Successful vaccination for disease control in turkeys

A good vaccination programme, along with proper flock management and stringent biosecurity, plays a key role in the health and productivity of turkeys, whether it is breeders or commercial birds. Many infectious diseases are difficult to control by biosecurity alone.

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Vaccination can play an important role in keeping these under control. Vaccination is carried out to either protect the actual birds from morbidity and mortality, to protect the progeny during its first weeks of life whilst they are not fully immune competent and are not yet protected by their own vaccinations, or to protect the egg laying process against egg production drops and egg shell quality issues.

The use of vaccines has been shown to lessen the effects of certain diseases – most commonly related to bacteria or viruses – by giving the birds resistance to the related pathogen. However, the success of vaccination depends on a number of factors which will be covered in this article.

A vaccination programme needs to take local regulations, regional disease situations, the type of bird, its age, and the specific disease situation of the flocks to be vaccinated into account; and the programme needs to be tailored accordingly. Vaccination should not be used as a tool to compensate for low levels of biosecurity or poor stockmanship but must be part of a fully integrated approach.

This article gives a brief overview on some aspects of vaccination: the most common types of vaccines used, their administration, and monitoring of immune response.

Example of a spray vaccination tool with spinning disc: Ulvavac.

Types of vaccines

Different types of vaccines are available for use. The two main types used in vaccination programmes for turkeys are live and killed vaccines which can contain bacterial or viral antigens.

Live vaccines

Attenuated and unattenuated live vaccines are used. In attenuated live vaccines the pathogen has been made less virulent by some suitable means. Unattenuated live vaccines will generally contain a less virulent, 'milder', strain of the pathogen. Live vaccines deliver lower doses of antigen as the antigen will multiply in the target organ.

This can define the route of application of the vaccine, delivering it to the target organ to establish local immunity. Examples would be the respiratory tract for TRT (turkey rhinotracheitis or avian metapneumovirus (aMPV)) or the intestine for HE (haemorrhagic enteritis). Most commonly live vaccines are administered by spray (aerosol) or via drinking water, but eye drop and injection methods also exist.

Inactivated vaccines

Inactivated or 'killed' vaccines consist of two components, a liquid and adjuvant phase, which are blended into a solution called emulsion. The liquid phase contains the inactivated (killed) antigen and the adjuvant generally enhances the bird's response to the antigen. The antigen can be part of the bacteria or components of it. In the case of the adjuvant, either aluminium hydroxide or mineral oil are commonly used.

The level of antibody response and subsequent immunity is dependent on the level of tissue reaction and the antigenic concentration of the vaccine. Inactivated vaccines contain a high concentration of antigen as the antigen will not be able to multiply as in live vaccines and can consist of one (monovalent), two or more (polyvalent) different antigens against various diseases.

This type of vaccine must be injected into each individual bird. The use of polyvalent vaccines reduces animal handling resulting in better welfare. Overloading a vaccine with too many different antigens can, however, make it ineffective.

Autogenous vaccines

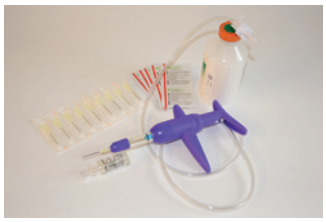
If registered vaccines are not available or are no longer effective, the use of autogenous vaccines which are specifically designed for the individual operation, most commonly involving bacterial infections, can be a good tool to minimise the impact of the pathogens specific to a farm, where needed.

The strains of a pathogen causing concerns in an individual flock are selected. It is important to monitor the disease situation in the flock regularly, in order to notice possible changes in the pathogen spectrum and consequently to adapt the autogenous vaccine. Mono- and combination vaccines are in use. They belong to the group of inactivated vaccines and, as such, must also be injected into each individual bird.

Vector vaccines

Vector vaccines use a technology where another organism – the 'vector'– is used to deliver a vaccine's active component to the bird. The vector is typically an apathogenic virus or bacterium, which has been modified to carry only a fragment of the target disease pathogen.

When the vector replicates in the vaccinated bird, it will complete its normal life cycle and at the same time will express the fragment of the pathogen's DNA (to produce an antigenic structure) which then stimulates the protective immune response in the bird without subjecting it to the whole pathogen.



