

Shielding layers from IB

Two top producers
tell their stories

5

12

Molecular technology helping to pinpoint IB variants, improve vaccine programs

14

WVPA symposium on Protectotype showcases new strategies for IB

26

As the crow flies? Austrian veterinarian reflects on IB signs and trends

Shielding layers from IB

Two top producers tell their stories

5

Despite the spread of the QX variant of infectious bronchitis (IB) and the constant threat of other strains, two top layer producers say they're keeping the disease at bay and actually seeing gains in production — even in free-range flocks.

PRP



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About the cover: A knight in shining armor might have been all anyone needed for protection in 12th century England. Some 900 years later, however, not even King Arthur's knights could thwart a challenge from infectious bronchitis at a modern layer operation. Fortunately, producers are shielding their flocks from emerging variants with a field-proven strategy called Protectotype.

Viewpoint

3

Frédéric David, DVM, says the fight against infectious bronchitis in poultry, particularly in layers and breeders, has been nothing short of a team effort.

Cutting Edge

12

x-OvO's Richard Currie, PhD, BVM&S, MRCVS, says advances in molecular technology have made it possible to pinpoint the strains of infectious bronchitis and fine-tune vaccination programs.

Science Track

4

- D388 'highly pathogenic' in layers, broiler breeders
- Swedish studies show evolution of IB viruses
- Novel QX IB virus strain found in Southern England

Field Report

26

Austria's Franz Sommer, DVM, DACPV, says there could be a link between the presence of crows and QX, but he's still not taking any chances.

Special Report

14

A symposium on Protectotype at the XVII World Veterinary Poultry Association Congress in Cancun, Mexico, showcased the latest ideas — from both the lab and the field — for managing infectious bronchitis (IB) in poultry.

- Understanding how IB attacks clarifies need for broad vaccine protection

Aris Malo, DVM

- 'More is better' when vaccinating layers, breeders against IB

Sjaak De Wit, DVM, PhD

- European approach to IB control explored for use in US flocks

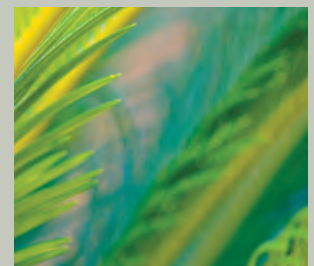
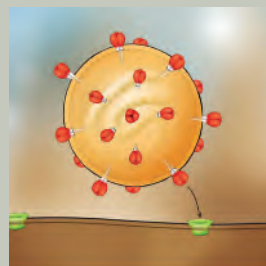
Mark Jackwood, PhD

- Test results show growing prevalence of IB 793B (4/91) over 5 years

Brice Robineau, DVM

- Monitoring helps Brasil Foods steer IB vaccination program

Mário Sérgio Assayag Jr., MV, DSc





Exploring new limits

Legendary cyclist Lance Armstrong once described life as “a series of false limits.”

“It’s my challenge to explore those limits,” he added. Then he went on to win seven consecutive Tour de France titles.

The poultry industry often reminds me of Armstrong because it, too, has a track record for “exploring limits” and achieving the unthinkable. Year after year, flock after flock, producers keep raising the bar for feed conversion, growth rate, egg production, survivability and uniformity. Numbers that once seemed unattainable are now taken for granted. It seems the more the poultry industry challenges itself, the more successful it becomes.

One recent example of the poultry industry’s resourcefulness can be seen in its ongoing battle with infectious bronchitis (IB). New and potentially costly variants such as QX are emerging all the time, challenging veterinarians and producers to find new means for control, often with existing tools.

Good fit

Through what is known as Protectotype — where some strains of IB viruses are highly effective at inducing cross protection against other serotypes — they’ve discovered that using certain combinations of vaccines can provide more

protection than the IB strain or strains found in any one vaccine vial.

One veterinary practitioner in Austria reports seeing this first hand in the 80,000 breeders and millions of pullets under his care (page 26). “If you use the Ma5 vaccine, it covers the Massachusetts-serotype virus,” says Franz Sommer, DVM, DACPV.

“If you use the 4/91 vaccine, it covers the 4/91 type of virus. But if you use the two of them together in the same program, they cover a couple of different serotypes. Vaccine A plus vaccine B protects not only against A and B, but also against serotype strains C and D.”

When it comes to managing IB, there also seems to be no limit to raising the bar for protection. For example, Paul McMullin, MRCVS — a consulting veterinarian for Hy-Line in the UK — notes that protection induced by live vaccines used in rearing should last to 20 to 23 weeks of age. “The problem... is that by 20 to 23 weeks, flocks are coming into lay,” he says. “That is a period of high physiological stress, so it’s a very bad time for birds and they’re very susceptible to new infections.”

For that reason, after giving the inactivated combination IB vaccine at transfer, he now recommends re-vaccinating with a live IB vaccine after 7 days — or whenever the flock has settled into its new accommodation.

Success by innovation

Scientists are also helping to develop new ideas for IB control. At the XVII World Veterinary Poultry Association Congress in Mexico, more than 400 poultry veterinarians packed a meeting room for a symposium about Protectotype, where specialists from five countries shared their experiences exploring new programs for managing the persistent disease (page 14).

These innovations are being used successfully by large poultry operations. As Richard Beevis, UK breeder farms manager at Hy-Line, says, “The QX variant is becoming more prevalent in the UK, yet we haven’t changed our vaccination program for 12 months. I think that says something about the vaccine products we’re using and when we’re using them” (page 6).

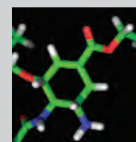
Once again, it’s all about exploring new limits. We are pleased to report on the industry’s latest feats in this issue of *PRP*.

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D388 'highly pathogenic' in layers, broiler breeders

The D388 variant strain of the infectious bronchitis (IB) virus is highly pathogenic in layers and broiler breeders, but protection can be achieved with broad, heterologous vaccination, Dutch investigators say.

The investigators conducted studies to gather advice for the Dutch poultry industry; it has suffered considerable damage due to infections caused by the D388 strain of the IB virus, which is derived from the IB QX genotype, says Sjaak De Wit, DVM, PhD, Animal Health Service, the Netherlands, and colleagues.

They tested several vaccination programs in young, specific-pathogen-free layers, in young layers with maternally derived antibodies against D388 and in young commercial broiler breeders. The results confirmed field observations that D388 of the QX genotype is able to cause cystic oviducts in a high percentage of birds, mortality due to nephritis and respiratory distress with complete tracheal ciliostasis and airsacculitis.

Vaccination programs using different combinations of heterologous live vaccines at day 0 or at days 0 and 14 induced a reasonable to high level of protection after challenge with D388 at 28 days of age.

However, "for very early protection, maternally derived D388-neutralizing antibodies

were shown to be very important," and could be achieved by using a broad, heterologous live, priming vaccine followed by boosting with inactivated IB virus vaccines containing two or three heterologous IB virus antigens, they say in the October 2011 issue of *Avian Pathology*.

Editor's note: For more on De Wit's work with IB, see page 18.



Swedish studies show evolution of IB viruses

Swedish investigators say they have demonstrated that infectious bronchitis (IB) viruses are constantly evolving, underscoring the need for careful monitoring of IB trends.

