

New directions in Newcastle control

Advances in vaccine technology
are helping to reduce mortality,
performance losses and stress

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Pilgrim's back
on track with
no-reaction
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Vet discusses
challenges, strategies
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University study
shows benefits
of PROTECTOTYPE
protocol for IB

New directions in Newcastle control

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While producers have many vaccines available for managing ND, acute and subclinical infections are still common in many markets — often because the right vaccine is not used at the right time. In this special report, the *Journal of Poultry Respiratory Protection* looks at new strategies, techniques and tools for managing this costly disease.

PPRP



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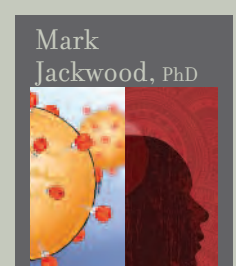
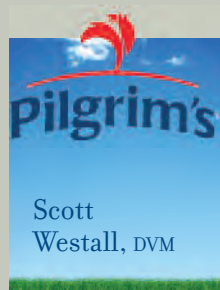
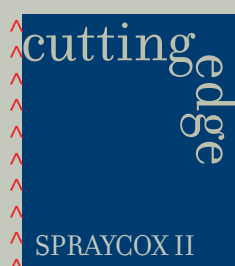
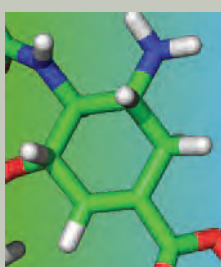
New approach needed for ND control

Laura Villarreal, DVM, talks about the challenges of Newcastle disease and the benefits of using a recombinant vaccine.

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Two-vaccine protocol protects broilers against new IB variants

New research provides further evidence that broilers can get broader protection with PROTECTOTYPE program.





Winning the war on Newcastle

It seems there are some poultry diseases that just won't go away and, in fact, become more challenging with time.

For many decades, that was the case with Newcastle — a persistent bug that the authors of the prestigious *Diseases of Poultry* once said was “unsurpassed by any other poultry virus and probably represents a larger drain on the world's economy than any other animal virus.”

In recent years, H5N1 avian influenza may have passed Newcastle as the virus that presents the biggest drain on the world's economy (Boven *et al*, 2008). Nevertheless, the economic impact of virulent Newcastle disease (vND) remains very big — and very real.

Making headway

The good news is that the global poultry industry is making significant progress against ND — not only with biosecurity and vaccination programs, but also in reducing the stress and production losses associated with some ND-management tools.

In Mexico, for example — a country with a long history of vND — researchers have made considerable headway using a recombinant vaccine built on the herpesvirus of turkey. Ángel Mosqueda Taylor, DVM, a veterinary consultant and former professor at the National Autonomous University, reports that some farms in endemic areas have reduced mortality from 24.5% to 5.5% by making subcutaneous INNOVAX-ND-SB the foundation for the ND-control program (page 7).

From research at Oklahoma State University in the US, we have also learned that broilers perform better the first 2 weeks of life if the ND vaccine they receive is one that causes less stress. Nutritionist Robert Teeter, PhD, found that birds immunized with a recombinant ND vaccine had significantly better weight gain and feed conversion than those receiving conventional ND vaccination protocols. They also retained more energy compared to the other vaccine groups (page 10).

Performance improvements

Some of the world's top producers have also reported measurable performance improvements by making adjustments to their ND vaccination program. At the

Pilgrim's operation in North Carolina, for example, Scott Westall, DVM, was concerned that summer heat and the stress associated with a live ND vaccine were increasing bird mortality and lowering carcass quality. After switching to the no-stress recombinant ND vaccine, the flock's livability, feed conversion and condemnation rates returned to normal (page 15).

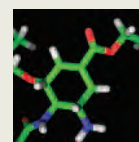
There's always room for improvement in any poultry-health program. Fortunately, in the case of ND, innovative vaccination strategies are making it possible to provide more dependable protection while reducing stress and improving flock performance.

This special edition of the *Journal of Poultry Respiratory Protection* offers many valuable, field-proven tips for battling one of the toughest diseases of poultry. For more information, please visit innovax-vaccines.com or contact your Merck Animal Health* representative.

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Pathological impact of Italy 02 IB virus studied

Spanish investigators have provided more information about the pathological consequences of the Italy 02 serotype of infectious bronchitis virus.

Even though it is a predominant infectious bronchitis (IB) virus serotype in several European countries, little is known about the pathogenesis of Italy 02 serotype, they say.

In their study, they infected chicks as well as old hens with the Italy 02 serotype and then evaluated clinical signs and gross and microscopic findings. They also utilized *in situ* hybridization (ISH) and real-time polymerase chain reaction (RT-PCR).

The Italy 02 serotype was shown to cause severe respiratory and renal damage in 1-day-old chicks but not in adult hens, which had only respiratory disease and a drop in egg production. The use of ISH demonstrated the presence of viral RNA in nasal turbinates prior to the trachea, but replication periods were more consistent and longer in lower gastrointestinal tract enterocytes.

In addition, the detection of viral nucleic acid in the gut by RT-PCR was consistent, and there was more persistent viral shedding detected in feces than in nasal exudates, Roser Dolz and colleagues, of the Centre de Recerca en Sanitat Animal, wrote in a recent issue of *Veterinary Microbiology*.



CEO vaccines for ILT given in water replicate differently

Two chicken-embryo-origin vaccine strains for infectious laryngotracheitis replicated differently in drinking water, Australian investigators say.

It is notable, they say, that recent infectious laryngotracheitis (ILT) outbreaks affecting intensive poultry production have been caused by vaccine-related virus strains. Consequently, they sought to characterize and compare the viral replication and transmission patterns of two attenuated chicken-embryo-origin ILT vaccines delivered in drinking water.

They inoculated two groups of specific-pathogen-free chickens with SA-2 ILT or Serva ILT vaccine strains. Unvaccinated birds were then placed in contact with vaccinated birds at regular intervals.

In addition, investigators collected tracheal swabs every 4 days over a period of 60 days and then evaluated the presence and amount of virus using quantitative polymerase chain reaction.

