Biosecurity At All Levels

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Biosecurity, oddly enough, a word that is not found in the dictionary, involves a comprehensive range of management procedures to limit the introduction of infection into a poultry operation. The extent to which biosecurity measures should be imposed depends on the disease prevalent in an area. Risk of infection is determined by the outbreak frequency of these diseases, which in turn is influenced by the population density, reservoirs, vectors and movement of flocks and people. Practical factors also influence the risk of infection.

In developing a suitable biosecurity program it is necessary to analyze the various methods by which diseases can be transmitted. Infections such as lymphoid leucosis, Salmonella pullorum and mycoplamosis can be transmitted by the vertical route. Most avian pathogens are spread by more than one route. Viral respiratory infections, such as Newcastle, laryngotracheitis and infectious bronchitis can be transmitted over distances of up to 5 kilometers by wind dispersal of virus laden dust particles. Maintaining solid levels of immunity in flocks reduces the probability that a pathogen introduced into a population will multiply and exceed the outbreak threshold.

Besides poultry infectious diseases the broiler and egg industry of today, is under increasing consumer and regulatory pressure to guarantee food safety and meet export requirements. As a result, broiler operations and leghorn facilities around the world require the supply of breeding stock free of salmonellas specific to avian species (such as *S. pullorum* and *S. gallinarum*) and those that could cause outbreaks of human food-borne illness. For this reason the ultimate goal is the eradication of all salmonellas from every level of the U.S. and International breeding program. We would all like a quick fix to solve this problem but a quick fix does not exist. There is abundant information available in scientific and trade journal on the topic of salmonella control in poultry. They all involve common sense and hard work.

The major emphasis for preventing infections is to avoid the introduction of pathogens into the farms (ILT), hatcheries Mg) and feed mill (Salmonella). This requires the establishment and implementation of biosecurity practices aimed at suppressing the most common sources of pathogens. These practices should be simple, cost-effective and reviewed regularly in accordance with the challenge situation and the resources available. A comprehensive-integrated biosecurity program must be established as a team effort and through a complete understanding of the goals at all levels of the company. To be effective, every employee must know that it is part of his or her job to prevent exposure to diseases such as Salmonella, and their vertical and horizontal spread following an infection. A comprehensive farm biosecurity program includes some of the following practices:

A comprehensive Biosecurity program for poultry farms incorporates a series of protocols and standard operational procedures aimed to limit or eliminate the risk of exposure to organisms that can affect poultry health and or embarrass food safety measures (Salmonella). In order to achieve this goal it is important to identify and prioritize the potential sources of the organisms and then design, put in writing and implement specific practices that will prevent their introduction and spread. These protocols should include;

Objective: Prevent the introduction of disease organisms into the chicken flock. (Salmonella species, a working model)

- Requirements for the location and layout of the farm
- Requirements for house construction (ease of
- Routine monitoring of the flocks' health status
- Proper disposal of dead birds
- Proper litter management and

C&D and to limit access of people, pests, etc.)
- No contact-proximity to any other poultry or back yard flocks
- Requirements for employment and contract growing
- Restrictions and/or regulations for farm visitation
- Restrictions to avoid contact with other avian or animal species
- Regulations for the movement of personnel and equipment according to the age and health status of the flocks
- Regulations for the approval of visitors and outside service personnel
- Regulations for personnel hygiene

disposalRequirements and monitoring of bedding material
- Decontamination and monitoring of company vehicles
- Poultry house cleanout and disinfection procedures
- Water management, sanitation and monitoring procedures
- Regulations for the movement of flocks and spent fowl
- Pest control
- Requirements for feed hygiene and transport

Realistically it is not possible to establish a single Biosecurity program that will be suitable and cost effective for every primary or broiler producing operation. Therefore, it is important to acknowledge that challenge levels, sources of infection, management philosophies, company goals, consumer demands, resources available and commitment to a control program are different in every company. The question that is frequently asked is how much is enough? The answer depends on the value of the flocks, short and long-term company goals, customer expectations, level of commitment and, of course, resources available. An integrated-comprehensive approach does have a significant cost. It requires constant and gradual improvements, routine evaluations, and periodic employee and growing contractor education and training. Ultimately, these tasks and associated costs must be offset by the benefits of meeting the increasingly higher quality/health standards of the producers and consumers of broiler meat products.

