

# Controlling necrotic enteritis in broiler chickens

by **L. Gobbi, Intervet/Schering-Plough Animal Health, Segrate, Milan, Italy.**

**C**lostridium perfringens type A in low numbers is a normal inhabitant of the chicken intestine. Under certain circumstances, however, the bacteria proliferate, secreting alpha toxins that produce necrotic patches on the epithelial surface, representing the disease known as necrotic enteritis (NE).

Clinical NE is associated with high mortality, while milder, sub-clinical forms of the disease result in depressed flock growth rates. Intestinal mucosal necrosis may be associated with cholangiohepatitis and necrotic dermatitis, which both lead to downgrading at the processing plant.

## A global problem

NE represents a globally important animal welfare and economic problem. It has been estimated that the sub-clinical form alone may cost poultry producers up to US\$0.05 per broiler chicken.

Antibiotic growth promoters have been used to control the disease. However, interest in immunising against NE has risen in recent years due to strong worldwide restrictions or even bans on the routine use of in-feed antibiotic growth promoters.

Generally speaking, passive protection in poultry still has several obvious shortcomings, most notably a limited duration of only 2-3 weeks and the absence of maternal antibodies from milk.

However, some authors have reported that maternal antibodies, either from natural exposure or following vaccine stimulation, may represent a valid alternative for protecting offspring against the pathologic effects of *Cl. perfringens*. More recently, a water-in-oil emulsion vaccine (NETVAX) for the control of NE has been investigated in poultry and it is now available for commercial use in some countries.

Currently, the vaccine is being used in the USA and Canada with a conditional licence granted by the United States Department of Agriculture. On the contrary, in the European Union the vaccine is not available yet, since an application is still pending at the EMEA.

In this article we will discuss data obtained either from serology studies and field trials preventing NE in broilers through the use of the above mentioned vaccine.

Laboratory studies were conducted to demonstrate the onset of antibody responses in vaccinated hens; moreover, pertinent experimental works were set up to show the passive protection in the offspring. In particular, serology showed that antibodies were induced against *Cl. perfrin-*

*gens alpha toxoid*. These antibodies persisted in hens for 55 weeks after first vaccine administration and for the same duration of time they were passively transferred to chicks via egg yolk. Other experimental trials showed that chicks hatched from eggs of vaccinated hens were protected against the development of necrotic lesions, caused by a virulent challenge of *Cl. perfringens* type A. Protection was shown in chicks of at least 18 days of age.

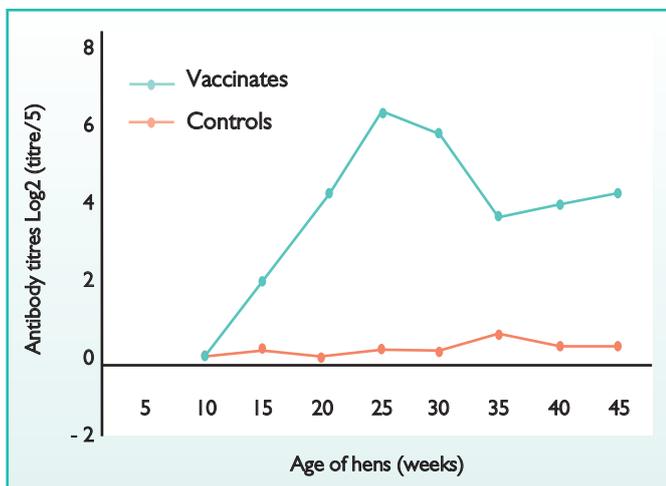
## Large scale trials

Large scale clinical trials were performed in several intensive poultry production areas to confirm in-use safety and efficacy of vaccination. In vaccinated replacement pullets there were no detectable effects on the reproductive performances and the vaccine was well tolerated with no adverse reactions reported, other than some swelling at the injection site.