A rapid increase in viral-genome copy numbers was observed shortly after inoculation with SA-2 ILT virus.

In contrast, a comparatively delayed virus replication was observed after vaccination with the Serva ILT virus.

Transmission to in-contact birds occurred soon after exposure to Serva ILT virus but only several days after exposure to the SA-2 ILT virus, according to a report

in *Avian Pathology* by Mauricio Coppo, DVM, PhD, MVSc, and colleagues of the University of Melbourne.



'Poor flock immunity' blamed for ND outbreaks

Inadequate vaccination may be to blame for Newcastle disease outbreaks in the Netherlands, Dutch investigators say.

In their article, they presented the complete genome sequence of a highly virulent genotype VII virus (NL/93) obtained from vaccinated poultry during a 1992-1993 outbreak of Newcastle disease (ND) in the Netherlands.

When challenged with the NL/93 strain, chickens vaccinated with a classic vaccine were completely protected against clinical disease; in addition, mortality and virus shedding were significantly reduced, even with a supposedly suboptimal vaccine dose. In contrast, a live vaccine antigenically adapted to match the genotype VII NL/93 outbreak strain did not provide increased protection.

It has been argued that ND outbreaks may be due to antigenic divergence between the vaccine strains and circulating field strains. However, "These results suggest that it is not antigenic variation but rather poor flock immunity due to inadequate vaccination," report J.C. Dortmans and colleagues, of the Central Veterinary Institute of Wageningen UR, the Netherlands, in *Veterinary Microbiology*.

SPRAYCOX II retooled for ND-IB vaccination

New SPRAYCOX II units arrive ready to spray the ND-IB vaccine and a coccidiosis vaccine; the units are also easier to operate and maintain. Older SPRAYCOX II units already in place...can easily be retrofitted.

SPRAYCOX II — a field-proven machine used for spray vaccination in the hatchery — has been retooled to allow easy application of vaccines for respiratory diseases and coccidiosis.

Originally, SPRAYCOX II was developed to administer Merck Animal Health's COCCIVAC and PARACOX coccidiosis vaccines at the hatchery. Although it could be used to administer vaccines for Newcastle disease (ND) and infectious bronchitis (IB) vaccine, SPRAYCOX II needed to be fitted with a plastic hood, power box and syringe delivery system — a time-consuming job for hatcheries.

The solution: Replace the plastic hood with one made of stainless

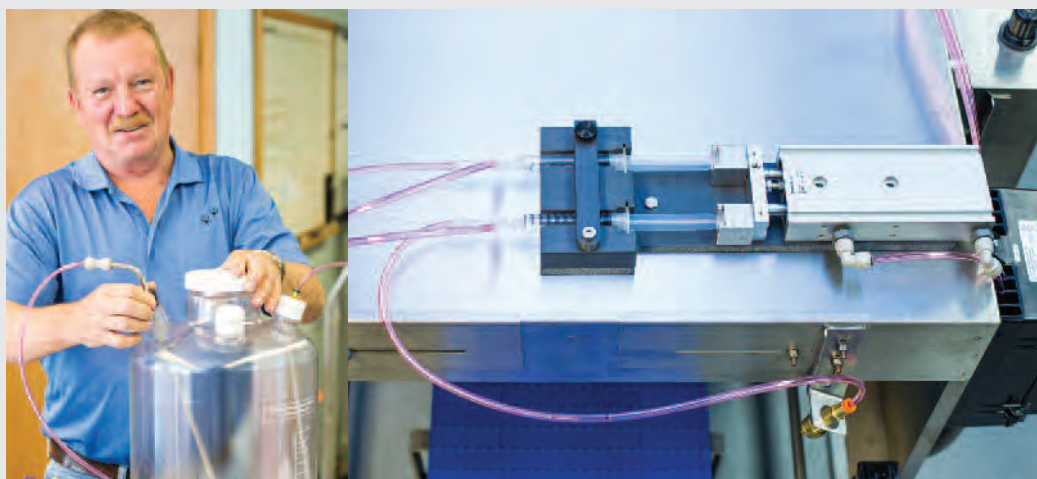
steel. Technicians also added a disposable-syringe delivery system that includes one dual block with two 10-cc disposable syringes set to spray 21 cc and one disposable plastic syringe check valve that attaches to the front of the disposable syringe.

The 10-cc syringes, which are widely used and readily available in the industry, can be pulled back to 10.5 cc so that 21 cc can be obtained from the two 10-cc syringes, he explained.

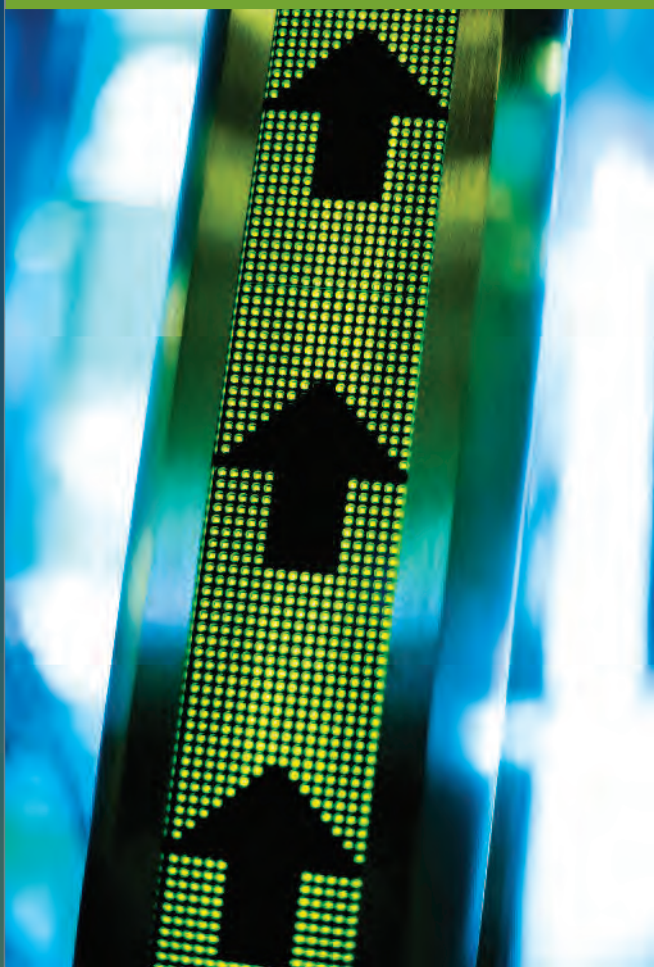
Other improvements include quick-connect tube fittings and a new stainless steel aeration tube. The unit's two power boxes have been replaced by one double stainless steel power box to house all electrical and pneumatic components.