In Sweden, IB in layers has been associated with a drop in egg production and thin eggshells, as well as poor growth in broilers. When the investigators sequenced selected isolates from some of the IB cases using conventional real-time polymerase chain reaction (PCR), they found the isolates were over 98% genetically similar to strains of the IB QX-like genotype.

Further analysis showed that Massachusetts-type strains of IB virus that were predominant in the 1990s had been replaced by D388/QX-like strains, but the evolutionary link could not be established. "Remarkably, a strong positive selection pressure was determined, mostly involving the S1 subunit of the S gene," resulting in recombination events, says S. H. Abro, Swedish University of Agricultural

Sciences and the National Veterinary Institute, Uppsala.

In addition, two new isolates generated from recombination were found, diverging from the D388/QX-like branch and indicating the emergence of a new lineage, they say in the September 2011 issue of *Veterinary Microbiology*.



Novel QX IB virus strain found in Southern England

A novel QX-like strain of the infectious bronchitis (IB) virus is co-circulating with previously described QX viruses on a commercial layer farm in Southern England, resulting in lost egg production and nephritis, investigators reported at the World Veterinary Poultry Association Congress held in Cancun, Mexico.

Molecular analysis of the strain, which was found during routine monitoring for IB viruses, revealed several substitutions in the major antigenic protein of the virus, said Isabella Monne, DVM, Istituto Zooprofilattico Sperimentale delle Venezie, Italy.

The results raise questions about the potential antigenic divergence of the new strain from other IB QX strains and the vaccination programs that will offer the best clinical protection, she said, noting that more surveillance will be needed to determine if this novel strain is spreading throughout the country.

Editor's note: For more on how the UK is coping with IB, see the cover story beginning on page 5.



Shielding layers from IB

UK producers tap power of existing vaccines to guard layer flocks against costly variants

Between the spread of the QX variant of infectious bronchitis (IB) and the constant threat of other strains, one might expect the UK layer industry to be reeling from false layer syndrome, poor egg quality and other costly side effects linked to this evolving disease.

As it turns out, however, leading producers there are not only coping with emerging IB variants, they're actually seeing gains in production — even in free-range birds that now dominate the national flock.

PRP's managing editor, Joseph Feeks, visited the UK headquarters of Hy-Line, the world's leading supplier of layer breeders and day-old laying stock, and Country Fresh Pullets, the UK's top layer-pullet rearer, to see how they were faring in the face of dynamic IB variants.



HY-LINE



'We're more conscious of IB than any other disease'

With up to 50,000 grandparent (GP) layer breeders and 142,500 parents on Hy-Line's floors at any one time, UK breeder farms manager Richard Beevis cannot afford any hiccups in production. Keeping birds healthy and growing at a desired rate and uniformity are essential to the success of his operation.

There's also plenty of peer pressure — literally. Internal peer reports at Hy-Line compare his production efficiency against other company farms in France, Brazil and North America. "That keeps us motivated," says Beevis, who is based at the company's facility in Studley, Warwickshire.

For Beevis, the critical milestones in his operation are 7-day mortality, as well as the bodyweight and uniformity at 6 and 12 weeks.

"We're typically targeting at least 80% uniformity," he says. "We also try to get the bodyweight up at 12 weeks — about 100 grams higher than target — because they naturally go through a 5% to 12% weight loss when we move them from small colonies of 1,500 to 2,000 to colonies with 5,500."

While Beevis and his veterinary consultant, Paul McMullin, MRCVS, need to keep their eyes on several intestinal and respiratory diseases in the GPs and parents, IB commands the most attention.

"There's no question, we're more conscious of IB than any other disease," Beevis adds. "If left uncontrolled, IB could have a devastating impact on our operation. Fortunately, we've managed to stay a few steps ahead of the disease."

Not just respiratory disease

When asked about the prevalence of IB, McMullin initially describes the disease as the "chicken version of the common cold because, in

essence, it will always be there in one form or another. There's also a wide variety of strains, some more aggressive than others."

But his common-cold analogy quickly ends there. "The trouble there is, comparing IB to a cold implies that IB is an upper respiratory problem, which it can be, but IB is able to infect a broad range of tissues," says McMullin, who has worked with the disease for 25 years in Brazil, Europe and Africa.

"In fact, the area where we can most readily demonstrate the presence of IB viruses for long periods after challenge is actually in the digestive tract, particularly those that are clustered in what's called the caecal tonsil. Kidneys can also be affected, as well as, of course, the reproductive tract. Calling the disease infectious bronchitis really is not giving it credit for everything that it can do."

Uniform eggs essential

Not surprisingly, the biggest concern at an operation like Hy-Line — or at least where the effect of IB is most visible — is its potential impact on egg production. "If we were running tight on eggs and suddenly had a large farm with a 5% or 8% drop in production from IB — eggs that we were counting on to set for our customers — that would be a big problem for us," Beevis says.

Furthermore, the eggs that are produced by infected birds are usually poor quality, with thin shells. "We're very strict in our criteria for selecting hatching eggs — an absolute minimum of 53 grams — so we can't afford to have something like IB compromise our standards or chick quality," Beevis says.

"With bronchitis," he adds, "it's not just the period of time that layer operations might see any production drop. It's prior to the drop and

continued

“Calling the disease infectious bronchitis really is not giving it credit for everything that it can do.”

PAUL MCMULLIN, MRCVS



HY-LINE

'We're more conscious of IB than any other disease'

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PROTECTION

“The egg drop might last only a couple of weeks,
but IB could actually affect about 8 weeks
of physical production...”

RICHARD BEEVIS

post the drop as well. The egg drop might last only a couple of weeks, but IB could actually affect about 8 weeks of physical production — 2 or 3 weeks before the drop and another 2 or 3 weeks after the drop.”

Fortunately, Beevis says, they have yet to have a positive diagnosis for IB on any of their farms, but that doesn't mean it hasn't knocked on his door. According to McMullin, Hy-Line's strategic approach to IB vaccination is designed to protect against a broad range of variants including the costly QX variant, which can attack the kidneys and central nervous systems of birds.

Broader protection

Hy-Line's success managing IB is a good example of the phenomenon known as Protectotype, he says. “Neither the Ma5 nor the 4/91 on their own provide good immunity for the QX strain, but in practice, when they're used sequentially or sometimes in combination, they have been shown to provide quite good protection,” McMullin adds.

The program starts on day 1, when chicks are vaccinated at the hatchery with Nobilis IB Ma5 and then at day 14 with Nobilis IB 4/91, both live vaccines. “Up to a couple of years ago, it was quite common to vaccinate broilers at day-old and not so common to vaccinate layers at day-old,” McMullin says. “That has changed, because clearly it's important with this particular QX strain, which is prone to cause damage to the oviduct if it occurs in early life.”

The Ma5 vaccine is used again at 5.5 weeks and 4/91 is repeated at 10 weeks. Birds are vaccinated at transfer — usually at 16 weeks — with Nobilis RT+IB Multi+ND+G (for GPs and breeders) or Nobilis RT+IB Multi+ND+EDS (for parents and pullets), inactivated vaccines that contain two IB serovars, plus avian pneumovirus, Newcastle disease and egg-drop syndrome viruses. At 18 weeks, they resume priming birds with live vaccines every 6 to 8 weeks and into lay.

