SPRAY VACCINATION IN THE HATCHERY

New equipment technologies, innovative vaccines and professional services: the combination for success

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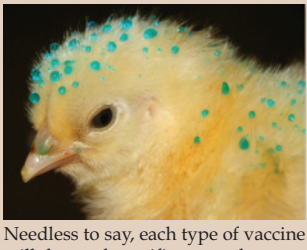
Spray vaccination of day-old-chicks in the hatchery is one of the most common vaccination practices performed worldwide. Traditionally, this vaccinating method has been selected for the mass administration of vaccines against Newcastle disease (ND) and infectious bronchitis (IB) in the hatchery, as it triggers local immunity in the upper respiratory tract and also stimulates general humoral immune response. The principle consists of bringing a live vaccine virus with tissue tropism for the respiratory system (ND,IB) in contact with the sinus and tracheal mucous membranes and the Harder's gland through microscopic droplets. Such stimulation will induce a local immunity based on immunoglobulins A (IgA).

Also, traditionally, some coccidiosis vaccines are designed to be applied via spray, in larger drops, in order to have them settle over the chicks for their subsequent ingestion. However, it is proven that new technology gel-drop coccidiosis vaccines show a better vaccination efficacy when applied in a gel-drop shape.



Needless to say, each type of vaccine will demand specific spray characteristics (droplet size, distribution pattern, targeted tissue, etc). If these conditions are not adequate for the type of vaccine applied, obviously, the vaccination efficacy index will drop. The use of the latest technology, like the innovative automatic smart in line sprayers, allows the spray vaccination to reach a higher vaccination efficacy than ever.

The initial droplet size is determined by the type of nozzles and the pressure used. This size greatly varies from the droplet's size upon impact, as the diameter decreases by evaporation from the nozzle up to the nostrils of the chick.

The smaller the droplets, the farther

they will go into the respiratory tract, therefore, the greater the immune stimulation, but also the risk of post-vaccine reaction (PVR), especially with less attenuated vaccine strains. Upon contact, droplets larger than 3µm in diameter (coarse nebulisation) will settle in the upper respiratory tract, which is desired for an initial vaccination against IB and ND. Droplets of approximately 1µm (fine nebulisation) will penetrate up to the lower trachea, the primary bronchi and the lungs, while minute droplets (0.1µm) will reach the posterior air sacs.

For vaccines with respiratory tropism, there should be the fewest possible droplets of very small size as they will either evaporate in a dry atmosphere or go too far into the respiratory tract. There should also be the fewest possible large droplets as they will fall directly on the floor or on the chicks' down before being inhaled or they will not penetrate far enough in the respiratory tract.

It is desirable to have the most homogeneous droplet size around 150–170µm at emission so as to obtain 3µm droplets upon contact with the chicks that are about 20cm from the nozzle.

The combination of the appropriate equipment, regular and professional routine quality control actions to monitor the application, and the best innovative vaccines is a must for ensuring good spray vaccination quality and, therefore, good immunisation of the chicks. In future technical articles in this series we will provide more information about these topics.

CHICK PROGRAM
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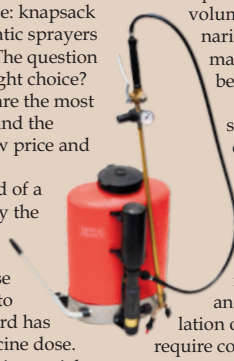
SPRAY VACCINATION IN THE HATCHERY

Choosing the right equipment for the best spray vaccination quality

William Boyer, Technical Services, Ceva Desvac Campus.

You can use the most effective vaccine; but it is worth nothing if it is not applied correctly. Among all coarse spray devices, three different categories are available: knapsack sprayers, semi automatic sprayers and in-line sprayers. The question is: how to make the right choice?

Knapsack sprayers are the most popular sprayers around the world, due to their low price and easy operation. These sprayers are composed of a vaccine tank carried by the operator and a spray-extension with nozzles Usually, with these systems, it is difficult to guarantee that each bird has received the right vaccine dose. Some knapsacks contain special components to keep key parameters under control. A simple manometer-regulator block, installed on the spray lance, allows the operator to control the pressure at nozzle level and to modify it. Nevertheless, handsprayers are only appropriate for low production volumes.