With these changes, new SPRAYCOX II units arrive ready to spray the ND-IB vaccine and a coccidiosis vaccine; the units are also easier to operate and maintain. Older SPRAYCOX II units already in place at most major poultry companies can easily be retrofitted with the upgrades in about 30 minutes.

The enhancements to SPRAYCOX II were developed by associate customer-support specialist Jerry Green and equipment specialist Tim Milam. For more information, producers should contact their Merck Animal Health representative.



JERRY GREEN



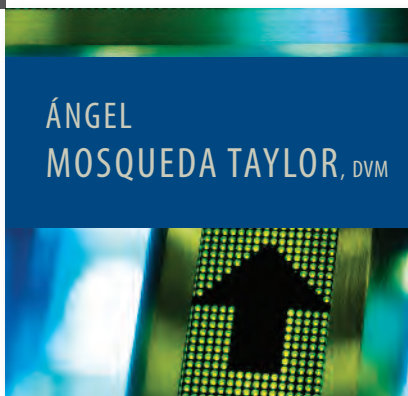
New directions in Newcastle control

For decades, Newcastle disease (ND) has been ranked among the most economically significant challenges in poultry production — perhaps second only to avian influenza.

If left uncontrolled, this highly contagious viral disease can impair a bird's respiratory tract, as well as its nervous, reproductive and digestive systems. Death losses of 60% or higher are not uncommon when outbreaks of acute ND occur.

While producers have many vaccines available for managing ND, acute and subclinical infections are still common in many markets — often because the right vaccine is not used at the right time. In fact, when not used properly, some conventional ND vaccines can stress birds, further impairing performance.

In this special report, the *Journal of Poultry Respiratory Protection* looks at new strategies, techniques and tools for managing this costly disease. For additional insights, please see the magazine's Field Report and Conversations sections.



ÁNGEL
MOSQUEDA TAYLOR, DVM

1 Change in ND vaccination strategy yields big benefits in Mexico

Field experience in Mexico has demonstrated the value of a recombinant vaccine for controlling Newcastle disease — including cases complicated by other types of viral respiratory infection. Problems in Mexico due to Newcastle disease (ND) are much like those in other Latin American countries, says Ángel Mosqueda Taylor, DVM, a veterinary consultant and former professor of poultry diseases at the National Autonomous University in Mexico.

The disease has a significant economic impact because the consequences of ND include mortality, chronic respiratory problems, condemnations and export obstacles.

Excessive field challenge

Controlling ND is difficult for a variety of reasons, including inadequate biosecurity, poor communication among producers, excessive field challenge in some areas and an abundance of backyard birds that are reservoirs for the disease, he explains.

Vaccination programs in Mexico to control ND vary widely, but a typical program might include a live LaSota ND vaccine given with an eyedropper plus an emulsified subcutaneous killed ND vaccine administered at 8 to 12 days, followed by another LaSota vaccine given orally or again by eyedropper at 22 to 25 days. Occasionally, a third LaSota vaccine is given orally at about 35 days of age. In addition, broilers tend to be vaccinated against infectious bronchitis (IB), avian influenza (AI) and, in some cases, infectious laryngotracheitis, Mosqueda says.

In many parts of Mexico, emulsified vaccines against low-pathogenic AI H5N2 are also administered and, for convenience, are often given along with ND vaccines. However, the result is antigen competition, he continues.

New vaccination strategy

More recently, some producers have started using the recombinant vaccine INNOVAX-ND-SB (sold in Mexico as FUSION-ND-SB), which can be given subcutaneously or *in ovo*. The vaccine was developed to provide immunity against very virulent ND viruses, such as the Mexican Chimalhuacán strain, as well as very virulent strains of Marek's disease, the veterinarian says.

One of several cases Mosqueda cited showing positive results with use of the recombinant vaccine involved repeated outbreaks of complicated ND on a broiler farm in the Central East region of Mexico. "These were not simple outbreaks; they were complicated by an AI virus, always with *Escherichia coli* and sometimes with mycoplasma," Mosqueda adds.

The conventional program had consisted of vaccines for Marek's disease and an inactivated AI vaccine that were given subcutaneously at the hatchery, followed on the farm by a combined ND/AI emulsified vaccine given subcutaneously, two oral UNIVAX-BD vaccines to protect against infectious bursal disease (IBD), a recombinant LaSota/AI vaccine given by eyedropper and an oral, conventional LaSota.

The new program, which reduced mortality from 24.5% to 5.5%, consisted of INNOVAX-ND-SB plus

an inactivated AI vaccine given subcutaneously and an IB Ma5 vaccine administered by coarse spray at the hatchery. Once on the farm, birds received an inactivated AI vaccine given subcutaneously, two oral UNIVAX-BD vaccines, plus a recombinant LaSota/AI vaccine given by eyedropper and a live NOBILIS ND Clone 30 oral vaccine.

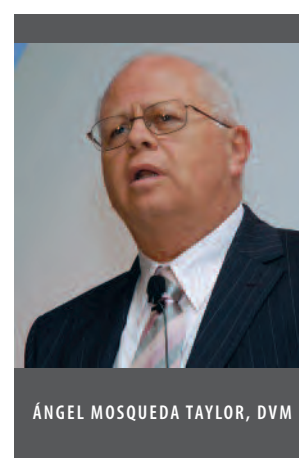
More advantages

One of the first advantages seen with INNOVAX-ND-SB vaccine was that it was given

separately from the influenza vaccine, which has improved the response to both ND and influenza, he notes.