Farm Location Construction

- It is best to build the farm in an isolated area, at least 1.6 kilometers (1 mile) away from the nearest poultry or other facility that may contaminate the farm.
- Build the farm away from major roadways that may be used to transport poultry.
- Fence the perimeter of the farm to prevent unwanted visitors.
- Test the water source(s) for mineral, bacterial and chemical contamination.
- The design and construction of the broiler house should prevent wild birds and animals from entering the building. All openings should be covered with 2.0 cm (3/4 inch) plastic coated poultry wire. It is preferable to have a concrete foundation and floor to prevent rodents from burrowing into the house.
- Clear and level an area 15 meters (50 feet) around all houses so that vegetation can be cut quickly and easily.

Preventing Diseases Transmitted by Humans

- Minimize the number of visitors to the poultry farm by locking the entry gates and posting no trespassing/no visitors signs.
- If supervisory personnel must visit more than one farm per day, they should make an effort to visit the youngest flocks first. Always visit flocks with disease problems last.
- All persons entering the farm should follow a Biosecurity procedure. The requirement that all workers and visitors shower and use clean farm clothes is one of the best procedures to prevent cross

contamination between facilities. If this is not possible, all workers and visitors should put on clean coveralls and boots upon arrival at the farm.
- Maintain a record of visitors, including name, company, purpose of visit, previous farm visited and next farm to be visited.
- When entering and leaving each poultry house, workers and visitors must wash and sanitize their hands and boots.

Preventing Diseases Transmitted by Animal

- Whenever possible, place the farm on an "all in/all out" placement cycle. Multiple age chickens on the same site provide a reservoir for disease organisms.
- Downtime between flocks will reduce contamination of the farm. Downtime is defined as the time between completion of the cleaning/disinfection process and placement of the next flock. A minimum downtime of 2 weeks between flocks is recommended.
- Keep all vegetation 15 meters (50 ft) away from the buildings to provide an entry barrier to rodents and wild animals.
- Keep all equipment, building materials trash picked up to reduce cover for rodents and wild animals.
- Clean up feed spills as soon as they occur.
- Store wood shavings and rice hulls for use as litter material in bags or inside a storage building or bin.
- Keep wild birds out of all buildings.
- Maintain an effective rodent control program. Baiting programs are most effective when followed continuously.
- Use an effective integrated pest management program to control pests through biological, mechanical and chemical means.

Rodent and Pest Control

Rodents are major vectors and reservoirs of *Salmonella spp*. for poultry flocks, especially *S. typhimurium* and *S. enteritidis*. Mice naturally infected with *S. enteritidis* can excrete at least 200,000 organisms/pellet. Besides amplifying the concentration of salmonellas in the environment, rodents can effectively transmit the infection to other houses and farms. Consequently, a biosecurity program should prevent rodent access to feed, water and shelter by:

- Building requirements to make facilities rodent proof (metal doors and concrete floors)
- Eliminating potential harborage inside and outside the poultry houses (high grass, shrubs, garbage, broken equipment, burrows, etc.)
- Prompt and secure disposal of dead birds and unused/spilled feed
- Appropriate house management and sanitation
- Regular inspections for pests
- Rodent baiting and trapping

The control of insect vectors (flies, beetles, ants, cockroaches) through good management practices, biological control and the careful selection and use of pesticides are also essential. Darkling beetles (*Alphitobious diaperinus*) have been found to carry over five different serotypes of Salmonella and shed *S. typhimurium* in their droppings for up to 28 days. During the last few years we have found that darkling beetles are one of the main vectors in returning salmonellas to the chicken house after it has been cleaned and disinfected. Furthermore, both beetles and flies can fly more than a mile, introducing salmonellas into farms in their path.

It is important that producers be aware of the biological, environmental, food-safety, welfare, occupational-safety and regulatory issues dealing with rodent and pest control products. Training of farm personnel through

the periodic assistance of poultry integrated pest management specialists is a growing trend in the animal food industry. In fact, this has evolved into integrated pest management programs (IPM) in which different methods are combined to maximize control for the long-term.