Giving set for inactivated vaccines: syringe with fixed volume and optional needle guard.

Vector vaccines can avoid unwanted vaccination reactions as the pathogen is not included as a whole. There is little risk of adverse reactions and no reversion to virulence. Vector technology also enables the creation of multivalent vaccines: most vector products protect against at least two diseases, thus reducing vaccination efforts and bird handling.

In some diseases where maternal antibodies in the poults interfere with classical vaccines, vector technologies have been used to overcome this challenge. This can make vector vaccines particularly suitable for hatchery vaccination (in-ovo or day-old birds).

Key points of vaccination

A few rules should be followed to ensure that vaccination is as efficient and effective as possible. Vaccine should only be administered by trained personnel who have full knowledge of the correct techniques.

Planning and sourcing

A vaccination schedule plan should be drawn up with a veterinarian reflecting local legislation and disease challenges. Vaccines should only be sourced from licensed providers to make sure that the

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vaccine is of good quality and handled correctly. Further points to take into consideration are the type and age of the bird, the dose to be administered, and whether the birds could be immunosuppressed.

Depending on the route of administration additional equipment must be sourced.

Handling

It is very important that the cold chain is uninterrupted from manufacturing until administration. Vaccine should be stored in a dedicated fridge at the recommended temperature – most often at 2-8°C but this can vary depending on the type of vaccine (some might require storage in liquid nitrogen), and a minimum/maximum thermometer should be used to check the temperature.

Water quality and hygiene

The vaccine will not be effective or will be killed if the water contains chlorine or other disinfectants. The chlorine in the water should be neutralised by using commercially available products which are used in the birds' drinking water system in order to de-chlorinate the water.

These products often contain a food dye which allows the efficiency of drinking water vaccination to be evaluated once it has been completed. It enables distribution in the water system to be seen and vaccine administration can be monitored due to staining of the tongues of the birds.

Where these products are not available, water can be treated with a low fat milk solution (2g of skimmed milk powder per litre of water). Neutralisation of the chlorine must take place at least 20 minutes before the vaccine is added.

Excessive biofilm in the drinker lines will also reduce the effectiveness of the vaccine. Biofilm and scale should be removed from the drinker lines using suitable products and drinkers (cups, bell drinkers etc) cleaned as part of a routine procedure at clean-out. All equipment must be clean, but the vaccine must not come in contact with disinfectant as this will kill the vaccine and make it ineffective.

Age

Unless the field challenge is high, it is advisable not to expose young birds to the aggressive effect of inactivated vaccines.

A comprehensive vaccination plan will allow for inactivated vaccines only to be given from seven weeks of age so that birds are conditioned in terms of body mass to respond to and assimilate the vaccine. Birds will better manage the tissue reaction if they are the correct age for vaccination, are on target body weight, and have good health status.

Inactivated vaccines require at least two doses for best results. Due to the reaction caused, it is recommended that the last application is given to turkey breeder hens by 26 weeks of age, thus giving the bird enough time to recover from the injection before onset of egg production. If the injections are too close to onset of egg production, the onset of lay or peak egg production could be compromised.

Methods of administration

As mentioned above, inactivated and live vaccines are administered by different methods. All methods have the objective to give every bird in the flock the correct dose of the vaccine.

Effective vaccination will provide the best possible protection for the flock from field challenges and/or provide passive protection via maternally derived antibodies to the progeny. The success of vaccination is dependent on the skill of the vaccine administrator in delivering a full dose of inactivated vaccine to each bird, and also the capability of the bird to manage the reaction. Sick birds must not be vaccinated.

Injection is the route used for inactivated vaccines, either intramuscular (i.m.) or subcutaneously (s.c.). Ideally automated syringes pre-set to a fixed dosage are used. The equipment needs to be checked regularly to make sure that there are no air bubbles and the vaccine has not separated. The needles need to be changed regularly, approximately at least every 500 birds to minimise the spread of contaminants and to make sure that the needle is not blunt, causing unnecessary lesions in the birds. Both the vaccine administrator's technique and the site chosen for injection of the vaccine can have an impact on the extent of the tissue reaction. Generally speaking, if given correctly, s.c. administration is gentler and causes less reaction compared with i.m. injection.