In another case, the goal of changing the vaccination program was to gain better control of several respiratory diseases on a broiler farm in the Northwest area of Mexico that was located near a chicken manure deposit and commercial layer houses. INNOVAX-ND-SB and the live IB vaccine NOBILIS IB Ma5 were incorporated into the vaccination program, Mosqueda says. The result was lower mortality and better performance (Table 1).

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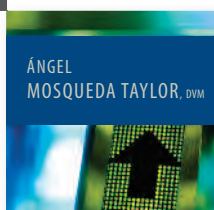


ÁNGEL MOSQUEDA TAYLOR, DVM

Table 1. Results of conventional versus new vaccination program				
	Average % mortality	Average selling age	Average feed conversion	Average daily gain (grams)
CONVENTIONAL PROGRAM Hatchery: Marek's disease + AI subcutaneous Farm: Inactivated ND/AI subcutaneous UNIVAX-BD x 2 oral Recombinant LaSota/AI eyedrop LaSota oral	22*	47	2.1	51
NEW PROGRAM Hatchery: INNOVAX-ND-SB + inactivated AI subcutaneous IB Ma5 spray-on Farm: Inactivated AI subcutaneous UNIVAX-BD x 2 oral Recombinant LaSota/AI eyedrop NOBILIS ND Clone 30 oral	10	43	1.9	58

* Mortality due to avian influenza and infectious bronchitis

ND mortality



1 Change in ND vaccination strategy yields big benefits in Mexico

When the chickens were challenged with the Chimalhuacán ND strain at days 21 and 35, they were 100% protected...

The new program enabled withdrawal of the second vaccination against ND at 35 days, more effective control of IB and AI, and a reduction in costs incurred due to medication required for respiratory illness.

Southeast field trial

In another flock, INNOVAX ND-SB was used in a trial in the Southeast region. The ND challenge was low and birds were free of AI. The goal was to see if the use of the emulsified ND vaccine could be eliminated. The protocol was as follows:

Day 1 **INNOVAX-ND-SB subcutaneous**

Day 9 **LaSota via coarse spray**

Day 17 **Gumboro Lukert (IBD) via drinking water**

Day 23 **Gumboro Lukert (IBD) via drinking water**

The results included a low 3.51% mortality in the females and a daily weight gain of 49.49 grams (Table 2).

When the chickens were challenged with the Chimalhuacán ND strain at days 21 and 35, they were 100% protected, compared to 0% protection in a group of unvaccinated, challenged control birds, Mosqueda says.

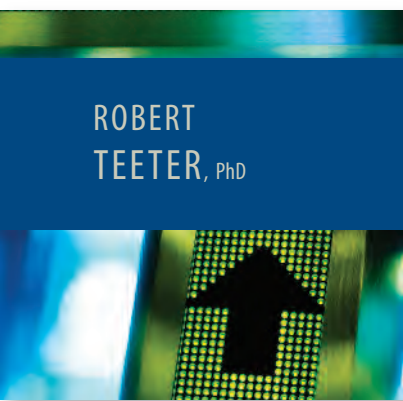
He concluded that field experience as well as challenge testing demonstrated the value of

Table 2. Results of Southeast trial

Cumulative mortality, %	3.51
Average bodyweight, kg	1.997
Daily weight gain, grams	49.49
Slaughter age, days	40.35
Feed conversion	1.832
European Production Index	261
Starter chickens/m ²	14.2
Meat produced (kg)/m ²	27.04

INNOVAX-ND-SB for managing ND. The vaccine also has value as an alternative to the use of subcutaneous ND emulsified vaccines, which have to be individually applied at the farm, affecting biosecurity as well as management.

Mosqueda emphasizes, however, that “for vaccines to work at their utmost ability, they need help. Bird susceptibility and the field challenge need to be reduced. Remember, the success of a vaccine partly depends on how it is placed inside your vaccination program.”



ROBERT
TEETER, PhD

2 Reducing stress in ND programs aids broiler performance

Broilers appear to perform better the first weeks of life if the Newcastle disease vaccine they receive is one that causes less stress, according to Robert Teeter, PhD, a consulting nutritionist formerly with Oklahoma State University, USA.

Today's broiler operates only at about 50% efficiency, says Teeter, who has spent decades studying energy utilization in broilers at his lab, which is outfitted with 60 metabolic chambers.

"When we look at all sources of lost energy in the bird, we can project that 66% efficiency — and a feed conversion ratio of 1 — is possible," Teeter says. Toward that end, "it's critical that we understand the growth curve and the various types of stresses that come from the environment. We must also account for every calorie."

Stress from vaccination

One stress to consider is vaccination. While vaccination is important to flock health, stimulating a bird's natural immunity can cause some short-term stress. Field vaccination with conventional, live attenuated vaccines against Newcastle disease (ND) can result in different levels of post-vaccinal reactions, depending on the vaccine strain used as well as the route of administration. The reactions can reduce bird performance.

Consequently, Teeter studied the impact of five different vaccines for ND because it is one of the most important and costly diseases of poultry, with a near 100% mortality.

For his experiment, Teeter used commercial Cobb male broilers that had not been vaccinated. He compared five vaccines administered on day 1 of their arrival at the laboratory:

Subcutaneous

- INNOVAX-ND (recombinant vaccine)
- ND-Broiler (inactivated vaccine)

Eyedropper

- C2-strain (live vaccine)
- Hitchner B1 (live vaccine)
- NOBILIS ND Clone 30 (live vaccine)

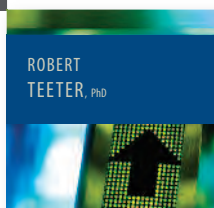
A sixth group of birds remained unvaccinated to serve as a negative control.

'Considerable' difference

After the birds were vaccinated upon arrival at the lab, they were housed until 28 days of age in metabolic chambers, which enable measurement of energy metabolism. Investigators weighted birds weekly and monitored them continuously for carbon dioxide production and oxygen consumption. They also measured heat production and body composition.

LESS STRESS

continued



2 Reducing stress in ND programs aids broiler performance

“The first 2 weeks following vaccination appear to be critical for vaccination impact.”

