Infectious bronchitis: spray vaccination in the hatchery

Avian infectious bronchitis (IB) is probably one of the most widespread poultry diseases around the world, given its highly contagious nature.

It is caused by a gamma coronavirus that affects the respiratory, urinary and reproductive systems of the chickens causing different disorders depending on the tissue tropism characteristics of the invading viral strain.

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The induced losses are very costly, because of uneven growth, respiratory distress, high morbidity, secondary opportunistic respiratory infections (E. coli, avian metapneumovirus, H9N2 low pathogenic avian influenza virus, etc) and related medication, egg drops, and/or kidney damage.

According to the World Bank (World Livestock Disease Atlas, 2011) it is ranked as the second most costly poultry disease, after highly pathogenic avian influenza.

One of the most important points to achieve successful immunisation of day-old chicks should be accurate application of the vaccine in the hatchery using advanced spray equipment, batch after batch, in addition to post-vaccination monitoring programmes.

A high vaccination rate and good quality of application will over time control IB in the field, and its effects.

Spray vaccination

Spray vaccination at the hatchery is an established practice. A worldwide hatchery survey conducted in 2016 showed that 90% of the hatcheries use spray vaccination on a regular basis.

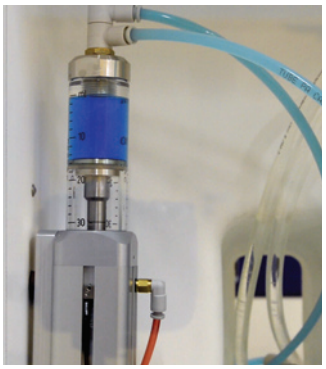
At first glance, spray vaccination seems to be a simple technique to master: select nozzle type and pressure to generate the right droplet size and then apply the spray to cover all the chicks in the crate and reach the upper respiratory tract.

In reality, there are many variables that affect the quality of spray vaccination among different hatcheries, mainly due to the sprayer equipment technology in use.

What must hatchery spray equipment do?

There are four main considerations for good spray vaccination quality:

● **Optimal crate coverage:**
The entire crate surface has to be covered by the spray in order to guarantee that all the birds receive the proper IB vaccine dose. The nozzle technology varies depending on the type of sprayer being used.



Vaccine volumes.

Historically, hatchery sprayers have been equipped with conical pattern nozzles. Obviously, it is impossible to cover a rectangle shaped crate by using two or four conical spray nozzles, as circular spray areas will overlap each other but leave the corners of the crate out of reach.

However, by using current nozzle technology, such as a flat pattern nozzle, crates can be perfectly covered from beginning to end without missed areas.

● **Uniform droplets of the right size:**
The recommended droplet size to vaccinate day-old chicks is around 150µm. Smaller droplet sizes increase the risk of post vaccination reaction. Bigger droplet sizes make it harder to target the upper respiratory track for an optimal immune response.

The droplet size is defined by two main parameters: nozzle type and air pressure. Air pressure control is something relatively easy to be managed, most of the current hatchery sprayers use a simple pressure regulator.

However, not all nozzle technologies produce uniform droplets of the right size. Only flat nozzles can guarantee it. A conical nozzle generates significant droplet overlapping and, therefore, droplet size variations.

● **No impact on the chick distribution:**
The operation of many of the currently available vaccination sprayers could impact the distribution of the day-old chicks inside the crate. For example, sudden stops by the automatic conveyor before the crate enters the sprayer could cause uneven distribution of the chicks in the crate. In other cases, manual handling of the crates is too rough.

Manual handling of the crates must be smooth. Uneven distribution of the chicks in the crate could cause vaccine waste (vaccine on areas with no chicks) and deficient vaccine delivery (birds receiving less vaccine than needed). Avoiding vaccine wastage and delivering the right vaccine dose to every chick can be achieved by using well-designed automatic in-line sprayers.

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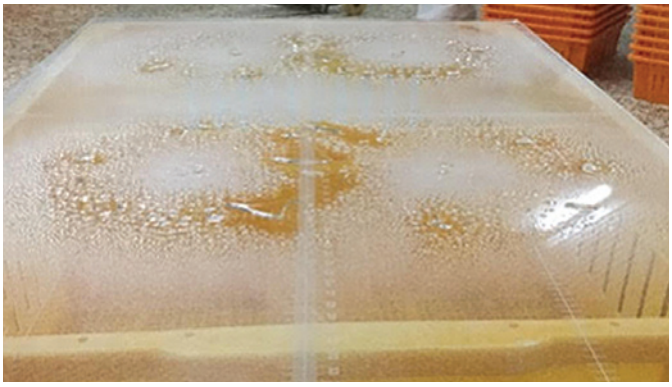
Flat-nozzle droplet size homogeneity.

Conical nozzle droplet size homogeneity.



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● **A consistent volume:**
The vaccine volume sprayed into each crate must be consistent. The vaccine volume can be controlled by two types of systems. Some older sprayers use a pressurised vaccine system. Unfortunately, these systems are susceptible to variations in air pressure occurring inside the hatchery's main air supply system. Vaccine volume variations up to ±50% of the desired volume can be observed. More recently, sprayers use a more reliable system consisting of an accurate syringe system. Normally, it is triggered by a pneumatic piston, allowing for direct control of the vaccine volume delivered to each crate with almost negligible variations.

Selecting spray equipment technology: which one?

Hatchery spray equipment can be categorised into three types:

● **Manual spray cabinets:**
These sprayers are better suited for small hatcheries (<200k day-old chicks per week). The crates are manually placed and held in the spray area. Once the crate is detected, the spray is applied through 2-4 conical nozzles. The vaccination quality is totally dependent on handling by the operator, as the crate must be placed smoothly, and cannot be removed before the spray cycle is completed.

As previously mentioned, these conical nozzles do not guarantee optimal crate coverage and droplet homogeneity.

Inline sprayer.

● **Stop and go cabinets:**
These sprayers are better suited for medium size hatcheries (200-500k day-old chicks per week). They are integrated onto an automatic conveyor line. Most of the time, they are installed after the chick counter. Once there, the crate is blocked by a pneumatic stopper, and then sprayed by 2-4 conical nozzles.

Finally, the stoppers release the crate. Stop and go cabinets suffer from the same disadvantages as manual spray cabinets due to the use of conical nozzles. Besides, most of the time, day-old chick distribution in the crate is negatively impacted by abrupt stopping of the crate prior to spraying.

● **In-line sprayer:**
This last category of sprayers offers the best vaccination quality. They are installed over the conveyor line right after the chick counter or as standalone equipment. They are well suited for medium and large hatcheries. The crate does not stop, so there is no waste of time and chicks' distribution in the crate is not impacted. The continuous movement of the crate allows the use of flat nozzles for 100% coverage and perfect droplet homogeneity.

In addition, with the Desvac in line spray, one device can spray two conveyor lines simultaneously, thanks to an independent double arm system.

Conclusion

Coverage, droplet size uniformity, chick distribution and volume control are critical factors for the proper delivery of IB vaccines via spray. These four factors for success must be mastered and controlled during the whole vaccination process.

Today, only the Ceva Desvac In Line sprayer can provide the best quality of vaccination with the best IB protection. Monitoring and regular maintenance are required to execute proper vaccination. This is why hatchery vaccination monitoring, such as the C.H.I.C.K. Program, is the key factor of success to ensure the quality of spray vaccination. ■