Newcastle disease vaccination of broilers

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Newcastle disease (ND) is predominantly a respiratory disease affecting chickens of all ages. The virus initially targets and damages the respiratory tract. Systemic protection by antibodies alone will not prevent damage to the respiratory tract. To prevent local tissue damage, a strong local immune response is vital for complete protection of the respiratory tract against a ND infection.

ND virus strains can have different preferences for target organs (tropism). There are ND virus strains with a high tropism towards the respiratory tract (respiratory strains) and other ND virus strains with a high tropism towards the enteric tract (enteric strains). ND strains with a high respiratory tropism (La Sota type, Clone 30, Hitchner B1) are the first choice for ND vaccines to induce good local immunity in the respiratory tract, forming a strong first line of defence against ND infection. On the contrary the enteric ND strains bypass the respiratory tract and replicate primarily in the enteric tract, inducing a local reaction there.

Vaccination reaction

Live respiratory ND virus (La Sota type) vaccines induce good protection but are often criticised for causing respiratory vaccination reactions, especially after primary vaccination at a young age. Various ND vaccines currently available may induce some, but nevertheless significant, vaccination reactions especially when used at one day of age. These reactions might be aggravated by secondary pathogens, such as E. coli, MG or Ornithobacterium rhinotracheale. This may

Newcastle disease vaccination of broilers by hatchery spray.

subsequently lead to an increase in morbidity and mortality after vaccination, but even more importantly the performance of flocks can be adversely affected. In the broiler sector this is a distinct disadvantage due to narrow profit margins.

The live enteric strains mainly replicate in the enteric tract causing local damage, which might interfere with digestion and absorption of nutrients. Often this reaction is not seen and also not perceived as a vaccination reaction but it will have an adverse effect on the overall performance of broilers.

To avoid a respiratory vaccination reaction after primary vaccination with live ND different vaccine options can be considered.

The first option is to move from respiratory ND strains to enteric ND strains; respiratory reactions will not occur as these strains mainly replicate in the enteric tract causing a local reaction there. The disadvantage is poor local protection in the respiratory tract, which is important as the first line of defence against ND infection.

The second option is the respiratory approach; application of a milder respiratory ND vaccine that still induces a good local immunity but without causing a respiratory reaction.

As duration of protection induced by live ND vaccines may be limited, chickens that are vaccinated at one day of age have to be revaccinated for complete protection during their total life span. For revaccination progressively more virulent vaccines (La Sota type) are generally advised. The immune response increases as the pathogenicity of the live vaccine increases. Therefore, to obtain the desired level of protection without serious reactions, vaccination programmes are needed that involve sequential use of progressively more virulent viruses or live vaccine followed by inactivated vaccine.

New concept

A good example of the respiratory approach is Nobilis ND C2 or Newhatch C2. This mild respiratory vaccine, based on the strain ND C2, has been developed to overcome respiratory vaccination reaction.

The ND C2 strain is a lentogenic respiratory ND virus (non-enterotropic) especially developed for vaccination at day old preferably by hatchery spray.

Nobilis ND C2 induces a primary immune response, in chickens with high levels of maternal ND antibodies, inducing good basic protection and reducing the vaccination reactions to subsequent live ND vaccinations.

Intervet developed a concept approach which consists of early first vaccination with the 'primer' Nobilis ND C2 (as early as one day of age) by coarse spray (preferably in the hatchery or in the chicken boxes at point of delivery) followed by a second vaccination with a La Sota type vaccine (Nobilis ND Clone 30) 14 -17 days later in order to accomplish full ND protection.

This approach compromises neither safety nor protection against ND.

This concept was tested in a field trial in the Netherlands including 20 broiler farms with a total of approximately one million birds. The objective of this trial was to investigate under field conditions the safety

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Table 1. Summary of performance parameters for trial flocks primed with Nobilis ND C2 and revaccinated with Nobilis ND Clone 30 compared to control flocks.