ROBERT TEETER, PhD

Table 1. Performance of broilers at 7 days of age

Treatment	Live weight (g)	Feed conversion ratio (g/g)	Metabolizable energy intake (Kcal)	Retained energy (Kcal)
Clone 30	147 ^b	0.986 ^b	430 ^b	243 ^b
Control	161 ^a	0.929 ^a	444 ^a	267 ^a
Hitchner-B1	147 ^b	0.987 ^b	430 ^b	243 ^b
INNOVAX-ND	163 ^a	0.923 ^a	449 ^a	272 ^a
ND-Broiler	148 ^b	0.979 ^b	433 ^b	246 ^b
NDC2	146 ^b	0.986 ^b	430 ^b	242 ^b

Table 2. Performance of broilers at 14 days of age

Treatment	Live weight (g)	Feed conversion ratio (g/g)	Metabolizable energy intake* (Kcal)	Retained energy (Kcal)
Clone 30	419 ^b	1.162 ^b	1452 ^c	755 ^b
Control	443 ^a	1.129 ^a	1489 ^a	803 ^a
Hitchner-B1	430 ^b	1.147 ^{ab}	1472 ^{ab}	777 ^a
INNOVAX-ND	439 ^a	1.135 ^a	1484 ^b	795 ^a
ND-Broiler	422 ^b	1.157 ^b	1459 ^c	761 ^b
NDC2	432 ^b	1.144 ^{ab}	1472 ^{ab}	781 ^b

* f statistic of .01 accepted

Superscript letters: Values with unlike superscripts differ (p < .08)

first 2

“...it’s critical that we understand the growth curve
and the various types of stresses that
come from the environment.” ROBERT TEETER, PhD



Chicks were placed in metabolic chambers, which enable measurement of energy metabolism.



ROBERT TEETER, PhD

“By day 7, the difference between the vaccine groups was considerable,” Teeter says.

Using the control group as a reference point, the pioneering nutritionist and his team determined that broilers receiving the recombinant vaccine — known for causing no reactions in birds — had significantly better weight gain and feed conversion. They also retained more energy compared to the other vaccine groups and had better values compared to other vaccine groups by day 14 (Tables 1 and 2).

Less heat production

At 7 and 14 days of age, the recombinant vaccine group also had significantly less heat production than those that received the other vaccines, as well as higher protein, fat and net energy values.

By 21 days, there was little difference among the vaccine groups. However, Teeter says, “Having a vaccine-reaction duration those first 2 weeks is the type of event that is cumulative with other aspects of performance. What other stressors will be added?”

Heat stress is particularly important, according to Teeter, because it is associated with a worsening feed conversion, and that translates into lost income for producers, he says.

Teeter concludes that different ND vaccines affect growing broilers differently. “The first 2 weeks following vaccination appear to be critical for vaccination impact,” he adds, “and INNOVAX-ND had less impact than all the other vaccines, especially during those first 7 days.”

weeks

FRANCISCO
RÍOS

3 New technology simplifying ND vaccination and control

Replacing a conventional Newcastle disease or infectious laryngotracheitis vaccine with a recombinant can simplify the vaccination schedule, improve control of these as well as other important poultry diseases and provide a good return on investment, says biologist Francisco Ríos.

Areas in Latin America with no or low (lentogenic) Newcastle disease (ND) challenge include Brazil, Chile and Argentina. At the other end of the spectrum are high-challenge areas, such as Mexico and Venezuela, where velogenic ND can cause mortality as high as 90%.

"And we are learning now that Peru may be included in this list," adds Ríos, a technical service manager for MSD Animal Health*, Mexico

Despite vaccination, ND alone still accounts for about 2% to 3% of the total yearly mortality in broilers in Mexico. "If we are talking about a yearly production of about 1.5 billion broilers, that's millions and millions of dollars lost," Ríos says.

For layers, the average loss due to ND is about 15% but can be as high as 25%. "The curious thing is that the hens do not die from ND; they just don't lay," Ríos adds.

Conventional vaccines 'problematic'

Conventional vaccination programs are costly and problematic, he continues. As an example, broilers in Mexico may have to be vaccinated against ND at least once with an individually applied, killed vaccine that stresses birds due to handling, potentially causes serious local reactions and runs up labor costs. Most companies also apply at least two live ND vaccines; these vaccines can cause severe respiratory distress, increase medication expenses, also run up labor costs and interfere with infectious bronchitis (IB) vaccines.

Control of infectious laryngotracheitis (ILT), which is endemic in major poultry-producing countries including Brazil, Argentina, Colombia, Mexico and Peru, is equally challenging, Ríos says.

The consequences of conventional ILT vaccination include potential respiratory reactions and, with some of the vaccines, house-to-house spread of the ILT virus; the result is reduced bird performance, he says.

Conventional vaccines for ILT and ND have to be applied separately, sometimes spaced several weeks apart depending on the situation. "Given the short life span of the broiler, this complicates vaccination-schedule planning," Ríos says.

* Known as Merck Animal Health in the US and Canada

Benefits of recombinants

Replacing conventional ND vaccines with the recombinant INNOVAX-ND-SB (sold in some markets as FUSION-ND-SB) decreases the viral load in the environment, improves vaccine uniformity, eliminates the problem of interference between live ND and other respiratory vaccines, and causes no vaccine reactions. Flocks will have solid protection against all known genotypes of ND, he says.

The “SB” in INNOVAX-ND-SB represents serotype 2 of the SB1 Marek’s strain, which protects against the very virulent form of Marek’s, Ríos says, adding that INNOVAX-ND-SB can be administered either *in ovo* or subcutaneously.

“Add up the cost of conventional ND vaccines, associated labor costs and export restrictions due to poor disease control. When you consider that switching to one dose of the recombinant vaccine removes all these negatives from the equation, you realize that it represents a good return on investment for both broilers and layers,” Ríos maintains.

In addition, by gaining good control of ND,

producers can focus on other disease problems,

such as IB, and additional ways that poultry production and profits can be improved, he adds.

