Installation of in ovo vaccination devices in the hatchery

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wenty five years ago the only way to vaccinate broilers against Marek's disease (MD) was to give day-of-hatch chicks a subcutaneous injection by hand.

On average, one person can inject about 2,000 chicks per hour, so a hatchery producing 250,000 chicks per day needed a team of at least 12 people, and enough room for them to work in.

The solution to this bottleneck in the system was the introduction of the first commercial in ovo vaccination device in 1992 by Embrex.

This new technology not only revolutionised hatchery vaccination but also had a fundamental impact on the way hatcheries operate.

Before installation

Although in ovo vaccination has potential benefits for many hatcheries, it is not suitable for every facility

There are a number of key questions which hatchery managers need to answer in order to determine if in ovo is the right solution for them. Is an approved in ovo vaccine available to match the local disease challenge?

	1993	2000	2005
Difference in hatchability (%)	+0.04	+0.88	-0.14
Difference in mortality (%)	0.00	-0.19	-0.21
Difference in body weight (g)	+09.10	+50.00	+16.00
Difference in feed conversion	-0.019	-0.020	-0.012

Table 1. Performance parameters for in ovo vaccinated birds versus subcutaneous vaccinated birds in three separate, controlled trials.

Not all in ovo vaccines are available in all countries.

Off-label delivery of other vaccines could cause serious problems. In the US the number of in ovo vaccines available to producers has more than doubled, from four to nine, over the last 10 years or so and more are in the pipeline. As the use of in ovo devices increases in other markets, the number of vaccines is likely to follow suit.

How many eggs are processed each month and how many times a week are they transferred out? To justify the use of a full-size Embrex Inovoiect, hatcheries need to be processing on average more than two million eggs/month.

The recent addition of a smaller, semi-automated model to the Embrex product portfolio (model Inovoject m), means that many

hatcheries with smaller throughput (<2 million eggs/month) or less floor space can also now adopt in ovo technology.

Hatcheries that require processing between 12,000 and 20,000 eggs per hour might consider the smaller machine. How many different flat configurations are used in the hatchery? Each Inovoiect machine is tailor made specifically to work with a particular setter tray. A wide range of different configurations are available, but if the hatchery uses several different flats, it may not be able to vaccinate 100% of all birds in ovo.

Suitable infrastructure

If these initial questions produce positive answers, then the next step is to check that the hatchery infra-



sure that the buildings, space distribution, storage facilities, utilities (water/electricity), ventilation, air compressor capability, etc are suitable for installing and operating an in ovo device. An environmental assessment is conducted to check the level of contamination. Samples are taken from around the hatchery and analysed for the prevalence of fungi and bacteria, but specially for Aspergillus moulds.

Because in ovo vaccination requires the egg shell to be punctured, hatchery hygiene is a prime consideration. The need for low contamination risk with in ovo has been a driving force behind the improved hatchery hygiene that has been seen in US hatcheries in recent years.

Staff training

The survey results determine what work, if any, needs to be done before an in ovo device can be installed and operated successfully.

Once all the installation criteria have been met, it is essential that staff are properly trained and on site support provided.

Zoetis staff stay with the hatchery Continued on page 17







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for the first two weeks, making sure the operators are fully trained and that the device is working properly and optimally. In addition, they leave a stock of common spare parts in the hatchery, so if something happens, parts can be replaced and the device can be working again with minimal down time.

Zoetis also operates a rapid callout support system, and makes regular, scheduled maintenance visits, at least once every nine weeks, to all of its devices in the field.

During installation

At first, one needs to be sure that the vaccine preparation is aseptic. If vaccine is not well mixed and aseptically prepared, then you can jeopardise its efficacy and even potentially kill birds.

Each Embrex Inovoject device incorporates a dual needle system to reduce contamination from the egg surface: the outer needle punches a hole in the egg shell and the inner needle penetrates in to the hole to the correct depth to deliver the vaccine. The system is automatically sanitised between injections by having a disinfectant solution washed between the two needles.