Wild Life, Pets and Other Farm Animals

All warm and cold-blooded animal species are potential carriers of *Salmonella spp*., and can introduce them to a breeder operation. This is why poultry houses should be constructed to exclude the entrance and perching of birds inside and outside (roof, eves) as well as any other type of animals. Feed spills outside should be cleaned up at once to avoid attracting any wild life. Monitoring procedures have shown the presence of salmonella in the droppings of raccoons, skunks and opossums. Any other kind of farm animals and pets (dogs, cats, etc.) should be banned from the poultry house and around the perimeter of the farm as much as possible. The use of cats as biological means of rodent control is a practice that has been completely eliminated at the primary breeding level. Cats kept from one flock to the next can serve as carriers of salmonellas and *Pasteurella multocida* (agent causing fowl cholera). Dairy and beef cattle are known to be common carriers of *S. typhimirium,* and *S. newport* among others. Therefore, fencing around the perimeter of the poultry farm has become a necessity to minimize the risk of exposure to salmonellas from cattle. Experiences with salmonellas and *Campylobacter jejuni* (another human enteric pathogen getting increasing attention) have demonstrated the high risk of allowing cattle to graze inside the poultry farms and/or in-between chicken houses.

Water Management

Drinking water can be another source of salmonella for the commercial poultry operation. Recent studies in effluent from sewage treatment plants and the monitoring of individual wells and municipal water sources have shown the presence of *Salmonella spp.* Chlorination (3-5 ppm) and other new methods for treating water are becoming increasingly popular.

It has been documented that water activity in the litter greatly affects the level of salmonella in a house. Increased moisture levels promote the survival and transmission of salmonellas. Water restriction programs, as well as the use of closed drinking systems, have been shown to reduce moisture and the incidence of salmonellas in the poultry environment.

Education, Training, Hiring and Contract Growing

Many individuals such as managers, flock supervisors, contract growers, farm employees, vaccination and monitoring crews, veterinarians and others are involved in a primary breeding operation. All individuals, with no exceptions allowed, must follow the biosecurity program on a daily basis. This is another reason why following and implementing the established biosecurity practices must be part of everybody's job. The first step to achieve this goal is to establish a program in detail and in writing that is easily understood by all parties involved.

Again, good biosecurity practices require both personal and financial commitment. For all the above reasons, the program should be set and practiced as a team effort. It is imperative to understand that while the enforcement of a biosecurity program should be rigid, the program itself should never be "set in stone". Constant review and updating are necessary for its success. Individuals should be encouraged to ask questions and offer suggestions for continuous improvement of the program. Goal setting, training and review sessions with all participants must be conducted periodically. Top management must recognize and reward participation and adherence to the program. Visitors and outside suppliers must also be informed and educated on the goals of the operation and on the requirements for visitation.

Quarantine restriction periods (3 to 5 days) since visitation of other poultry companies must be mandatory for all individuals visiting a primary breeding facility. Similarly, primary-breeding employees must follow the same

quarantine restrictions when visiting farms at different levels of the breeding program or after visiting poultry facilities outside the company (poultry facilities). Flock technical supervisors should visit farms starting from younger to older birds and based on salmonella status. In order to conduct objective evaluations at the farm level, it is helpful to develop questionnaires with numerical scores covering areas of biosecurity and management.

Mandatory participation in all aspects of the biosecurity program is a condition for hiring and establishing growing contracts. In this regard, it is critical to state clearly and in writing that failure to follow the established practices or that breeches in the execution of the biosecurity program can result in termination of employment or contract growing agreements.

House Cleanout and Disinfection

House cleanout and disinfection procedures are an integral part of the biosecurity program. These procedures are required between growing cycles to eliminate or minimize the concentration of salmonellas and other poultry pathogens that may infect subsequent flocks. Young baby chicks are extremely susceptible to salmonella infections after hatch and during the first days of life. Likewise, pullet flocks transferred from growing to laying facilities tend to be highly susceptible to salmonella infections. This is, presumably, due to stress and changes in their normal gastrointestinal flora. As new flocks arrive at the farms it is important that their environment be as clean as possible. Bacteriological monitoring of new litter material has proven to be valuable in avoiding the introduction of salmonellas as well as mold species such as *Aspergillus spp*. Most primary breeders prefer litter material that has been heat-treated and transported in clean and disinfected vehicles.

