The benefits of good vaccination techniques for poultry protection

The main goal of vaccination is to provide protection against a certain disease without outbreak of this disease. To reach this goal, the antigen in the vaccine has to activate the immune system of the bird, stimulating induction of protective immunity via antibodies and killer cells and also formation of memory cells for long term protection.

by Luuk Stooker, Zoetis.
zoetis.com

In ovo vaccination with the Zoetis Embrex Inovoject system.

For the bird to develop a good immune response, a lot of different factors are of importance. One of these factors is a good administration technique.

One way to classify different vaccination techniques is by their possibility or impossibility to individually control the dose. Methods that allow individual dose control include in ovo vaccination, subcutaneous or intramuscular injection, eye drop and wing web. Methods without dose control include delivery through drinking water or via spray application.

Although historically successful, mass vaccination techniques have challenges that are important to recognise to make the best choice for maximising efficacy.

Drinking water

The advantages of mass vaccination through drinking water include low labour costs, minimum bird stress and good oropharyngeal mucosal immune stimulation.

Disadvantages of drinking water vaccination include inconsistent vaccine dosage as vaccine dosage is dependent on water consumption of each individual bird. Temperature-sensitive vaccines like IB vaccines run a higher risk of damage. Bad water quality or additives in the water might interfere with vaccine efficacy.

The general perception of mass vaccination through drinking water is that it requires less labour than other methods. But this is neither the simplest nor the fastest vaccination method if the objective is to achieve a high level of efficacy.

To help ensure fast administration of vaccine, drinking water should be withdrawn for 1.5-2.0 hours prior to vaccine administration. The vaccine solution should be consumed for two to three hours, divided into two sessions. For the first session, apply two-thirds of the vaccine solution. For the second session, apply the remaining one-third of the solution.

To help protect vaccine integrity, suspend water chlorination, antibiotic application and acidifiers in water at least 24 hours prior to adding vaccine to the water. Water drinkers should be cleaned before vaccine solution is loaded into the system. The water lines should be clear of biofilm.

Adding nonfat powder or fluid milk to vaccine solution helps protect vaccine efficacy. Additionally add dye to assess the success of your vaccine application. Check 50 birds from each corner of the chicken house. At least 90% of the birds should have blue dye on their tongues or blue-stained crops.

Practice by simulating vaccination with dye and audit your technicians.

Spray

Spray application is a delivery system for live vaccines mixed with water. Under the appropriate pressure, the vaccine solution will generate droplets suspended in the air that will impregnate the birds' mucosae, infecting the vaccine virus target cells.

This vaccination procedure can be used in hatcheries with spray cabinets or on farm with (automatic) spray devices.

Spray vaccination allows for a large number of birds to be vaccinated at low cost in a short period of time.

Larger droplets target the upper respiratory tract and conjunctiva. Aerosol spray targets the lower respiratory tract, including lungs and air sacs.

The amount of pressure plays a major role in droplet formation and size. As pressure increases, droplet size decreases.

Another important factor to consider with spray vaccination is nozzle type. The type of nozzle determines droplet distribution. With small droplets, it is better to concentrate them to avoid evaporation before droplets reach the animal. With large droplets, nozzles that apply spray in a wide cone provide maximum coverage.

Environmental conditions can affect spray vaccination. Evaporation speed is related to relative humidity. For example, a droplet that is 50 microns lasts five seconds in 50% relative humidity and 62.5 seconds in 95% relative humidity.

Evaporation also causes water impurities which increase the risk for vaccine inactivation.

Some general considerations for spray

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vaccination include the use cool or cold water. Turn ventilators and/or heaters off. This allows the vaccine to stay in the environment longer and increases the relative humidity. In hot weather conditions, vaccinate in the morning.

Dim the lights during spray application but do not switch them off. A lower titer response has been associated with lights switched off, likely because of lack of contact between droplets and eyes when closed. The Harderian gland in the eye is of importance for the primary immune response after vaccination.

Eye drop

Vaccine application via eye drop assures a consistent vaccine dose and uniform application to every bird, promoting a local immune response where respiratory viruses usually replicate. It is one of the most effective means of vaccine administration.

Due to its uniform vaccine delivery in the flock, it decreases the risk of rolling vaccine reaction.

A drop of 0.03ml is considered effective. It is important to wait a few seconds after the vaccine is dropped before releasing the bird. Eye drop is however a very labour-intense procedure and not always done correctly when high numbers of birds need to be vaccinated.

To prevent the vaccine from becoming warm in the operator's hands, it is advisable to use two or three droppers and alternate between them keeping the non-used bottles in a cooler with ice packs.

Injection

Subcutaneous or intramuscular injection is used for either modified live or inactivated vaccines. Be careful with simultaneous injection of different vaccines.

Combining two inactivated vaccines potentially increases the risk of tissue reactions due to increased volume of adjuvant. Combining inactivated vaccines with lives can negatively affect viability of the live vaccine.

Further to that homogeneity is questionable for the least when considering mixing an aqueous (live) vaccine with an inactivated oil vaccine.

Most mechanically assisted vaccine delivery devices have been designed for subcutaneous injection in the chicken's neck. Needles should be replaced several times throughout a day of normal operation to minimise contamination carry-over and bent or blunt needles should be replaced immediately.

Usually, vaccine delivery devices do not have a built-in disinfection mechanism that can be applied during operation.

Because birds must be taken in hand, stress is a well-known disadvantage.

Wing web

Wing web vaccination is used mainly to apply live pox vaccines.

For vaccine application, a two-needle lancet is dipped in reconstituted vaccine. Vaccine finds its way in the needle grooves, and then the lancet is stabbed through the chicken's wing web.

Other vaccines administered in conjunction to fowl pox will replicate on the adjacent tissues or will be transported via the bloodstream into the bird where they will target the appropriate cells for infection and replication.

To assess successful wing web vaccination, a local reaction, also called a granuloma or 'take', should be distinguished at the injection point seven to ten days after vaccination.

Select a random sample, 50 to 100 birds, throughout the chicken house. At least 90% of the vaccinated birds should show a granuloma.

In ovo

In ovo vaccination is the procedure of delivering vaccine to the embryo inside an egg during the late stage of development. Specific sites within the egg where vaccine is capable of stimulating an immune response are targeted.

There are five different compartments inside the embryonated egg that can be reached with a needle from outside. These compartments include the air cell, allantois, amnion, yolk and the embryo body. The amniotic fluid and the embryo body are the two most effective sites for vaccine delivery to stimulate an immune response.

In ovo vaccination offers some advantages, including automated delivery to individual eggs while delivering to many eggs at once; accurate vaccine volume and gentle dispensing; fast processing (up to 70,000 eggs per hour); and disinfection of needles after each application.

Other possible advantages compared to conventional subcutaneous injections are early protection, better bird performance as well as decreased labour costs and with that less reliability and availability issues.

Some of these advantages depend on the brand of the device. All advantages named above are known advantages of the Zoetis Embrex Inovoject system.

To choose the best vaccination technique, you will need to know which application method will be most suitable for the vaccine you will use. Know the advantages and disadvantages of each different vaccination technique, educate and audit your technicians and take your time.

Good vaccination technique will give your birds better protection. ■

References are available from the author on request