Auto-sanitisation is critical to the success of the device because we know that every surface will have a certain amount of bacteria and fungi.

However, it is important to make sure the hatchery is clean and sources of contamination such as the ventilation system are addressed

One of the key requirements of in ovo vaccination is the ability to deliver the same amount of vaccine consistently to the right site within the egg, every single time. The vaccine must go into the amniotic fluid or subcutaneously into the embryo, if it is to trigger the best immune response.

Vaccine delivered into the amniotic fluid at day 18/19 is quickly distributed to the upper respiratory tract, gut and bursa – all key sites for the development of immunity arainst diseases.

But how do you deliver a dose of vaccine to a tray with up to 165 eggs, in the correct site and all at the same time? Eggs are different shapes and sizes, so the injection locator needs to be able to adjust both laterally and vertically to ensure that the shell of each one is punctured in the correct site.

Embrex solved the problem by designing a system of floating tooling heads with an expandable tubing matrix which, for a fraction of a second, receives a burst of air to fix each individual tooling in the correct position and ensure the right needle trajectory on its egg. So each egg is taken care of individually.

Maternal antibodies

Along with the benefits of a more automated hatchery, the introduction of in ovo devices also heralded a more effective way of delivering vaccines to broilers.

At 18/19 days, some but not all of the maternal antibodies in the yolk have been absorbed by the embryo; full maternally-derived immunity does not develop until a few days post-hatch.

If a live vaccine is given to the embryo during this 'window', then the virus can replicate without too much interference from maternal antibodies and thus trigger a good immune response; at the same time the embryo has enough maternallyderived immunity to protect it from developing disease as a result of being vaccinated.

The result is a chick which has the earliest possible immune response and thus protection against disease when it moves into the growing environment.

After installation

Although the potential benefits of earlier vaccination may be obvious on paper, they are not so easy to demonstrate in practice.

It is actually quite difficult to show the benefits to an individual producer, because to do that you have to conduct a 'pair type' study where all the possible sources of variation are equalised between the in ovo vaccinated and the conventional vaccinated groups.

Such a trial requires that eggs come from the same broiler breeders' flocks, be stored in the same room for the same amount of time and incubated in exactly identical ways – even down to the proportion of eggs allocated on different levels within the incubator.

At the transfer time, eggs have to be separated into two different hatchers to avoid mixing them up when the chicks hatch.

Birds then need to be raised in identical conditions, in two separated houses that share the same ventilation, feeder and drinking systems, with exactly the same initial stocking density. You need to make sure everything is identical, except the vaccination system, and not many producers are willing to do that.

Zoetis has data from three such studies however, conducted in 1993, 2000 and 2005 (Table 1).

They generally show improve-

ments in the percent of hatch, mortality, body weight and feed conversion with in ovo vaccination.

As might be expected, the exact figures vary between the three different studies.

The feed conversion is between one and two points better with in ovo vaccination. In the US, a one point saving could represent about \$500,000 for a unit processing one million birds per week, depending on the cereal prices.

Double vs single needle

Recently the company had the opportunity to conduct a comparison trial between two commercially available in ovo vaccinators, one with double needle injection system and another with a single needle injection system (see Figs. I and 2).

Broilers were vaccinated in ovo at 18 days of embryonation with a recombinant vaccine of HVT and IBD insert (rHVT-IBD) and a combination of two monovalent vaccines (HVT+IBD). By day five the birds were challenged with virulent MD virus (RB1B).

The body weights were recorded at 14, 21 and 49 days of age. At 50 days of age all birds were necropsied for Marek's disease lesions as well as all mortalities that happen from the beginning.

Birds vaccinated with the double needle system showed significantly greater weight than birds vaccinated with the single needle. There was no significant difference between vaccines.

Likewise, the protection level was significantly higher on the double needle system than in the single needle system and, again, there was no significant difference between vaccines.