“Technically, the local immunity achieved by the live vaccines we use in rearing will last up until 20 to 23 weeks of age,” McMullin says. “The problem, though, is that by 20 to 23 weeks flocks are coming

into lay. That is a period of high physiological stress, so it's a very bad time for birds and they're very susceptible to new infections.

“For that period of increased risk, after giving the inactivated usually on transfer, we generally recommend re-vaccinating with a live vaccine after about 7 days — after the flock has settled into the new accommodation, which also has its stresses,” the veterinarian adds. “If we can avoid it, we don't vaccinate for the following 10 weeks or until they are over peak production.”

Onsite support

Reflecting on their ability to fight off IB in the face of QX and other variant strains, Beevis says, “The vaccines are doing their job, no doubt about it. We see mild — very mild — IB challenges in most flocks most years. But at the moment, it's short-lived. IB comes and goes. The QX variant is becoming more prevalent in the UK, yet we haven't changed our vaccination program for 12 months. I think that says something about the vaccine products we're using and when we're using them.”

Beevis also credits Jonathan Perkins, a sales manager at MSD Animal Health, for the success of their IB-management program. “Jonathan has worked closely with us, providing training and auditing, which have been very useful,” Beevis says. “He's conducted excellent workshops here for the people that actually handle our inactivated vaccine for us, as well as for the farm managers.

“These workshops keep everybody fresh,” Beevis continues. “If people understand why they're doing something, they'll do a better job. If they understand the consequences on a rearing farm as to why they need to administer an IB spray vaccination correctly, and if they understand the consequences of what happens if they don't perhaps toe the line, then they'll focus more.”

Cover Story continues on page 9

Richard Beevis of Hy-Line: 'The vaccines are doing their job, no doubt about it.'



COUNTRY
FRESH
PULLETS'We have to provide a bird that's
been given the maximum
IB protection available'

While consistency and uniformity might be the hallmarks of a layer-breeder producer, diversity and customization are the bywords at an operation like Country Fresh Pullets, Shropshire — the largest pullet rearer in the UK.

"We are totally customer-driven," says Richard Parsons, production manager. "We don't advertise breeds. Whatever the customer wants, we will rear. We've got the space. Last year we reared in excess of 7 million."

Country Fresh currently rears layers from Hy-Line, Lohmann, Goldline, Hendrix Genetics and at least five other breeding companies. "We also do some Columbia Blacktails. And we also do a few what we call specials — exotic things that lay blue eggs and brown eggs."

Country Fresh has 34 contract and 15 company-owned farms ranging in capacity from 6,000 to 200,000 birds. Farms take delivery of day-old chicks and then rear them to week 16. During that time, birds are typically primed and boosted with vaccines 16 or 17 times, against a wide assortment of poultry diseases.

'Massive concern'

"Obviously, vaccination is critical to our own production, but it's even more critical to the end-user, our customer," Parsons says. "We want repeat customers. So it's important that our product leaves us with the highest level of protection possible."

Parsons lists Marek's and Gumboro as the most feared diseases in their rearing operations, but his radar is firmly fixed on IB and its changing variants.

"We don't tend to see too many IBs in a rearing environment. It's not something that would affect us here today," he says. "But obviously, for our customers, it's critical that the birds are protected because there's a lot of bronchitis out there. If our birds get an early infection with an IB QX, for instance, then the repercussions to the lay of our customer could be severe. So basically, if IB is a concern for them, it's a massive concern for us. We have to provide a bird that's been given the maximum IB protection available."

For that reason, Parsons continues, they were advised last year to introduce Nobilis IB Ma5 at day-old, which is administered in the hatchery, and then follow up with Nobilis IB 4/91 at 14 days, both live vaccines.

"Our vets, as well as the veterinary surgeons of our customers, tell us that's the best cross-protection available against QX, which can be devastating in the laying environment," Parsons reports. "And theoretically, they also cross-protect against IB 755 (Italian 02) and other variants. The tricky thing is, the variants change all the time. You never know what to expect. We do serology at 12 or 13 weeks to make sure the priming vaccines are doing their job. But in general, the vast number of IBs that we're seeing are related to 793B (of the same Protectotype as 4/91) or QX."

No standard program

The Ma5 vaccine is administered again at day 35, this time as Nobilis Ma5+ Clone ND, which includes protection against Newcastle disease, followed by another IB primer vaccine at day 84 to protect against the IB H120 and IB D274 variants. At transfer, birds are vaccinated with the inactivated combination vaccine Nobilis RT+IB Multi+ND+EDS "for extra IB barriers."



Birds like routine; they *love* routine.
But when you put birds into a
free-range situation, routine is
blown out of the water.

RICHARD PARSONS

“The stronger the bird is, the better it will withstand the rigors of IB and other disease challenges.” RICHARD PARSONS

“We’ve got something like 67 vaccination programs currently in our database that we use all the time,” Parsons says. “There’s no such thing as a standard program, but broad IB protection is something our customers need to have.”

When Parsons joined Country Fresh 21 years ago, the company predominately used one breed of bird. “They pretty much received all of the same vaccines and that was it,” he recalls. “Now, we have about 10 different breeds out there, all of which will be transferred to different types of farms, in different environments with different lighting and so on. We have to segregate houses by breeds, lighting and vaccination programs.”

More than anything, Parsons says, the industry’s switch to free-range production — now practiced by about 70 percent of his customers — has increased flock exposure to diseases.

‘Blown out of the water’

“When birds were in cages, they were in a controlled environment and probably subjected to less stress,” he says. “Birds like routine; they *love* routine. But when you put birds into a free-range situation, routine is blown out of the water. Birds are being let outside, so they’re exposed to more disease — not just the IBs, but farm-specific problems. If people are raising pigs and sheep in the range area, for example, erysipelas and *E. coli* can be a concern. The demand for more complex vaccination programs is being driven by free range.”

To minimize stress on its birds, Country Fresh works under two auditing bodies — Freedom Food, the farm assurance and labeling initiative monitored by the Royal Society for the Prevention of Cruelty to Animals, and the British Lion Code of Practice administered by the British Egg Industry Council. Many of their farms now have slatted-perch flooring areas, which helps maximize production per square meter while allowing birds to be more mobile and develop better leg strength, Parsons says.

“That’s a huge advantage for the free-range layer,” he adds. “The stronger the bird is, the better it will withstand the rigors of IB and other disease challenges.”



Country Fresh Pullets' Richard Parsons: 'There's no such thing as a standard program, but broad IB protection is something our customers need to have.'

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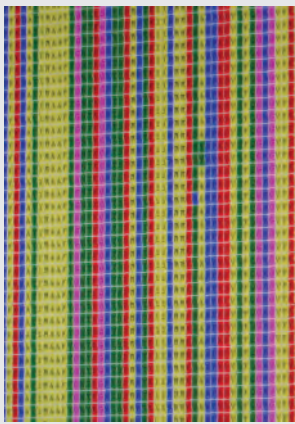
The economic impact of infectious bronchitis is mainly due to poor growth performance and mortality related to respiratory disease in broilers and egg production losses in layers and breeders. It can be prevented by implementing sound biosecurity principles and vaccination programs.

Prime with Nobilis[®] IB Ma5 at day-1 and see the benefits.



