Maximising immunity development against Newcastle disease

Newcastle disease (ND) is caused by a single-stranded RNA virus that produces several proteins, including the haemagglutinin-neuraminidase (HN) protein and the fusion (F) protein, on its envelope (surface). Both of these proteins are crucial to the infection process. Chickens produce antibodies to both proteins to protect themselves.

Challenge level	Solutions
Respiratory only, no mortality	Innovax ND subcutaneous or in ovo injection only
Velogenic ND with mortality after three weeks	Innovax ND injection + Nobilis ND C2 spray at hatchery – Optional Nobilis ND Clone 30 at two weeks
Velogenic ND with early mortality	Innovax ND injection + Nobilis ND Clone 30 spray at hatchery – Optional Nobilis ND Clone 30 at two weeks

Table 1. Vaccination program recommendations.

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Antibodies against both the HN and the F protein prevent attachment of the Newcastle disease virus (NDV) to the cells, avoiding the infection cycle.

Vaccination with live NDV induces antibodies to all of the surface proteins and results in rapid protection against challenge with the field strains of NDV. Unfortunately, vaccination with the live virus also produces a 'vaccination reaction' that may result in performance loss.

Stronger challenge viruses require stronger live vaccines and frequent revaccination to induce effective and durable protection. The live ND vaccinations may interfere with live infectious bronchitis (IB) vaccines, complicating protection to one or both viruses.

Traditionally, very strong challenge viruses may require the addition of inactivated ND vaccines to provide effective protection. The oil emulsion adjuvant in the inactivated ND vaccine can result in significantly reduced weight gain in broilers for three weeks after vaccination or more.

Early protection

Innovax-ND uses the Marek's disease vaccine HVT (herpesvirus of turkeys) as a vector to carry the gene for the NDV F protein.

A small piece of HVT viral DNA is replaced by the gene transcribed from the NDV RNA, which enables the HVT virus to make F protein. Therefore, Innovax-ND is a Marek's disease vaccine that produces NDV F protein and induces antibodies against ND F protein as well as Marek's disease. Since Innovax-ND is not a Newcastle disease virus, it cannot cause a vaccination reaction or a loss in performance.

A recombinant or vector vaccine does not act exactly like the live NDV vaccine. The HVT must replicate in the birds to produce enough F protein copies to induce a protective antibody response against that protein and, consequently against the NDV infection.

Partial ND immunity is evident, even against very strong challenge, by 11 days post-vaccination, but complete immunity may take up to 28 days (3-4 weeks). Once immunity is complete, the birds maintain ND immunity, demonstrating protection for at least 60 weeks.

Building up efficacy

It is important to take the onset of immunity into consideration whenever broilers are exposed to very strong, early ND challenge.

Vaccination with live ND vaccine may be necessary when challenge is early because the response to the live vaccine is faster, providing protection during the gap, while the HVT vector is producing the copies of the F-protein needed to induce a protective antibody response. The type of live ND vaccine used depends upon the severity of the ND challenge (Table 1).

To maximise broiler performance and infectious bronchitis vaccine response, use the minimum vaccination program that will provide adequate ND protection.

Layers and breeders

Layer or breeder vaccination programs can use Innovax-ND to simplify and streamline the ND vaccination program. One example layer program from the Middle East area, where Genotype VII ND challenge is a significant problem, shows the difference that Innovax-ND can make (Table 2).

The Innovax-ND program was not only simplified, it resulted in four additional eggs per bird in paired houses, with peak production at 94% for the Innovax-ND vaccinates vs. 92% for the original program. Innovax-ND reduced process and improved performance.

Table 2. Example of a layer program with and without Innovax ND.

Program before Innovax-ND	Vaccination program with Innovax-ND
Day 1 – Inactivated ND	Day 1 – Innovax ND
Day 14 – Nobilis ND Clone 30	Day 14 – Nobilis ND Clone 30
Day 30 – Nobilis ND Clone 30	----
Day 55 – Nobilis ND Clone 30	----
Day 60 – Inactivated ND	----
Day 105 – Inactivated ND	Day 105 – inactivated ND

Protection against velogenic strain

Innovax-ND has demonstrated protection against the following ND challenge strains:

- Texas GB (Genotype II – US).
- Chimalhuacan (Genotype V – Mexico).
- CU2 (Genotype VII – Thailand).
- Herts (Genotype IV – UK).

On-going studies continue to test Innovax-ND efficacy against a wide variety of field isolates.

The optimal vaccination program to protect against these strong challenge strains will depend upon the age at which challenge occurs. Early vaccination with a live ND vaccine may be required to ensure early protection.

Broilers

Broiler performance is enhanced with the Innovax-ND vaccination strategy. In the US, where infectious bronchitis (IB) is usually a more serious threat to respiratory health, broilers vaccinated with Innovax-ND in ovo demonstrated an improvement in condemnations during the winter airsacculitis season when compared to conventional live Hitchner B1 strain vaccinated flocks.

At one major integrator, condemnation was reduced from 0.77% to 0.38% during the winter airsacculitis months.

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In Mexico, where ND challenge is severe and often complicated by avian influenza (AI) and IB, incorporation of Innovax-ND allowed an integrator to remove inactivated ND vaccine and to improve IB protection. The result was improved weight gain, reduced feed conversion and improved mortality (see Table 3).

Innovax-ND can be used to remove live and/or inactivated ND vaccinations in a broiler program to reduce the negative effects of ND vaccination while enhancing IB protection and overall broiler performance.

Defining the best strategy

The recombinant HVT vaccines compete with each other, and a program can only use one recombinant HVT product.

When constructing a vaccination program, the producer must first consider mortality: which virus is causing the greatest mortality in the field? If that virus is ND or IB, the vaccination program should be built around rHVT-ND to control the ND and to allow flexibility of IB vaccination. If infectious laryngotracheitis is causing heavy mortality, an rHVT-ILT should be used.

If mortality is well controlled, the second consideration is performance. The live and inactivated respiratory vaccines have a negative impact on broiler and layer performance.

Incorporation of an Innovax strategy will enable producers to remove inactivated vaccines and reduce or remove the live respiratory vaccines to enhance broiler performance.

Conventional infectious bursal disease vaccine can then be used to complete the vaccination program without efficacy or performance problems. ■

References are available from the author on request

Table 3. Mexican broiler flock history with and without Innovax-ND-SB.

Vaccination program	Flock	Mortality (%)	Market age (days)	FCR	Daily weight gain (g)
Conventional[A]	A	24	48	2.2	49
	B	25	46	2.1	47
	C	17	44	2.1	49
	D	17	44	2.1	55
	E	27	50	2.3	51
	F	20	48	2.2	53
	Average	22	47	2.1	51
Innovax-ND[B]	A	11	42	1.9	59
	B	4	45	2.0	54
	C	10	44	2.0	64
	D	8	41	1.9	59
	E	19	41	2.0	63
	F	5	41	1.9	52
	G	13	46	2.0	59
	H	5	45	2.0	52
	I	16	44	1.9	59
	Average	10	43	1.9	58

[A]Conventional program: Day 1 – inactivated AI; Day 12 – Inactivated ND + Inactivated AI + Live LaSota ND + Mass IB; Day 21 – Live enteric ND

[B]Innovax-ND program: Day 1 – inactivated AI + Innovax-ND-SB; Day 12 – Inactivated AI + Nobilis Clone30 + Ma5/IB 4-91; Day 21 – Live enteric ND