The first step is to plan a flock placement schedule that allows sufficient down time for all poultry houses in the operation to be cleaned. A minimum period of 4 weeks for pullet houses and 6 weeks for laying houses is needed in order to conduct thorough cleaning and disinfection, and repairs and maintenance. A complete house cleanout and disinfection schedule usually includes the following procedures:

- Insect and rodent control
- Litter removal and disposal
- Washing using a high pressure washer with hot water and detergent
    - Ceiling
    - Walls
    - Curtains
    - Feeders, drinkers and other equipment
    - Concrete floor from back to front
- Cleaning of external areas
- Repairs and maintenance
- Inspection and securing of the farm
- Disinfection (inside and outside)
- Fumigation
- Bacteriological monitoring for salmonellas
- Laboratory approval ("passing" status before re-stocking)
- Placement of new bedding material
- Litter treatment

Education and training of specialized crews are needed so they can develop an attitude that these procedures are designed to sanitize a "food producing facility" instead of "just another chicken house". Attention to detail must be emphasized in order to meet the objectives and avoid failures or having to repeat some steps in the established schedule.

Careful planning of each stage; preparation of the houses; selection of suitable detergents and disinfectants and application methods are needed to eliminate salmonellas and other pathogens, and to make these procedures cost effective. Since detergents and disinfectants can be harmful to animals, humans and the environment it is important to use only approved products (EPA) and follow health and safety (OSHA) regulations.

Interventions for Salmonella Control

It is known that a healthy intestinal flora naturally protects chickens against the colonization by salmonellas and other pathogenic bacteria of their intestinal tract. However, this phenomenon is delayed when chicks are hatched and placed in clean environments. Consequently chicks are not exposed to healthy intestinal flora that in nature will come mostly from their parents. The use of defined and non-defined avian gut flora (competitive exclusion) has shown to be a valuable aid in helping chicks to establish a normal flora and protect them against salmonella infections. Other bacteria such as *Lactobacillus acidophilus*, among others (probiotics or direct-fed microbials), have also been used to maintain a healthy intestinal flora. These methods used to manipulate the intestine's micro flora are becoming increasingly important since a ban on the use of subtherapeutic doses of antibiotics has become a reality in many countries around the world. The use of essential oils, carbohydrates, herbs or spices (naturally occurring substances or nutraceuticals) is being investigated as potential alternatives to prevent colonization.

Inactivated salmonella vaccines have also shown benefits, as the induction of immunity in the hens against specific salmonella serotypes prior to the onset of egg production, help to reduce of the risk of vertical transmission. More recently, a few live salmonella vaccines (deletion mutants) have become commercially available to protect against specific salmonella species by reducing the risk of colonization, persistence and spread of pathogenic-field strains.

These interventions are aids but, particularly for the primary breeding companies, cannot be a substitute for a sound integrated-biosecurity program aimed to limit or eliminate exposure. It is hoped that further work on these interventions will improve our ability to manipulate the microflora in the intestines of domestic poultry and that vaccines will induce a safe and better spectrum of immunity against multiple salmonella species without interfering with bacteriological or serological monitoring procedures.

Conclusion

The implementation of an effective integrated-biosecurity program that prevents salmonella infections will protect the value of the capital invested and contribute to customer satisfaction and the profitability of a primary breeder operation. Salmonella, like other pathogens, is "a management disease" since its control depends largely on controlling the sources of infection and the factors that favor its spread. Disease control can be achieved by committing to the goal, providing resources, establishing objectives, and promoting active participation by all individuals involved in the poultry operation. An effective biosecurity program is never static. All practices included must be regularly reviewed and updated. To be effective a biosecurity program must follow under the principles of on-farm HACCP. Simply, write down what you do, do what you write down and PROVE IT. Present options for intervention and future developments in this area may offer additional and safe complements for the ones biosecurity program.

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