Protectotype

Advanced molecular technology helping to pinpoint IB variants, improve vaccination programs



By comparing sequences of commercial IB vaccine strains to those in the field, it's possible to determine if an IB field strain is identical to a vaccine IB strain or different in a defined way.

Richard Currie, PhD, BVM&S, MRCVS

Advances in molecular technology now make it possible to pinpoint the strains of infectious bronchitis (IB) affecting poultry flocks and to tailor a vaccine program that can more effectively control the disease, according to a leading poultry veterinarian with expertise in molecular diagnostics.

"You have to know the nature of the field challenge to design a vaccination program capable of protecting," says Richard Currie, PhD, BVM&S, MRCVS, president of x-OvO Limited, Scotland, a biotechnology company that performs diagnostics for many poultry companies in Europe.

"In addition, to be cost effective, you want to use as many vaccines as you need — but not more than you need. Appropriate molecular diagnosis of IB infections gives you that option," he says.

Complicated diagnosis

The diagnosis of IB infection is complicated, in part, Currie explains, because of many diverse IB viruses present in the field. IB is an RNA virus and RNA viruses easily undergo genetic changes.

Testing for IB viruses is also an expense, and in the current economic climate, many producers often prefer to limit costs until a major clinical problem occurs. When producers do request IB diagnostic tests, they usually opt for serological-based tests that are conducted on a more or less routine basis, but the sample sizes tested make this of relatively limited diagnostic value, he says.

New, pre-packaged polymerase chain reaction (PCR) tests can reveal whether a particular subtype of IB is present, but they can't differentiate between vaccine and field strains nor can they identify emerging new IB strains. "You can only find what you know already exists," Currie says.

'Indispensible' testing

In contrast, molecular investigation using real-time quantitative PCR testing plus sequencing of the S1 gene of IB virus not only allows specific identification of the virus that is present, it also provides several practical ways that veterinarians can alter the way a flock is managed to optimize health status and performance, he says.

"In fact," Currie says, "there are poultry veterinarians who now consider PCR testing an indispensable part of their clinical approach to IB."

The newer technology makes it possible to identify novel IB viruses, determine the quantity of IB virus present and compare the efficacy of different vaccine application methods.

Studies by x-OvO, in collaboration with MSD Animal Health, have demonstrated that more IB vaccine virus replicates in birds vaccinated by the spray route compared to administration of the vaccine in water, Currie says.

By comparing sequences of commercial IB vaccine strains to those in the field, it's possible to determine if an IB field strain is identical to a vaccine IB strain or different in a defined way, he continues.

"These differences can be significant because there are specific changes that are associated with a breakthrough in vaccine protection. Hence, the presence of these types

continued

cutting
edge

“...the presence of these types of viruses can indicate to the veterinarian that a stronger, broader-protective vaccination strategy is more appropriate.”

Richard Currie, PhD, BVM&S, MRCVS

of viruses can indicate to the veterinarian that a stronger, broader-protective vaccination strategy is more appropriate,” Currie says.

The resulting information can help veterinarians determine if flocks would benefit from using a combination vaccine approach, such as Nobilis IB Ma5, which is based on the Massachusetts IB serotype, and Nobilis IB 4/91, which is based on the IB 4/91 variant serotype, he adds.

Monitors trends

The newer molecular technology now used by x-OvO also makes it possible to identify important trends in the field that can guide poultry veterinarians and producers, according to Currie.

It enabled the first diagnosis of the Chinese IB QX-variant genotype outbreak and subsequent epidemic in the UK. “This would have been missed with the previous technologies,” he says, noting that trends in the IB viruses circulating tend to be

the same whether it’s the layer, breeder or broiler segment of the market in a given area.

The technology made it possible to demonstrate that suspected field outbreaks of IB QX in German flocks vaccinated against IB QX with a live QX vaccine were due to QX field infection — not simply to the detection of the live QX vaccine.

“Older technologies would simply have confirmed the presence of IB QX and everyone would have thought it was the vaccine,” Currie says.

For French flocks, the combination of PCR testing and extensive IB hemagglutination testing of sera samples clearly showed the presence of an IB 4/91 serotype field challenge in flocks vaccinated only with an IB H120 vaccine. “This is a good application of the technology, clarifying serological results with a molecular confirmation test, and it justified the need for changing the vaccination program,” he says.

The technology further demonstrated that the IB Italian 02 variant, which was a major problem in the EU some 8 years

ago, has almost disappeared from the area, he notes.

Testing with service package

Another advantage, Currie says, is that veterinarians who collaborate with certain animal health companies, such as MSD Animal Health, gain access to molecular diagnostics as part of a service strategy that supports appropriate vaccine use.

For molecular diagnostics, x-OvO prefers that tracheal and cloacal swabs be submitted; they provide larger amounts of intact viral RNA, and the company can provide the permits necessary for sending clinical material for testing, he says.

FTA cards can be used for submission of samples from countries where the export of genetic material is not allowed by local authorities; the cards inactivate and stabilize genetic material, but the technique required to remove RNA from the cards can sometimes lower diagnostic sensitivity, Currie says.

If uncomplicated testing is all that’s required, which is the case

with most submissions, results are guaranteed a maximum of 21 days from submission; they come with an analytical report that puts the results into a clinical context that veterinarians can use. Sometimes, when dual infections are involved, further analyses may be necessary and the results are sent as they become available, Currie says. The goal is to customize the format of the results so they emphasize issues that are critical to the client.

There’s another important benefit that advanced molecular technology brings to the poultry industry, he says. With the tracking abilities it affords, the technology can help define the epidemiology of IB viruses in a certain region or country, which enables the poultry industry to make better use of the IB vaccines that are available and tailor vaccination protocols as needed.

Additional information about x-OvO Limited’s diagnostic services is available on the company’s website at x-ovo.com.

special report

from the XVII World Veterinary Poultry Association

Integrated strategies for more effective IB control

A symposium on Protectotype at the XVII World Veterinary Poultry Association Congress in Cancun, Mexico, showcased the latest ideas and trends — from both the lab and the field — for managing infectious bronchitis (IB) in poultry.

Sponsored by MSD Animal Health, the 90-minute session attracted more than 400 veterinarians, as well as editors from the *Journal of Poultry Respiratory Protection*. Following are reports on the key presentations.

XVII

Aris
Malo DVM

Understanding how IB attacks clarifies need for broad vaccine protection

1



Understanding how the infectious bronchitis (IB) virus attacks the chicken's respiratory system clarifies why broad IB vaccine protection is needed, said Aris Malo, DVM, global technical director for poultry, MSD Animal Health.

IB, a highly contagious and widespread disease, has become a major economic concern to the poultry industry worldwide, causing urogenital as well as respiratory problems, he said.

In layers and breeders, it leads to reduced egg production and poor egg quality; in broilers, it causes poor performance; and in all affected chickens, it predisposes to secondary infections, resulting in higher mortality and an increased use of antibiotics, Malo explained with the aid of a colorful, animated video.