Parameter	Trial flocks	Control flocks	Statistics*
Mortality: first week (%)	1.22	1.84	p = 0.11
Mortality: total (%)	3.75	4.67	p = 0.014**
Slaughter weight (g)	2061	2049	p = 0.51
Average daily gain (g)	49.3	48.7	p = 0.23
Feed conversion	1.757	1.783	p = 0.013**
Feed conversion 1500	1.538	1.565	p = 0.038**
EPI***	270	261	p = 0.035**

*Paired t-test, vaccinated flock versus mean of control flocks on each farm. **Significant: P 0.05 *** EPI

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and efficacy of spray vaccination of day-old broilers with Nobilis ND C2 in a combined scheme with spray vaccination of Nobilis ND Clone 30 at 17 days of age.

Field trial

The study was designed as an open study with historical and future controls (five last pre-trial rounds and first post trial round) within the farm. Safety and efficacy of Nobilis ND C2 was judged on basis of clinical observations, daily mortality, performance parameters, and ND-HI antibody titres. Efficacy of the concept was determined in a vaccination/challenge trial.

Species	Vaccination (spray) Day 1	Day 14	HI titre (^{2}log) against NDV Day 0	Day 35	Day 43	Protection at 10 days post challenge*
Broilers: Farm 1	Nobilis ND C2	Nobilis ND Cl30	5.5	3.0	-	Challenge at day 35:95%
Broilers: Farm 2	Nobilis ND C2	Nobilis ND Cl30	4.8	-	2.4	Challenge at day 43:93%

*Challenge: 10^6 EID50/chicken i.m. Herts 33/56: Protected = no clinical signs of or mortality due to ND

Table 2. Protection of broilers vaccinated with Nobilis ND C2 and Nobilis ND Clone 30, after challenge.

The mean of the production parameters of the last five pre-trial rounds and the first post-trial farm was used as a reference (controls). These farms had been vaccinated according to the standard vaccination schedule of the poultry integration with enteric and/or respiratory ND vaccines. In this trial no vaccination reactions were observed and full protection against ND was achieved. This resulted in improved performance.

Results

The vaccination reaction score in the broilers was assessed on a scale of 1 to 4 in which 1 = normal active birds: no reaction; 2 = less active birds: some respiratory signs; 3 = sick birds and 4 = very sick birds.

The mean vaccination reaction score was: 1.01 (1.0-1.14) after vaccination with Nobilis ND C2 at one day of age by coarse spray. The vaccination score after the second ND vaccination with a La Sota type (Nobilis ND clone 30) vaccine was 1.1 (1.0 -2.0). This shows no vaccination reaction after Nobilis ND C2 and no or very mild reaction after vaccination with Nobilis ND Clone 30.

The total mortality was significantly ($p = <0.05$) reduced by nearly 1% (4.67 vs. 3.75%) and the feed conversion was significantly ($p < 0.05$) lower (1.759 vs. 1.784) in the Nobilis ND C2 vaccinated flocks when compared to the controls.

The European Production Index (EPI) of the Nobilis ND C2 vaccinated flocks was 270, which was significantly better ($p = <0.05$) than that of the control group (261) (see Table 1). In other countries, like USA, Turkey, South Africa, Brazil, Thailand and the Philippines, Newhatch C2 or Nobilis ND C2 have given similar results.

To test efficacy, birds from two farms were taken back to isolator units and challenged with a virulent Herts 33/56 strain intra muscularly. This was done at 21 (age 35 days) and 29 days (age 43 days) post last vaccination. The protection was 95% at 35 days and 93% at 43 days (see Table 2), which is considered excellent.

Conclusion

The mild ND C2 strain is safe for use at day old. It does not cause vaccination reactions after coarse spray application and minimises vaccine reactions to subsequent live ND vaccinations.

The programme of Nobilis ND C2 followed by Nobilis ND Clone 30 induces solid protection and compromises neither safety nor protection against ND, resulting in improved broiler performance. ■