, based on effective separation of populations of different status and application of biosecurity measures to prevent the introduction of infection.

Conclusion

Proper planning and maintaining appropriate up to date records help in keeping diseases at bay in smooth functioning of farms. The salient features of bio-security measures that are mentioned in the above article will help in formulating appropriate bio-security measures.