IMMUNE RESPONSE

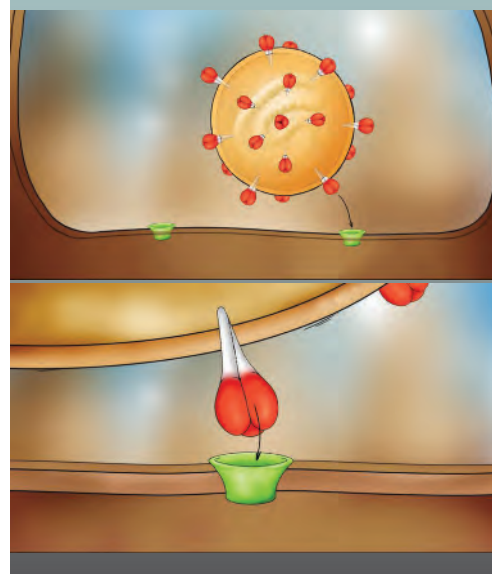
The IB virus, which is spread by the inhalation of droplets, has a number of characteristic spikes on its surface. The spikes are proteins that play an important role in the onset of infection and the corresponding immune response, he said.

After entering the bird's body, the IB virus quickly reaches its primary targets — the trachea and bronchi. Birds with immunity to the virus have protective barriers, which consist of the cilia — the hair-like structures lining the respiratory tract — and mucus produced by goblet cells. Together

they form a self-cleaning mechanism that provides protection against a variety of invading pathogens, Malo continued.

In unprotected birds, however, the IB virus is able to overcome the protective mechanism. The virus binds to cells on the surface of the trachea. To do this, it uses its protein spikes to attach itself to receptors on the cell membrane (Figure 1). Next, the virus pushes itself into the cell interior, where it multiplies and infects other cells, in turn producing more viruses and causing the cells to lose their cilia (Figure 2).

Figure 1. IB virus "spikes," which are surface proteins, bind to receptors on the cell membrane.



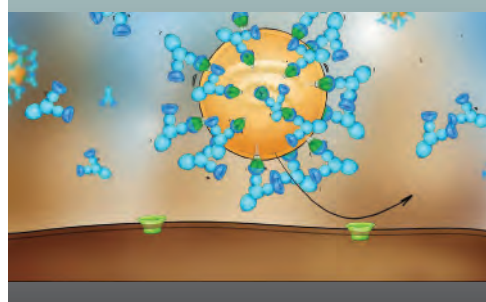
“...if the binding of IB virus to cells can be prevented, infection will not occur.” ARIS MALO, DVM

XVII

Figure 2. The IB virus pushes the membrane back, reaching the cell's interior.



Figure 3. Antibodies induced by vaccination bind to surface protein spikes on the IB virus.



“In this way, the natural barrier against invading pathogens is progressively destroyed, but if the binding of IB virus to cells can be prevented, infection will not occur,” he said.

INITIATING IMMUNITY

Vaccination can prevent binding by initiating a prompt immune response based on local mucosal immunity, the veterinarian explained. Antibodies to the IB virus are produced and bind to the protein spikes on the IB virus; the spikes are no longer free to attach themselves to receptors on the cell membrane, thus preventing IB infection (Figure 3).

“Unfortunately, it gets a bit more complicated,” he said. There are many variants of the IB virus with different surface proteins or spikes; protection induced against one type may not always be efficacious against other types.

“That’s why, despite vaccination, birds can still break with IB — if the IB virus that attacks is different from the IB vaccine used,” he said.

On the other hand, it is possible that some IB serotypes induce immunity against more than one serotype because even though they have different surface proteins or spikes, they share some similarities. In that case, such an IB serotype is called a Protectotype, Malo said.

An example of Protectotype is Nobilis IB Ma5 vaccine, based on the Massachusetts serotype, which leads to broad protection, he said.

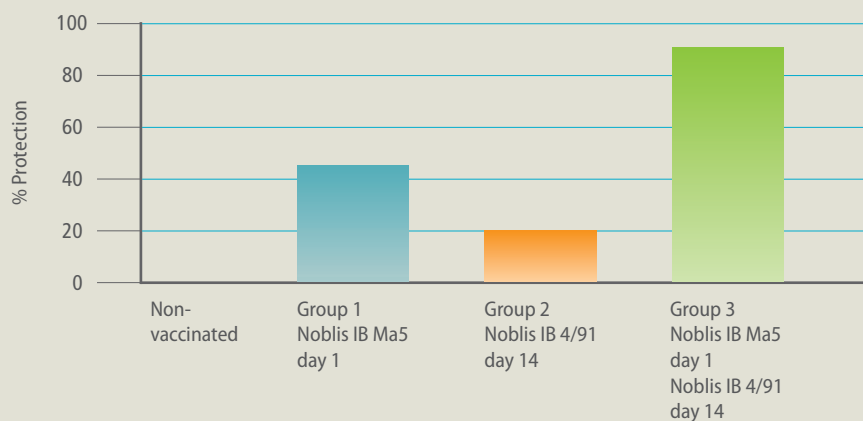
Even better protection is achieved if an additional IB serotype is used for vaccination. An example would be Nobilis IB 4/91, which is based on the 4/91 variant that is widespread throughout Europe.

continued

Aris
Malo DVM

1

Figure 4. Protection against an IB virus variant isolate demonstrated by the ciliostasis test



“The use of Ma5 administered on day 1, followed by 4/91 on day 14, has been found to be especially effective and will protect the birds against most IB viruses during the first weeks of their lives,” Malo said.

To safeguard egg production in long-lived layers and breeders, repeat vaccinations before the onset of lay is needed and should include the use of an inactivated, multivalent IB vaccine, he advised.

PROOF OF EFFICACY

The efficacy of these two vaccines has been widely proven using the ciliostasis test, a tool that measures the impact of a virus on the cilia of the trachea. For the test, veterinarians or technicians

take samples from different areas of the trachea so ciliary activity can be measured. The ciliostasis test also evaluates the level of protection after vaccination, Malo said.

Values above 50% represent good ciliary activity and, therefore, good protection. Values below indicate insufficient protection. Studies show that the use of both Ma5 and 4/91 yields far better results than using each vaccine individually, he said (Figure 4).

The vaccines can help the poultry industry avoid the considerable financial losses associated with IB infection, Malo concluded.

'More is better' when vaccinating layers, breeders against IB

Sjaak DeWit DVM, PhD

2

“More is generally better” when it comes to infectious bronchitis (IB) vaccination for layers and breeders, said Sjaak De Wit, DVM, PhD, of the Animal Health Service, Deventer, the Netherlands.

Few regions in the world are without IB virus variants, he said. “In many countries, you have three, four or five variants. We’re realizing that it may be futile to vaccinate against one specific IB virus strain. You have to try and make smart vaccine combinations so your protection is broader.”

While IB variants can cause respiratory disease, the greater concern in layers is a drop in egg production and poor egg quality; in breeders, a drop in hatchability might also occur. False layers and nephritis are other possible consequences of IB, De Wit said.

LOW TITERS = POOR PROTECTION

Because they are long-lived birds, layers and breeders need long-term IB protection. Live IB vaccines can provide good protection but only for a short period of time; they result in low antibody titers, which correlate with low protection during the laying period. Killed vaccines are required for long-term protection but work much better if they are administered after birds have received a live vaccine first as a primer, he explained.

De Wit cited published, controlled studies conducted by other investigators demonstrating that layers not vaccinated against IB have the most severe drop in egg production — above 70%.