Ríos reminds producers that two herpesvirus-of-turkey (HVT) vaccines cannot be used together. This caution applies to regular or recombinant HVT vaccines. He advises choosing the recombinant HVT respiratory vaccine that controls the biggest problem and using conventional live vaccines for the other diseases.

For instance, infectious bursal disease (IBD) virus — commonly called Gumboro — can still be controlled well with conventional vaccines, especially in areas where the presence of IBD antigenic variants are documented, Ríos says.

With the recombinant vaccines, he says, there are no respiratory reactions, no interference with other conventional respiratory vaccines, decreased mortality from ILT, decreased productive failure and improved possibilities for export.

“Our recombinant vaccines are now the best tool that we have available for control of ND and ILT,” he says.



FRANCISCO RÍOS

Despite vaccination, ND alone still accounts for
about 2% to 3% of the total yearly mortality
in broilers in Mexico.

Pilgrim's back on track with gentle ND program

It was summer when field service technicians at Pilgrim's started reporting lameness in broilers at contract farms in Marshville, North Carolina, USA, where the company processes 650,000 birds weekly at 58 to 60 days of age.

"Then we noticed that our livability numbers were down, and there were some condemnation issues with trimmed parts at the processing plant," says Scott Westall, DVM, director of veterinary services for the company's eastern division.

Necropsies revealed femoral-head necrosis thought to be due in part to heat stress.

'Suspected culprit'

"We felt we should do everything we could to take stress off the birds," Westall says. One suspected culprit was vaccination for Newcastle disease (ND) with a live B1 strain, which is boosted in the field after the initial dose.

"If birds have a little heat stress anyway and they're also trying to clear a vaccine reaction, they can develop a secondary bacterial problem," he explains. "We think that's what was causing the femoral-head necrosis and that reactivity to the vaccine was a big factor."

Pilgrim's decided to try INNOVAX-ND-SB. The vaccine, developed by Merck Animal Health (known as MSD Animal Health outside of the US and

Canada), is administered *in ovo* at the hatchery, causes no reactions and doesn't require a second dose. It's a herpesvirus of turkey (HVT)-vectored vaccine that protects against ND, as well as Marek's disease. Pilgrim's started using the vaccine in July, and when the birds were processed starting in September, they looked better, Westall says.

The results with birds receiving INNOVAX-ND-SB were analyzed two ways. First, Westall compared their performance to results at the same time the previous year, when lameness and femoral-head necrosis weren't a problem. "There wasn't much difference" between the 2 years, he says.

Compared to the prior 3 months, however, when lameness and femoral-head necrosis were a problem, birds that had received INNOVAX-ND-SB fared better. "Our livability goal is 95%, but it had slipped to 94% when the lameness problems occurred," he says. After using INNOVAX-ND-SB, livability as well as feed conversion and the condemnation rate of the broilers returned to normal.

'More cost effective'

"The recombinant vaccine is more cost effective [than the conventional live vaccine] if you can improve livability and eliminate condemnations," Westall says. It would also save producers on labor if they had to hire vaccination teams to booster ND in the field, he adds, noting that "we vaccinate for

bronchitis and have staff out there anyway."

In addition, producers with bronchitis issues in broilers might achieve better control by eliminating the live ND vaccine and using the recombinant, he predicts. Using more than one respiratory disease vaccine at the same time can result in less than optimal control because the vaccines compete for the same receptor sites. This problem can be eliminated with INNOVAX-ND-SB since it can be given *in ovo*, before the bronchitis vaccine.

'The main plus'

Pilgrim's had temporarily switched from INNOVAX-ND-SB to a live B1 ND vaccine again because infectious laryngotracheitis (ILT) had become a threat in the area. The company is using INNOVAX-ILT, another HVT-vectored vaccine, to protect its birds against ILT, and more than one HVT vaccine can't be used at the same time. It planned to return to using INNOVAX-ND-SB after ILT was under control.

"For us, the main plus of using INNOVAX-ND-SB is removing the stress of the live ND vaccine," Westall says.

The experience has made him wonder if it would be beneficial to use INNOVAX-ND-SB in other places, such as Pilgrim's small-bird program. "Maybe we're creating issues we don't know about" with some conventional vaccines, he says.



“If birds have a little heat stress anyway and they’re also trying to clear a vaccine reaction, they can develop a secondary bacterial problem.”

SCOTT WESTALL, DVM

New approach needed for ND control

Laura Villarreal, DVM, Merck Animal Health, reviews the advantages of a recombinant vaccine for Newcastle disease



Q How big of a problem is Newcastle disease (ND) in poultry production?

LV: Newcastle is one of the oldest diseases affecting poultry worldwide. When the virulent, velogenic form of this paramyxovirus strikes, mortality can exceed 80% to 90%. Even if chickens survive, they may have no value if they develop neurological signs and have to be discarded.

The milder, lentogenic form of ND can reduce broiler flock performance and cause economic losses due to condemnation for airsacculitis, especially when ND occurs along with other agents such as mycoplasmas, pneumovirus or secondary bacterial infections. In laying hens affected by ND, egg production drops.

Q Tell us more about the economic consequences of ND.

LV: ND is probably one of the most costly diseases affecting the global poultry industry. Losses are obviously high when recurrent outbreaks result in widespread mortality and morbidity or they are associated with drops in egg production in layers and breeders. Other economic consequences result from restrictions on exports and commercialization.

Virtually all commercial poultry operations in the world need to vaccinate against ND — yet there is a high price for ND prevention with conventional protocols. Besides the cost of multiple live and killed vaccines, conventional programs require handling birds in the field, and they can cause post-vaccination reactions. These are stresses that adversely affect uniformity and weight gain in broilers and in layers, and can result in reduced egg production.

Let's consider the world population of 61 billion commercial birds, which includes broilers and layers. If only one dose of a live ND vaccine is administered — and that would provide bare-minimum protection — the cost is about US \$137 million. If you factor in the cost of additional vaccinations and the impact of post-vaccination reactions on performance, the cost is far, far higher.

Q Are conventional vaccine programs effectively controlling ND?