The next category, semi-automatic sprayers, is more convenient for medium production volumes. This equipment is usually designed as a standalone unit with a vaccine tank, pneumatic components, air pressure and spray vaccine systems. It is recommended to select a device with an integrated protection cabinet, to protect the spray from air drifts. The impact of environmental factors like humidity level, atmosphere pressure, etc, on spray quality should not be underestimated. The working principle of semi-automatic sprayers is as follows: The operator brings one crate on the table until sensor detection. Then, vaccine is delivered through nozzles at the defined dosage and droplet size.

The spray quality is uniform between each crate. However, semi-automatic sprayer operation is really time consuming. It takes time for the operator to correctly manipulate the crate. Semi-automatic sprayers are consequently not adapted for large volumes or high labour cost scenarios. If this is the case, automatic in-line sprayers are the best option.

Automatic in-line sprayers have been specially developed for that segment. The sprayer unit is integrated within the day-old chicks processing conveyor. High vaccination efficacy can be reached in terms of quality and homogeneity. The installation of such equipment could require conveyor engineering. Normally each crate is stopped for a few seconds while vaccination is performed. The most important drawback with this group is the lack of quality control during vaccination as operators do not normally pay enough attention to this process and, in case any mis-adjustment or equipment failure occurs, the consequences of a deficient vaccine application can be dramatic. A good indicator to check the in-line sprayer application performance is to see the amount of vaccine deposited on the floor right under the equipment.

Special care must be taken regarding cleaning and disinfecting processes for all groups of sprayers. Water is the most common basis of spray vaccines, but it is also one of the most important contamination vectors. For keeping the equipment contamination-free, equipment cleaning and disinfection processes must be strictly implemented.

Choosing the right equipment depends on your operational needs. Exploring all alternatives like new automatic smart in-line sprayers, gel vaccine applicators, new generation knapsacks or the latest technology stand alone sprayers is recommended. Focusing on equipment speed is not wise as the main purpose of these devices should be to perform high quality and high efficacy vaccination. Vaccination homogeneity, consistency and equipment reliability should be the first priority. ■

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SPRAY VACCINATION IN THE HATCHERY

How to monitor spray vaccination

Sergio Magallón Ibánez, Poultry Services Manager Western Europe, Ceva Santé Animale.

As important as choosing the right vaccine and the right strain to protect the animals from different diseases, is to guarantee that these vaccines are applied correctly.

There are three main points which need to be checked to succeed in the correct application of spray vaccines in the hatchery.

Dosage

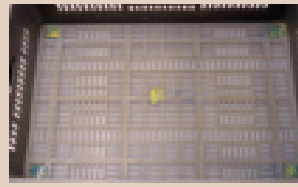
A precise volume of spray must be used for each box. This volume needs to be defined by the vaccine manufacturer and approved by the veterinarian. It is calculated according to the number of animals placed per box, therefore, it is necessary to have it monitored. Applying a higher volume would imply a waste of vaccine as well as a chance of getting the chicks wet, creating thermal discomfort. If the volume is lower than specified, then the animals will be not receiving the correct dose of vaccine and they may not be well immunised.

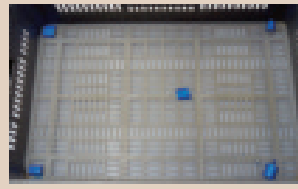
To check this volume, a metered container should be placed under the nozzles and apply several spray shots. It is necessary to do it individually in each nozzle to make sure there is an even distribution of the volume across the box. It is important to control the absence of vaccine leaks from the nozzles when not operating, since this could mean a risk of underdosing.

Spray distribution

It is crucial to reach an even distribution of the vaccine spray along the surface of the box, so all the animals are fully covered by the spray.

A quick, but not very accurate way to do this monitoring is by adding blue dye to the vaccine solution and doing a visual check on the chicks. Nevertheless, it is necessary to carry out a proper spray distribution control using empty baskets covered with paper in which the droplets can be visualised. Water sensitive papers should be displayed uniformly along the hatching basket, including the corners. This test paper will turn colour when in contact with the spray and it will allow you to see if the spray has been distributed through all the area of the baskets, where the chicks will be placed.





Droplet size

Droplets are produced by passing the vaccine solution through the nozzle under pressure. The size of these droplets will determine which part of the respiratory tract will be reached. The smaller the droplet size, the deeper they will go into the respiratory tract.

Drops sizes of 3µm diameter will arrive in the upper part of the respiratory tract. If the diameter is below 1µm, they will reach the lower respiratory tract. When the size is below 0.1µm, then they will get to the air sacs.