A group vaccinated at 3 and 16 weeks of age with a killed IB vaccine but no live primer had a drop in egg production of about 30%, while a group vaccinated with a live IB Massachusetts-strain vaccine at 3 weeks of age then with a different live IB Massachusetts-strain vaccine at 16 weeks of age had about a 10% drop in egg production.

Even better results occurred in birds vaccinated once with a live IB vaccine at 3 weeks of age, followed by an inactivated IB vaccine at 15 weeks of age. This group had no drop in egg production, he said.

De Wit also presented the results of studies he and colleagues conducted testing four IB vaccine combinations against four Chinese Q1 IB strains obtained from Latin America in 2009 and 2010. The primer was either a live Massachusetts (Ma5) IB strain or Ma5 plus a live IB 4/91 variant, which is prevalent in Europe, followed by killed boosters with IB M41 alone or with IB D274 (Table 1).



Table 1. Four IB vaccination programs tested against a Q1 IB strain

Vaccination program	Live primers	Killed boosters
1	Ma5	M41
2	Ma5	M41 + D274
3	Ma5 + 4/91	M41
4	Ma5 + 4/91	M41 + D274

Sjaak
DeWit DVM, PhD

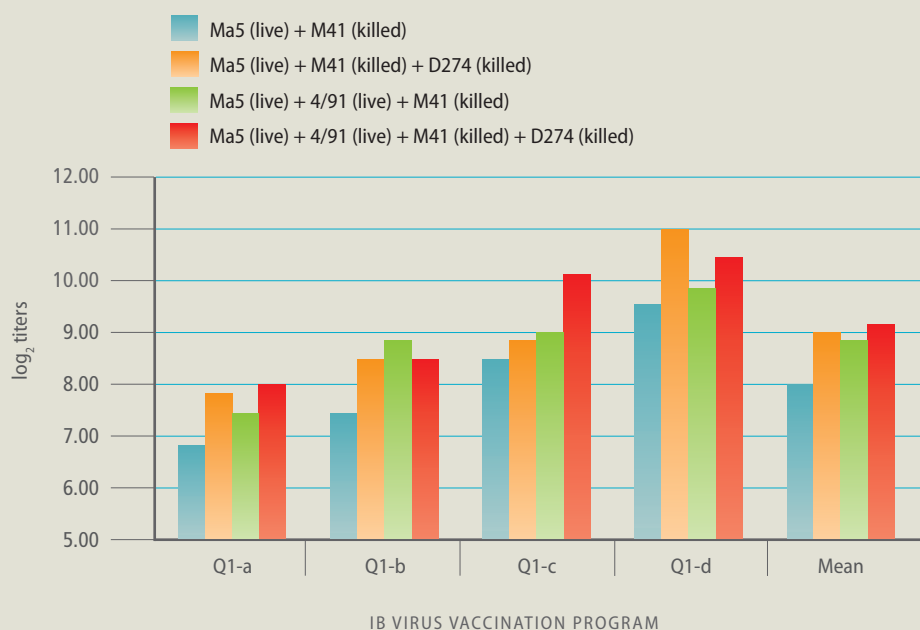
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"The lowest level of virus-neutralizing antibodies against this Q1 strain occurred when only a live Massachusetts-strain (Ma5) vaccine and a boost with inactivated M41 was used. On average, the most complicated system of broad, live-vaccine priming then a broad-boosting killed vaccine had the best results and yielded the highest level of neutralizing antibodies," De Wit said (Figure 1).

BROAD, HETEROLOGOUS BOOSTING

"There are exceptions, but the message is usually the same. It's highly recommended, especially in areas with a high IB challenge, that inactivated vaccines be used to get more protection against IB and, in general, that more vaccine strains be used to achieve broad, heterologous boosting," De Wit said.

Figure 1. Mean virus-neutralizing titers (\log_2) against four strains of Chinese Q1 infectious bronchitis (IB) virus after boosting with killed IB vaccines



“We’re realizing that it may be futile to vaccinate against one specific IB virus strain.” SJAAK DE WIT, DVM, PhD

He also advised using a good, live, priming vaccine before killed vaccines are administered to increase the efficiency of the killed vaccines.

Even though good IB protection requires more complicated vaccine programs, the good news, he said, is that not every IB variant needs a vaccine specifically for that variant. “By making smart vaccine combinations, you can solve your problems with a few vaccines.”

In addition, De Wit noted, “Producers quite often complain that vaccination isn’t working because there’s still a drop in egg production of about 5%, but without vaccination, that drop could have been 50%, 60%, 70% or even 80%.”

VACCINE EFFICACY

Efficacy with IB vaccines, he pointed out, will be affected by the strains of IB virus that are administered, by the quality of each antigen per dose and by the adjuvants used in each vaccine.

Proper vaccine application is imperative, De Wit emphasized. In addition, trials conducted with live IB vaccines have demonstrated that efficacy improves if the ventilation system is turned off and the lights are on. If the vaccine is administered in water, there needs to be good water quality, low in temperature and free of pathogens.

“Keep in mind that you are working with a very sensitive virus that’s easy to kill. If you’re aware of that, you’re on the path to better results,” he said.

DIAGNOSTICS

De Wit is a “big fan” of diagnostics when IB is suspected. “Even if there are no problems, I think it’s a good idea to obtain serological testing at the end of each flock just to see if titers are high for IB, because that means there was a challenge.”

It also means that the vaccination schedule was working. The information can help producers decide whether they should continue doing what they’re doing, or that their program needs adjusting, he said.

Certainly, he said, samples should be taken for testing when there are clinical problems. “It’s very, very easy to make incorrect conclusions if you don’t obtain diagnostics. Maybe it’s not IB or it’s some unexpected variant. If you don’t know that, plans for the next flock will be wrong.”

Asked about the role of co-existing disease, De Wit said that flocks with infections such as mycoplasma, pneumovirus or other health problems are not necessarily more susceptible to IB — but the clinical signs after the IB infection will be more severe and the recovery will be harder.



Mark
Jackwood PhD

3

European approach to IB control explored for use in US flocks



A novel approach to control of infectious bronchitis (IB) that's been effective abroad may be on the horizon for US producers struggling with the disease in their flocks.

The new approach is based on the use of IB serotypes, and its adaption for the US poultry industry is being spearheaded by Mark Jackwood, PhD, a molecular virologist at the University of Georgia, USA.

It is well known that if just one virus in an IB vaccine is administered, birds will be protected against that particular virus but not other IB viruses, Jackwood said.

However, it is also now known that some IB serotypes have cross-protective ability against other IB serotypes — a phenomenon that scientists call "Protectotype." In addition, when two different IB serotypes are used, birds will develop immunity not only to those serotypes, but they will develop cross-reacting antibodies to some of the other IB serotypes. "We get a broader type of protection," he said.

LESS COSTLY

An approach toward IB control involving Protectotype is largely based on work by Jane Cook, PhD, a microbiologist in the UK and recognized authority on IB. She points out that IB variants arise frequently and that Protectotype is less costly and makes more sense than developing a new vaccine for every variant that arises. Even though the IB virus is capable of frequent mutations, she says, the genetic makeup of the

virus changes only minimally and the rest remains the same, which is why some IB serotypes are able to provide cross-protection.

