

Biosecurity Principles for Livestock Producers

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This NebGuide discusses how to develop a biosecurity plan to protect livestock from disease.

Biosecurity is action taken to prevent the transmission of disease. Biosecurity may be applied regionally, between herds, or within herds. It is overlooked in many livestock operations.

“Risk” Management Instead of “Risky” Management

Successful biosecurity plans manage the **risk** of disease transmission. Risk is the likelihood of an uncertain event or hazard occurring. Factors that change a risk are called **risk factors**. For example, if we blindly walk through an intersection we risk being struck by a car. By looking both ways before crossing we can reduce our risk of being struck by a car. Not looking both ways before crossing the intersection is a risk factor for being struck by an automobile. Risk factors don’t guarantee the outcome, but they are good predictors of what to expect. It is possible to look both ways before crossing and still get hit by an automobile, or you may cross blindly and not get hit. But, in the long run, fewer people will be hit by automobiles if they look both ways before crossing.

Some risk factors increase, and others decrease the risk of something happening. For example, adding purchased livestock may increase the risk of disease for the main herd; providing a sound nutrition program may decrease the risk of some diseases. In a biosecurity management plan we identify risk factors which can be controlled, then minimize the factors that increase the risks for disease transmission and maximize the factors that decrease the risk.

The risk factors for infectious diseases are either related to the host animal (livestock), the agent, or the environment that puts them in contact. Host factors are those risk factors related to the ability of the livestock to resist infection. Agent factors are those factors related to the infectious agent’s ability to invade the host or cause disease. Environmental factors are those risk factors about the environment that put the agent into contact with the host.

The Components of a Biosecurity Plan

The goal of a biosecurity plan is to reduce the risk of disease transmission. Regardless of the disease, there are just three principles to be addressed in any biosecurity plan:

1. Increase the animal’s ability to resist disease;
2. Minimize the number of contacts that might result in disease; and
3. Eliminate sources of the infectious agent.

Increasing the animal’s ability to resist disease.

Resistance may mean being resistant to infection with the agent, or being resistant to disease after infection. The distinction between infection and disease is important. In some circumstances we are most concerned with disease; infection without disease may not be important. Other times we worry about the presence of animals that are infected but not sick, because these subclinically-infected animals may spread the agent to other animals or may become sick themselves at another time. Resistance to disease may be nonspecific, meaning that the animal is in good enough health to generally fight infection; or specific, because its immune system is prepared with antibodies to defend against a particular disease agent.

Vaccines are designed to increase an animal’s resistance to specific diseases. **Vaccination** is the act of administering a vaccine; **immunization** is the protective response to the vaccine we hope to stimulate within the animal. Immunization means the animal has immune system components on the alert for specific pathogens. Immunization may reduce the likelihood or the severity of illness but may not prevent infection. Unfortunately, many producers, and some veterinarians, place all of their faith in vaccination and do little to manage other important risk factors. Vaccinated animals may still get sick because pathogens different from the vaccine were involved, because the immune system was overwhelmed by the infection, or because the vaccinated animal failed to develop a protective immune response. Vaccination programs, as part of a strategic health plan, supplement other disease control procedures, but do not replace them.

Minimizing the number of contacts that result in disease. Not every animal exposed to a disease agent becomes infected or diseased. Sufficient exposure to result in infection or disease is called an **effective contact**. Effective contact may depend on the length of contact time or the number of agents transferred. The number of effective contacts can be reduced by physically separating animals, or reducing the dose-load of organisms transmitted during contact. Methods of physical separation include quarantine of animals; segregation, often by age or class of animal; or dilution of the number of animals over a large geographical area. The dose-load of some pathogens can be reduced by the use of preventive medications and good hygiene.

Eliminating sources of the infectious agent. Reservoirs of infection are animals or objects that the agent depends on for survival; including, but not limited to, other livestock, birds, insects, rodents, people, manure, soil, surface water, water tanks, feed, and feeding equipment. Infectious agents may reside in carrier animals that are infected, but may not show signs of disease; or they may survive in the environment waiting to be transmitted to the susceptible animals by direct or indirect contact.

To eliminate the reservoirs of infectious agents we must know where the agent survives and how it makes contact with the host. The ecology of the production system must be understood to know where potential reservoirs exist on a farm. For some diseases, test and cull strategies are used to remove carrier animals from a herd. It must be possible to accurately determine an animal's infection status for this method to be effective.

Costs Versus Benefits

The benefits of controlling risks must be weighed against the costs. If a spray was developed that could greatly reduce your risk of being stepped on by an elephant, would you buy it? Except for zoo workers, most of us are probably willing to accept the low risk we have of being attacked by elephants. So even if the spray really did prevent elephant attacks, its benefits probably do not outweigh its costs. The cost of controlling risks need not be in monetary terms; for example the elephant spray may cause severe itching, or maybe it causes cancer. Even when there are real benefits to reducing a risk, the costs to do so may still be too great. Biosecurity must be managed so that the costs associated with controlling disease are not greater than the damage done by the disease.

Summary

The biosecurity principles are simple and few, but how they are applied may be the difference between success and failure. If livestock producers are concerned about disease transmission in their herds, then biosecurity management can pay big dividends. Effective biosecurity management requires an assessment of what the effective control points are, the means to implement those control points and knowledge that the benefits to animal health and performance outweigh the costs. Biosecurity strategies may include practices such as vaccination, quarantine and segregation, and strategic diagnostic testing. Consult with your veterinarian about how to implement biosecurity in your operation. For many livestock producers, biosecurity remains a management niche yet to be filled.

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