Depending on the type of vaccine and the strain, the target location varies. The lower in the respiratory tract, the better immunisation of the animal, but also the higher risk of post vaccination reactions.

Consequently, it is essential to know the droplet size to guarantee that the vaccination is done in an optimum and safe way. The initial droplet size is determined by the pressure and the type of nozzle, and will be then affected by external factors such as temperature, relative humidity, drift and air currents.

The easiest way to estimate the droplet size is to follow the nozzle manufacturer guidelines. Another possibility is to use water sensitive papers and determine the particle size using a microscope and specific software.

The most accurate procedure is to use laser techniques to do these measurements, although the high cost and the need of experimental laboratory conditions make it not very practical to use at hatchery level. ■

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SPRAY VACCINATION IN THE HATCHERY

Consequences of a poor spray vaccination

By Christophe Cazaban, DVM International Technical Manager – Knowledge Management, Biology Innovation Strategy Department, Ceva Sante Animale, France.

Spray administration technique is widely used by the poultry industry mainly to vaccinate chickens against viral respiratory diseases (infectious bronchitis, Newcastle disease, and avian pneumovirus).

It targets the stimulation of the immune system from the upper respiratory tract. It is also used to deliver Coccidiosis vaccine where the goal is to get the vaccine oocysts ingested to activate the immune response in the gut.

Spray vaccination can be done either in the hatchery or on the farm with different kinds of sprayers.

However, if improperly managed it is not always synonymous of efficacy (immune stimulation and then, protection) and can even lead to vaccination failure for two main reasons.

The first reason is the uneven vaccination coverage of the birds: only a part of the birds get the vaccine dose properly, whereas another part of the same batch of chickens do not get a full dose or even worse do not get any vaccine at all.

This will occur in the case of poor maintenance of the spray device, or poor management of the technique itself.

This may lead to the so-called 'rolling infections', when immunised birds start to shed the vaccine virus to contacts that are fully susceptible and that are later on showing an exacerbated reaction. This is particularly well described in the field with any vaccination against respiratory disease in several parts of the world.

Another consequence is the undesired persistence of a vaccine strain in the field (for example, laryngotracheitis) with its subsequent 'warming up', or its apparent disappearance and resurgence (for example infectious bronchitis).

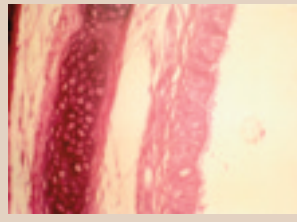
Another reason for failure is due to the development of respiratory Post-Vaccination Reactions (PVR). This can be met when too aggressive vaccine strains (for example, pneumotropic Newcastle live vaccine strains, like LaSota) are used in highly susceptible birds, like day-old chicks and/or using a too small droplet size.

Such strains are actively replicating in the respiratory tract and they can induce some damage (see photographs below).

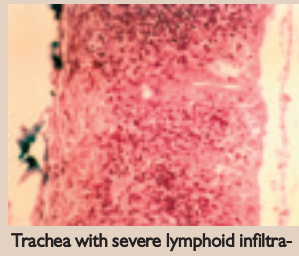
This can be worsened in case of contemporaneous Mycoplasma gallisepticum contamination. It is important to remember that even using a well adjusted coarse spray device, a proportion of very small droplets will be formed (< 3µm): they will end up in the lungs and in the air sacs.

Therefore, the choice of the strain to use for Newcastle vaccination becomes a critical issue, because a small amount of droplets of a strong strain, such as LaSota is enough to cause severe respiratory reaction, while the same amount of droplets of a non-pathogenic strain such as CEVAC Vitapest L (Phy-LMV-42 strain), cause no or very mild PVR.

Note that PVR can also happen in case of harsh weather conditions when birds are panting under a hot environment. In this situation the droplets will bypass the nose filtration system and will be going directly into the trachea, lung and air sacs.



Normal trachea after use of Cevac Vitapest (40 x) (Afssa study).



Trachea with severe lymphoid infiltration – Clone LaSota strain (40 x) (Afssa study).

Conclusion

The due management and care of the spray administration equipment and technique are critical factors to ensure the successful vaccination of chickens against a variety of respiratory viral diseases as well as against coccidiosis. Any mistake can lead to losses, birds stress and poor protection. ■