In Europe and elsewhere, research and field experience have demonstrated that using an IB vaccine based on the Massachusetts serotype followed by one based on the IB variant 4/91 — a common variant in Europe — can provide broad protection against many IB variants.

SUBSTITUTE STRAIN FOR US

In his WVPA presentation, Jackwood said, "We don't have 4/91 in the US and it's not permitted for good reason; the major problem we have is the Arkansas IB strain. We're asking what can we substitute for 4/91?"

Toward this end, Jackwood spent a week in Europe with Sjaak De Wit, DVM, PhD, at the Animal Health Service, Deventer, the Netherlands. "We vaccinated specific-pathogen-free birds with Ma5 at 1 day of age and with 4/91 at 14 days of age, then challenged birds with the US Arkansas or Georgia 98 IB strains," he continued.

Five days after challenge, birds that had received both the Ma5 and 4/91 vaccines had about 90% protection against the Arkansas IB challenge, and there was 86% protection against challenge with the Georgia 98 strain, which is a Delaware-type virus, he said (Table 1).

In birds vaccinated only with Ma5, protection against the Arkansas IB challenge was also determined to be about 90%; this was higher than

Five days after challenge, birds that had received both the Ma5 and 4/91 vaccines had about 90% protection. MARK JACKWOOD, PhD

XVII

Table 1. Results in vaccinates and controls after challenge with IB viruses

Vaccination	Day of hatch	Day 14 of age	Challenge virus	Number of birds per group	Average protection level against ciliostasis
Unvaccinated, unchallenged controls	—	—	—	5	100%
Unvaccinated, challenged controls	—	—	ArkDPI/81	10	24%
Ma5	—	—	ArkDPI/81	10	90% (weak challenge)
Ma5	—	4/91	ArkDPI/81	10	90%
Unvaccinated, challenged controls	—	—	GA98/0470/98	10	0%
Ma5	—	—	GA98/0470/98	10	37%
Ma5	—	4/91	GA98/0470/98	10	86%

expected, but as it turned out, the challenge was weaker than intended. As expected, protection against the Georgia 98 IB challenge was only about 37% in birds that received only Ma5, Jackwood continued.

Protection was determined by scoring ciliary activity in the tracheal epithelium, he noted.

DELAWARE 072?

For the US market, Jackwood and colleagues are going to try substituting IB 4/91 with the Delaware 072 IB strain because it is distinct and may provide a broader set of antibodies. The studies are underway and Jackwood hopes to have data to share in the near future.

Jackwood explained that this work involves determining genetic similarities between viruses,

particularly regarding a spike protein on the outside of viruses, and virus neutralization testing. "The spike protein is the one that induces neutralizing antibodies. If we get an amino acid sequence similarity between spike genes in the high-80% or low-90% range, there will usually be some cross-protection."

The researchers are also carefully examining the significance of ciliostasis scores and want to find out if protection against ciliostasis correlates with protection in the field. "We know it does in Europe; we want to see if the same holds true here with US IB viruses," he said.

Jackwood is confident that progress can be made. In an interview, he said, "We already have a lot of really good vaccines available to us. I think that we can do a better job of actually applying those vaccines and getting a little broader protection using a protocol involving Protectotype."



Brice
Robineau DVM

4

Test results show growing prevalence of IB 793B (4/91) over 5 years



A 5-year summary of test results by a diagnostic laboratory in Europe shows that infectious bronchitis (IB) virus is clearly the most prevalent respiratory disease among poultry, reported Brice Robineau, DVM, of Finalab, which specializes in veterinary biological analysis.

While the tests involved poultry flocks only in France — Europe's top producer of chicken meat — the data provide a meaningful snapshot of the prevalence and diversity of the IB virus.

In 2009, the year with the greatest number of samples, more than half of layers and breeders tested were positive for IB virus. Between 2007 and 2010, an average of 45.2% tested positive (Table 1).

In 2010, the number of positive tests tapered off to 34%, but Robineau said some of the samples submitted could not be typed, possibly because the virus is a new genotype not sensitive to polymerase chain reaction testing.

According to Robineau, the most common IB virus strain circulating is the variant 793B (Table 2), which first appeared in France in 2005. The 793B variant is of the same Protectotype as IB 4/91, which means it has cross-protective ability.

The next most often found IB virus strains were Massachusetts and the variant QX, he said, explaining that the study was based on samples sent by farmers or technicians who suspected infectious respiratory disease.

In broilers, Robineau said, 81% were positive for IB virus in 2010, up from 76% in 2009. Again, the majority of IB virus strains found were 793B,

Table 1. Percentage of layer and breeder samples positive for IB virus

Year	Number of samples tested	Percent positive for IB virus
2006	51	47%
2007	76	41%
2008	71	49%
2009	99	55%
2010	32	34%

Table 2. Percent of samples positive for IB virus strains in layers and breeders when both single and multiple IB virus isolations are considered

Year	IB virus strains		
	793B	MA	QX
2006	50%	17%	8%
2007	58%	26%	10%
2008	54%	6%	18%
2009	46%	22%	6%
2010	64%	18%	9%

Table 3. Percent of samples positive for IB virus strains in broilers when both single and multiple IB virus isolations are considered

Year	IB virus strains		
	793B	MA	QX
2006	44%	38%	24%
2007	71%	38%	49%
2008	68%	30%	33%
2009	53%	39%	21%
2010	45%	32%	5%

“You have to get immunity very early, during the first weeks of life, to prevent damage to the reproductive tract.” BRICE ROBINEAU, DVM

followed by the Massachusetts then QX IB virus strains, but the percentage positive for 793B was not as high as it was in the previous 3 years (Table 3).

SENTINEL LAYER STUDY

To further assess the prevalence of IB viruses, Finalab also conducted a study in 2011 using sentinel birds involving six layer farms in France. Between six to 10 specific-pathogen-free birds were placed on each of the farms, which were all contaminated with IB virus.

This study further demonstrated that 793B was the most prevalent IB virus circulating. It also showed that sentinel birds not vaccinated for IB were contaminated by the production birds, he said.

IMPROVED RESULTS

In a third study, Finalab compared two vaccination protocols on five broiler farms with high IB pressure. Protocol 1, used in 2007 and 2008, began with a conventional IB H120 vaccine in the hatchery and a booster at 14 days of age with IB virus 4/91 in the field. The H120 vaccine is based on the Massachusetts IB serotype.

Beginning in 2009, the farms started transitioning to Protocol 2, which consisted of Ma5 (Massachusetts) and 4/91 vaccines administered at the hatchery. By 2010, all five farms were using Protocol 2. Several production parameters, such as condemnation and age at slaughter, were better with the updated vaccination plan (Table 4), while daily weight gain and the feed-conversion ratio

Table 4. Results of study comparing conventional to updated vaccination plan for broilers

Year	Number of flocks	Losses	Condemnations	Viability	Age at slaughter
2007-2008 (conventional vaccine plan)	70	3.12%	0.77%	96.11	42.22
2010-2011 (updated vaccine plan)	54	2.84%	0.55%	96.61	41.39

was comparable between the two regimens, Robineau said.

The veterinarian concluded that for broilers in an area with high IB virus pressure due to 793B IB virus variant and possibly to the QX IB virus strain, “vaccination with H120 followed by field vaccination at 14 days can be replaced with vaccination that can be done in the hatchery to prevent the degradation of performance by IB virus contamination.