Mass vaccination of a flock via drinking water or spray is a simple and quick method of vaccine administration. Due to the lower level of bird handling it can have measurable benefits to bird performance over individual vaccination; such as better weight gains and uniformity. However, such benefits will only be realised through effective management of the vaccine procedure and appropriate monitoring of the birds' response to vaccination.

The aim of drinking water vaccination is for the water containing vaccine to be consumed by the flock over a period of 1.5-2.0 hours. If the time is less than 1.5 hours then not all the birds may receive a dose of the vaccine. If it is longer than two hours the vaccine may die before it is consumed by the birds. In order to achieve this aim, the amount of water that is normally consumed within a 1.5-2.0 hour period by the flock must be estimated. This can be accurately done the day before vaccination by measuring the amount of water consumed by each house, over a two-hour period, commencing 45 minutes after feeding. On the day of vaccination the water is withheld for 60 minutes prior to vaccination, so that the flock will consume more water than normal.

Drinking behaviour should be observed ensuring all birds are drinking and are receiving a dose of vaccine. The consumption rate of the vaccine should be monitored ensuring calculations are correct and that the vaccination solution will be consumed over a two hour period. Note: The vaccination solution will be consumed quite quickly at the start of the process.

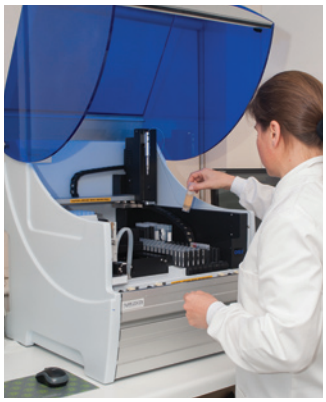
Only when the vaccine solution in the drinkers is finished should the mains water be turned back on. The vaccine must not be diluted by the addition of mains water and should be reconstituted in clean, cold water. If the water contains chlorine, water stabilisers should be used.

The other main method of mass administration of live vaccines involves application by spray or aerosol. Depending on the vaccine, knapsack sprayers or sprayers based on a spinning disk system are in use. The vaccine should be reconstituted in distilled or deionised water, not tap water, as this can contain chlorine, dissolved solids and salts, which concentrate rapidly as spray droplets evaporate and this can be harmful to the vaccine. Spray vaccination is generally more effective in a controlled environment than in open-sided houses. In closed houses, fans should be turned off with the inlets and outlets closed. The lights should be dimmed and the birds allowed to settle quietly before spraying commences.

Monitoring immune response

The ultimate goal of any vaccination program is to achieve high, uniform (low variation), and long-lasting antibody titres in a flock.

It is important to remember that just because the birds seem to have been vaccinated properly it does not mean they are protected from the disease for which they have been vaccinated. Titres which refer to the level of antibodies that the individuals have produced give an indication of how their immune system has responded. Titres can be checked using a biochemical technique called Enzyme-Linked Immuno Sorbent Assay (ELISA) which detects the presence of antibodies in a sample or via haemagglutinin inhibition (HI) test.



ELISA machine for checking antibody titres.

It can take up to three weeks for the birds to develop antibodies after vaccination or a challenge. Antibody titres should be determined by taking blood serum samples from a representative sample of the population (20 birds). These birds should be chosen at random. The amount of antibodies produced by an individual will depend on a number of factors including the method of administration. For example, drinking water vaccination provokes a stronger production of antibodies than spray vaccination.

The coefficient of variation (CV) refers to how 'similar' to one another individuals are within the population. In general, for any disease the CV should be less than 50% in terms of antibody titres.

In addition, it is also important to establish a baseline antibody response for an individual farm. This will provide the expected titre or antibody response and CV for all the diseases that the birds are vaccinated against. These baselines are generally produced by taking the average titre for the last 12 months across the entire farming base with the same vaccination programmes. If the baseline titre is different to the expected titre indicated by the vaccine manufacturer then an investigation should occur and corrective action taken where necessary.

Conclusions

By properly implementing a good vaccination programme as one of the cornerstones in a preventative health management of modern turkey production, it is possible to achieve the most productivity from the flock while maintaining good bird health.

The correct vaccination programme according to the local conditions, type of bird and careful administration are important.

Vaccination is not a substitute for a lack of biosecurity, which is another major cornerstone for disease control. ■