LV: Conventional programs can provide good protection, but outbreaks still occur for many reasons. These include improper administration, immunosuppression, inadequate hygiene, poor biosecurity and ND field viruses that are very virulent.

Continued ND outbreaks coupled with the problems associated with conventional ND programs leaves producers eager for ND-control methods that are more efficient and convenient and that improve their return on investment.

Q What should producers do for better ND control?

LV: Good hygiene and biosecurity will always be important, but we need to do some things differently. Einstein is widely quoted as saying the definition of insanity is "doing the same thing over and over again and expecting different results."

This saying can be applied to the poultry industry. We need updated, simpler, convenient immunization programs designed to address the ND challenge in a given area. The program should enable birds to develop immunity without causing reactions, while minimizing field-handling of birds.

The best vaccine program must complement industry trends, such as the move toward higher-yield broilers produced in a shorter period.



Convenience Program helps producers protect flocks against respiratory diseases and maintain marketing goals

Q How does the recombinant vaccine INNOVAX-ND figure into today's management programs?

LV: This innovative vaccine has several advantages compared to conventional ND vaccines. Its foundation is the herpesvirus of turkey (HVT), which is known to be safe for chickens and protects against Marek's disease. It carries the fusion or "F" protein of the ND virus, which initiates immunity against ND. So, you get protection against two important diseases with one vaccine.

The vaccine can be administered *in ovo* to 18-day-old embryos or soon after hatching by subcutaneous injection at the hatchery, where application is more likely to be properly done than in the field. INNOVAX-ND is effective in the presence of maternal antibodies.

One application provides lifelong protection and eliminates or minimizes the need for ND field vaccination.

with a variety of ND strains, including the virulent Texas GB strain and strains with an intra-cerebral pathogenicity index between 1.89 and 2.0, such as Hertz 33, Chimalhuacán and Asian virulent CU2 strains.

Q How long does it take for immunity to develop with INNOVAX-ND?

LV: Immunity gradually increases after vaccination and is complete 21 to 28 days later. A key to success with INNOVAX is the inclusion of a conventional ND vaccine to cover birds while immunity from the recombinant vaccine develops. Usually one live vaccine administered at the hatchery is adequate.

In high-challenge areas facing velogenic viscerotropic ND, a second live ND booster can be administered before 21 days to help ensure total protection. On the other hand, in regions with a low ND challenge, INNOVAX-ND alone should be all that's needed.

Q Does the recombinant vaccine protect against virulent ND?

LV: Yes. The F protein protects against all ND strains and genotypes, including velogenic ND. Experience with millions of birds already vaccinated with INNOVAX-ND — including those challenged by more virulent forms of ND — has demonstrated that INNOVAX-ND is effective. In addition, for licensure in different countries, studies were conducted that showed INNOVAX is effective when vaccinated birds are challenged

Q Is the recombinant cost effective?

LV: Economic analyses have shown that whether flocks are challenged by mild or virulent forms of ND, INNOVAX-ND will provide a high return on investment because it controls ND mortality and morbidity, and it eliminates the problem of post-vaccinal reactions and associated production losses that can occur with conventional vaccine protocols. It increases productivity and, consequently, profitability.

Merck Animal Health has developed a hatchery-based Convenience Program designed to help poultry producers protect chickens against respiratory diseases while achieving optimal bird performance and marketing goals.

In today's competitive, global marketplace, poultry producers are under increased pressure to reduce the growing period, says Laura Villarreal, DVM, global marketing director, Merck Animal Health. "There will be less time for field vaccination and no time for vaccine application mistakes, vaccine reactions or performance setbacks. Even one day of lost performance is expensive," she says.

The Convenience Program features hatchery application of recombinant INNOVAX vaccines, which provide lifelong protection with one dose, and the PROTECTOTYPE concept, which provides broad protection against infectious bronchitis (IB).

Depending on the predominant disease in their area, producers can use either INNOVAX-ND to protect against Newcastle disease (ND) or INNOVAX-ILT to protect against infectious laryngotracheitis. Like INNOVAX-ND, INNOVAX-ILT does not cause performance-damaging respiratory reactions, Villarreal says. She notes that both vaccines, which are based on the herpesvirus of turkey, cannot be used together, but says that INNOVAX vaccines do not interfere with administration of live respiratory vaccines.

In areas with a high ND challenge, hatchery administration of NOBILIS ND C2 and/or NOBILIS Clone 30 will protect chicks while immunity from INNOVAX-ND develops, Villarreal says.

The PROTECTOTYPE concept lets producers provide broad-spectrum protection against IB with hatchery vaccination. NOBILIS IB MA5, a vaccine based on the Massachusetts serotype, NOBILIS 4/91 and SHOR-BRON DE072 vaccines can be administered from day 1 in the hatchery.

For more information, contact your Merck/MSD Animal Health representative.

Two-vaccine protocol protects broilers against new IB variants



in 30 seconds

- When a live IB vaccine from one serotype is followed by vaccination with an IB variant from another serotype, birds develop immunity to the serotypes in both vaccines — in addition to cross-reacting antibodies to other IB serotypes.
- By using the right combination of IB vaccines, existing vaccines protect poultry against several of the IB-variant viruses.

Recent research findings in the US are providing further evidence that broilers can be protected from new infectious bronchitis variants with a protocol featuring two existing vaccines.

The studies, conducted by the University of Georgia, also revealed a strong correlation between clinical signs, ciliostasis and virus detection, indicating that it's important to consider these three parameters when evaluating cross-protection with infectious bronchitis (IB) virus vaccines.

In 2011, a new, variant IB virus — known as GA11/GPL90/11 (GA11) — was isolated from broilers in north Georgia. The isolate was not related to any viruses used in commercially available vaccines. Molecular virologist Mark Jackwood, PhD, and colleagues designed a challenge study to determine whether they could use what is called a "PROTECTOTYPE protocol" to protect broilers from the new variant.

Added protection

Even though different serotypes of the IB virus generally do not fully cross-protect, there are "gray areas," Jackwood says, noting that some IB serotypes are serologically related to other serotypes "just enough to provide cross-protection." Each is called a "PROTECTOTYPE."