“What’s remarkable, in my opinion, is that the 793B virus has been very stable over the years,” he said.

For long-lived birds such as layers and breeders, Robineau said the vaccination plan would depend on the situation in a given area or on a given farm, but “our strategy is to use a lot of live vaccines providing broad protection, then to booster with inactivated vaccines.

“You have to get immunity very early, during the first weeks of life, to prevent damage to the reproductive tract. You have to use multiple variants and booster for them,” he said.



Mário Sérgio
Assayag Jr., MV, DSc

5

Monitoring helps Brasil Foods steer IB vaccination program



Careful, high-tech monitoring has demonstrated the volatility of infectious bronchitis (IB) in the field and enabled a Brazilian producer to provide the most effective vaccination programs to contain the disease.

Mário Sérgio Assayag Jr., MV, DSc, the veterinarian in charge of animal health for Brasil Foods, Curitiba, explained that IB has been a problem for both broilers and broiler breeders and that the challenges are both seasonal and periodic.

In broilers, IB often leads to increased use of medication in the field and higher condemnations due to airsacculitis and colibacillosis, the veterinarian reported.

In breeders, IB results in poor hatching, egg production and mortality. An added complication is frequent co-infection with avian metapneumovirus, which requires its own vaccination, he added.

In one field example cited by Assayag, broiler flocks affected with IB had watery feces, extremely wet litter and were depressed and rough-feathered; they also were severely dehydrated, which was indicated by dark muscles, and had kidney lesions, mild airsacculitis and contact dermatitis. Mortality was elevated by 3%.

A field case involving breeders was characterized by watery feces, severe dehydration, kidney lesions, airsacculitis, contact dermatitis and a 0.5% increase in mortality, he said.

ECONOMIC IMPACT

The economic impact of IB has been significant: Over US \$3 million annually for broilers and nearly US \$4 million for breeders, Assayag continued.

The company, which has its own facilities where IB viruses can be typed using polymerase chain reaction (PCR) and genetic sequencing, also conducts challenge trials in its lab as well as field trials. It has found that 58% of IB viruses affecting its flocks are of the Massachusetts serotype and 42% are IB variants, he said.

Brasil Foods uses testing results to adapt its vaccine programs to the IB challenge as needed. In broilers, it has administered IB H120 or Ma5, both of the Massachusetts IB serotypes. "The protection with an IB Ma5 vaccine is much higher, and it's a better vaccine to use because you don't have to vaccinate as many times," Assayag said.

In breeders, the vaccination program used also varies depending on the IB challenge and is tailored to meet the needs of these longer-lived birds that need protection longer than broilers. The company may use a live IB Ma5, H120 or both vaccines to start, followed by killed IB vaccines such as Mass or the variant D274, and then revaccinates during production with two killed vaccines.

"We use those two inactivated vaccines with good results when there is a very high IB challenge," Assayag said.

The concept of Protectotype — using more than one IB vaccine from serotypes that have cross-protective ability — "is a very important way to look at infectious bronchitis if we want results in the field," he said.



Tracking IB, as the crow flies

Serology and polymerase chain reaction testing might be effective ways to track the prevalence and scope of infectious bronchitis (IB) variants, but sometimes circumstantial evidence and even old-fashioned farmer intuition can pick up patterns as well.

"Farmers always told me that they associated QX problems with the arrival of crows from eastern countries," says Franz Sommer, DVM, DACPV, a consulting veterinarian based in Vienna, Austria.

Whether crows have anything to do with the level or type of IB pressure is wide open for discussion at egg producers' nearest café. Meanwhile, Sommer says, he isn't taking any chances.

Added protection

To provide the broadest protection against IB, he builds vaccination programs around a concept called Protectotype, which involves using specific IB vaccines in the same program, at specific times, for added cross-protection against different variants, including QX.

"Infectious bronchitis is rather tricky," he says. "If you use the Ma5 vaccine, it covers the Massachusetts-serotype virus. If you use the 4/91 vaccine, it covers the 4/91 type of virus. But if you use the two of them together in the same program, they cover a couple of different serotypes. Vaccine A plus vaccine B protects not only against A and B, but also against serotype strains C and D."



As a consulting veterinarian for Schropfer, a leading layer multiplier that supplies ready-to-lay pullets to more than 40% of Austria's layer market and covers more than 80% of that country's day-old pullet market, Sommer and his veterinary colleague manage the health program for 80,000 breeders plus a hatchery that produces 7 million birds a year. In addition, they consult with about 60 independent egg producers in Austria and work with clients in Hungary, Slovenia, Croatia, Montenegro, Albania and Bulgaria that buy day-old chicks from Schropfer.

For all of these birds, Sommer says, IB looms as a "two-fold problem" that affects the reproductive and respiratory systems. "It's more a respiratory disease in young birds and a reproductive disease in older birds," he says.

Losses of 50%

When QX came on the scene in 2006, many producers in the area suffered production losses up to 50%. The QX outbreaks returned in 2008, but the variant has been relatively quiet since then — partly because producers are taking more strategic measures to ensure broad protection against all IB viruses.

"The main difference now is that we use the Ma5 vaccine at day 1 in the hatchery and 4/91 at day 14," he says. "With these two vaccines, we've been really successful in preventing any major IB problems."

'Insurance policy'

In addition, Sommer recommends vaccinating with H-52, another live IB vaccine, at 10 weeks and then coming in again with 4/91 at 14 weeks. At 17 weeks, when birds are being transferred, he vaccinates with an inactivated vaccine that provides additional protection against IB variants, plus Newcastle disease, egg drop syndrome and avian pneumovirus.

"I look at the killed vaccine as an insurance policy," Sommer explains. "In my opinion, with this vaccine, you get more stable birds that are able to withstand challenges a lot easier because they have antibodies against the major diseases of concern in our area."

After week 26, Sommer urges producers to revaccinate with the live Ma5 and 4/91 vaccines, usually alternating them every 6 to 7 weeks.

"With the live vaccines, you get local immunity at the oral mucosa, nasal mucosa and ocular mucosa," he says. "Those areas — the ocular one, in particular — are main entrance ports for IB. So, on top of vaccinating them with a killed vaccine at transfer, we run a really successful revaccination program."



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Ref: 1. Intervet Poultry Focus Technical Bulletin, June 2006. Nobilis® IB Ma5 is a live vaccine containing Avian Infectious Bronchitis virus strain IB Ma5. POM-VPS. Nobilis® IB 4/91 is a live, freeze dried virus vaccine containing Infectious Bronchitis strain 4/91. POM-V. Additional information and advice is available from your veterinary surgeon. Nobilis® is a trademark of Intervet International B.V. or affiliated companies or licensors and is protected by copyrights, trademark and other intellectual property laws. Copyright © 2011 Intervet International B.V., a subsidiary of Merck & Co., Inc., Whitehouse Station, NJ, USA. All rights reserved. This advertisement contains information on veterinary products based on international registration dossiers and may refer to products that are either not available in your country or are marketed under a different trade name. In addition, the approved indications as well as safety and efficacy data for a specific product may be different depending on local regulations and approvals. For more information, read the product labeling that applies to your country or contact your local MSD Animal Health representative.

