New research in spray cabinet application for optimal IB control

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Infectious bronchitis (IB), a highly contagious upper respiratory tract disease of chickens, can result in major economic losses for producers.

IB infection causes poor growth and performance, decreased egg production, and predisposition to secondary infections, which leads to air sacculitis and condemnation at the processing plant.

The speed and frequency at which the disease evolves and spreads, as well as the presence of more than a dozen different serotypes and hundreds of variants of the virus, makes IB protection a significant challenge for the poultry industry.

A critical component of maximising IB protection is starting the vaccination process in the hatchery rather than the broiler house. By doing so, chicks are protected earlier and are exposed to a more efficient, precise vaccination process.

Spray vaccination offers mass application via multiple routes of rapid exposure to the vaccine, including intraocular (eye drop), intranasal and oral application.

Care must be taken to ensure that the spray pattern provides vaccine coverage of the entire chick basket, so that droplets reach all routes of vaccine uptake – the eyes, the nares and the feathers.

Factors affecting efficiency

Dr Brian Jordan of the Poultry Diagnostic and Research Center, University of Georgia, Athens, GA, reviewed the state of spray cabinet vaccination in hatcheries today in, 'Spray Cabinet Application of Infectious Bronchitis Virus Vaccines in the Hatchery: How Efficient Are We?'

"While spray vaccination seems simple, all system components – syringes, nozzles, tubes and connections – must be frequently evaluated to avoid leaks, corrosion and malfunction, and ensure proper vaccination," said Dr Jordan.

The efficiency of vaccine application is influenced by line speed, pressure, flow rate, the number of nozzles and vaccine application volume. Unfortunately, as producers troubleshoot these factors to process more chicks in less time, many hatcheries may not be vaccinating their chicks properly and efficiently.

● Adjusting nozzles to increase or decrease vaccination speed

To vaccinate effectively, the chicks must move through the spray cabinet at a rate so that the correct number of doses from the syringe are expelled through the nozzle. Also, the spray must be timed to the chick basket moving under the nozzles.

Air pressure and nozzle flow rate must be adjusted to match the speed at which many hatcheries operate and accommodate the application volume used.

However, the adjusted pressures, flow rates, and application volumes can also increase shearing forces that destroy virus particles or increase the aerosolisation of the vaccine, making finer droplets that blow out of the cabinet without reaching the chicks.

"In fact, research shows that 50% or more of vaccine volume applied never reaches the level of the chick," Dr Jordan added.

Furthermore, increasing nozzle pressure to match line speed can overshoot vaccine, decreasing the amount reaching the chicks.

Conversely, decreasing nozzle pressure and flow rate to match a slower line speed decreases the spray angle, meaning chicks on the side of the basket may not receive vaccine coverage.

● Adjusting nozzles and syringes to apply greater vaccine volume

To increase efficiency, many hatcheries apply IBV vaccine in larger volumes by adjusting the nozzle to increase flow rate or adding more syringes and nozzles to the cabinet.

Adjusting the nozzle to increase volume can have an added benefit of producing larger, heavier droplets of vaccine, making it easier for them to 'fall' down to the chicks. Larger droplets also prevent the chicks from inhaling the vaccine too deeply, keeping it in the upper respiratory tract where the IB pathogen is active. However, this approach results in excessive wetting and over-cooling of the chicks, increasing first week mortality.

● Damage to live vaccine virus may go unnoticed

Spray cabinet syringes can be displaced, leak, or draw in more air than vaccine, and they are designed and specified for a single use, not the hundreds or thousands of times they are used in a hatchery. Syringes also account for significant vaccine destruction.

Research shows the differential pressures and shearing forces applied to the vaccines when forced in and out of the syringe is more than enough to kill structurally labile viruses, like IBV.

Additionally, though cost effective, brass nozzles can corrode easily and kill vaccine virus without disrupting spray patterns – causing a failure undetectable without laboratory virology work.

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"Thus, there are multiple places in a system that can destroy live vaccine and reduce its efficacy, even while it appears to be running properly," noted Dr Jordan.

● Choosing an IBV vaccine to maximise IB protection

While many parameters that affect mass spray vaccination can be adjusted, the choice of IBV vaccine should also be considered. Research shows that a combination of two vaccines such as MSD Animal Health's Nobilis IB Ma5 and IB 4/91 – the Protectotype concept – provides broader spectrum IB protection. When a bird receives two IB vaccines, cross-protection against multiple heterologous IB serotypes along with full protection against the two IB vaccine serotypes is achieved. Critical when a novel serotype or variant arises for which there is no vaccine available, cross protection helps promote healthier flocks with decreased morbidity from IB infection, which helps maintain daily weight gain and feed conversion performance.

Mass spray vaccination

Training for proper spray cabinet usage and ongoing monitoring and inspection are necessary to ensure effective and efficient vaccination.

Through its Convenience Program, a full-spectrum respiratory health and immunity program that also focuses on process and performance improvement, MSD Animal Health helps hatcheries optimise their spray vaccination processes.

Designed to increase the convenience, efficiency and accuracy of vaccine administration in the hatchery, the program includes an evaluation to assess spray vaccine solution preparation and the vaccination process, and provides input on spray cabinet maintenance.

To optimise speed, safety and vaccine uptake while minimising waste, the program seeks to standardise spray cabinet sanitation, calibration and operation, and other methods of vaccine delivery, such as Marek's vaccination.

A new partnership

To further advance vaccination, the University of Georgia partnered with MSD Animal Health to redesign spray cabinet technology. Dr Jordan presented the resulting innovation, which is expected to reach the market soon, at the American Association of Avian Pathologists (AAAP) meeting in Boston, MA in July, 2015.

The new spray cabinet is designed to provide better vaccination through reduced destruction of virus.

This is achieved through constant pressure application.

Constant pressure system

"Pressure differentials and turbulence in the spray cabinet's syringes cause destruction of live vaccines. In contrast, a constant pressure system allows the user to pressurise the vaccine rather than the syringes, eliminating the need for syringes completely," Dr Jordan explained.

The user can also set correct specifications for pressure and optimised nozzle flow rate, making application volumes more standardised by being flexible but directly related to the other specifications.

By reducing the amount of viruses being destroyed, the redesigned spray cabinet will increase the amount of vaccine that poultry are exposed to, increasing their immunity against IB. With the constant emergence of different bronchitis serotypes and hundreds of variants of the virus, IB protection represents a significant challenge for the poultry industry.

Improving the efficiency of the vaccination process will in turn improve immunity and reduce the emergence of viruses. ■

References are available from the author on request