Furthermore, previous research by Jackwood and European investigators has demonstrated that when a live IB vaccine from one serotype is followed by vaccination with an IB variant from another serotype, birds develop immunity to the serotypes in

continued on page 21

Genetic d·r·i·f·t & s·h·i·f·t

Changes in the infectious bronchitis (IB) virus occur due to mutations or recombination:

- Mutations occur when the virus replicates its genome, but errors occur in the genetic code, resulting in “genetic drift.” These are variant viruses.
- Recombination occurs when two or more similar viruses infect the same cell, which leads to a rapid change in the genetic makeup of the virus. This is called “genetic shift” and constitutes a new viral serotype.

The virus-neutralization test, which requires live virus, is used to group IB virus isolates into serotypes. It cannot, however, compare viruses from different geographic areas. This is now possible with molecular techniques, which examine the spike gene that is routinely used to identify IB virus types.

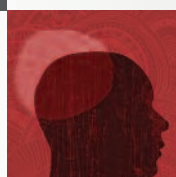
The two molecular procedures used for IB-virus diagnostics are real-time polymerase chain reaction (PCR) and genetic sequencing. Real-time PCR allows researchers to rapidly screen field samples for IB viruses; it also determines the amount of virus in the sample. However, it does not identify the IB-virus type; the type of IB virus is determined by genetic sequencing.

According to the University of Georgia’s Mark Jackwood, PhD, surveillance and identification of new variant viruses by sequence analysis are key steps for improved control of IB. Other steps include determining if new variants are pathogenic (not all are), using clinical-case data and surveys to determine how widespread the variant has become and discovering whether commercially available vaccines are effective, he said.



“...It is important to measure clinical signs, ciliostasis and virus detection when evaluating cross-protection in IB virus-vaccinated birds.”

MARK JACKWOOD, PhD



Two-vaccine
protocol protects
broilers against
new IB variants

the vaccines — in addition to cross-reacting antibodies to other IB serotypes. The result is broader protection than what either vaccine can provide on its own.

Study protocol

For the challenge study, researchers split the broilers into three groups with different vaccine protocols (Table 1):

- IB Ma5 vaccine at day 1 of age plus a IB DE072 on day 14 of age
- IB Ma5 vaccine on day 1
- IB DE072 vaccine on day 14

The IB Ma5 vaccine is based on the major Ma5 virus serotype, while the IB DE072 vaccine contains a variant of the Delaware IB virus. For controls, birds from each vaccination group were vaccinated but not challenged, while another group was not vaccinated and was challenged.

[In Europe and Latin America, a similar protocol using an Ma5 vaccine on day 1 plus vaccination with IB 4/91, a variant common throughout Europe, has been shown to protect against several IB-virus variants; 4/91 vaccines are not licensed for use in the US, however, so investigators replaced it with the DE072 vaccine.]

Investigators gave each bird a full dose of each vaccine, half by eyedropper and the rest by intranasal application. They then challenged the vaccinated birds with the viruses at 35 days of age with infectious doses.

Table 1. Design of challenge study

Vaccines administered		GA11	Mass 41	GA98	Unchallenged controls
Day 1 of age	Day 14				
Ma5	DE072	10	10	10	5
Ma5		10	10	10	5
	DE072	10	10	10	5
Unvaccinated controls		5	5	5	5

Clinical signs of IB include mild upper-respiratory-tract disease such as sneezing, tracheal rales, gasping and coughing. In layers, IB can also result in decreased egg quality and production. Some strains of the IB virus, a coronavirus, cause kidney lesions. IB viruses can result in 100% morbidity. Mortality varies and is worse if there are other, co-existing infections such as *Escherichia coli*.

Results

For their study, Jackwood and his team considered birds protected from IB if there was $\geq 90\%$ protection from clinical signs, over 50% protection against ciliostasis and $\geq 90\%$ against virus detection. (The ciliostasis test involves microscopic observation; investigators

Understanding IB variants

Some IB serotypes are serologically related to other serotypes “just enough to provide cross-protection.” Each is called a “PROTECTOTYPE.”

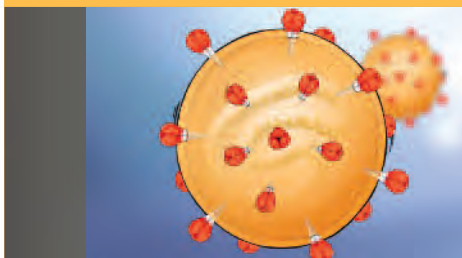
then score the level of ciliary activity.) Based on these criteria, vaccinated broilers were protected against GA11, Mass 41 and GA98, he says.

“For birds that were clearly protected and birds that were not clearly protected, there was a strong correlation between clinical signs, ciliostasis and virus detection,” Jackwood reports. For partially protected birds, virus detection was always positive, but clinical signs and results with ciliostasis were variable.

“Based on these data, it appears that it is important to measure clinical signs, ciliostasis and virus detection when evaluating cross-protection in IB virus-vaccinated birds,” he said.

In addition, a protocol utilizing existing vaccines appears to provide a method of protecting poultry against several of the IB-variant viruses circulating now in different geographic areas and can alleviate the need for development of new vaccines for every new IB variant that emerges, which would be time consuming and costly.

He notes that maternal antibodies to IB viruses provide homologous protection for 1 or 2 weeks and do not appear to interfere with vaccination.



A serotype is a virus characterized by its neutralizing antibodies that are specific to that virus.

Variants can be a new serotype or an existing virus that has undergone changes in the amino acid sequence of its spike protein, which is on the surface of the virus and may induce neutralizing antibodies.

After the IB virus was first recognized in the early 1930s in the US, the Massachusetts serotype was the only known serotype of the virus for about 15 years.

Today, there are more than 20 recognized serotypes and countless variant IB viruses. In the US, Arkansas remains the most isolated type of IB virus and it is undergoing genetic drift.

ILLUSTRATION ABOVE:

IB shows a number of characteristic spikes on its surface. These consist of proteins and play an important role in the onset of infection and the corresponding immune response.

Discover a new world of protection...
without reaction



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