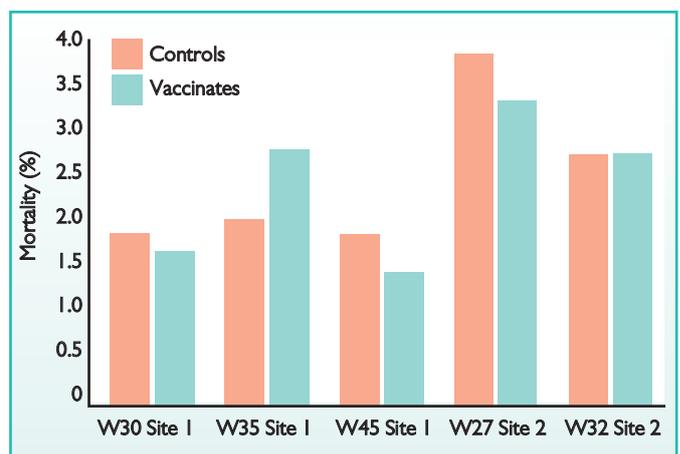
The product efficacy in progeny (i.e. protection against NE effects) was evaluated under the following conditions and results were as reported hereinafter.

A floor pen study was conducted at a USA research station to evaluate the efficacy of NETVAX for breeders, using two sources  
*Continued on page 9*

**Fig. 1. Mean serum *Cl. perfringens* alpha toxin antibody titres in hens.**



**Fig. 2. Mortality, shown at various weeks (W) throughout the study, was somewhat higher among controls compared to birds from hens vaccinated against *Cl. perfringens*.**



*Continued from page 7*

of Cobb 500 chicks (one source from breeders that had received the NE toxoid vaccine and the other source from breeders that had not received the vaccine).

The study design also compared the performance of vaccinated broilers in ionophore coccidiostat medication or anticoccidial vaccination programs.

The different treatment groups were artificially infected according to a specific *Cl. perfringens* challenge model, and performance results including growth, feed conversion, mortality and NE lesion scores were compared. Overall, groups of broiler chickens derived from NETVAX vaccinated hens had significantly better live weights and reduced FCRs at the different time-points (0-16, 17-23, and 24-42 days of life).

1A total of 79,865 replacement pullets from a company that produces antibiotic-free broiler chickens in the USA were vaccinated with NETVAX via subcutaneous injection at 10 and 18 weeks of age. Flock mortality in the progeny from vaccinated birds was compared against flock mortality in the progeny from non-vaccinated hens at 8-14 days, 15-21-days, 22-28 days and at slaughter time.

Mortality trend lines demonstrated an advantage for progeny from vaccinated hens during the seasonally high NE challenge period.

1Four pullet operations in the USA for a total of 863,760 birds were vaccinated with NETVAX (two doses per pullet at 9-12 and 17-20 weeks of age).

The same four operations provided groups of non-vaccinated pullets and they served as controls. Progeny from these pullets (more than 10 million broiler chickens either from vaccinated and non-vaccinated hens) were fed with in-feed ionophores to control coccidiosis, but they did not receive antibiotic growth promoters (AGPs).

Progeny of parent flocks vaccinated with NETVAX and fed ionophores (but not AGPs) demonstrated improved liveability and reduced FCRs, calorie conversion and standard costs.

1A field trial in Western Canada examined flocks hatched from parent flocks vaccinated with NETVAX. Under standard growing conditions performance data were compared to non-vaccinated derived control broiler flocks.

These test flocks were also given a coccidiosis vaccine at day of age to replace in-feed anticoccidials. Performance parameters (mortality, final body weight, feed conversion, condemnation rate, and breast yield) were compared to control flocks.

In addition, flocks of broilers from NETVAX parent flocks, grown on a standard in-feed anticoccidial medication program, were compared to non-vaccinated derived progeny also on a standard program for coccidiosis control.

In this extensive field trial vaccinated

derived progeny gave performance results superior to broiler flocks from non-vaccinated breeder hens.

Although field trials are not yet concluded, there is confirmation that maternal antibodies against the *Cl. perfringens* alpha toxin helped to prevent NE, hence it may be advised that NE toxoid vaccination of breeders should become an important tool to improve the performance of broilers in the absence of efficacious preventative antibiotics.

1A Good Clinical Practice (GCP) trial on NETVAX was performed in two European countries. The study was conducted in two breeder hen farms and included 11,234 vaccinated and 9,304 control hens.

Clinical observation of their progeny, consisting of five batches of broiler chickens, was used to test the safety and efficacy of the test vaccine.

The results were as follows:

Breeder hen vaccination induced a significant antibody response against *Cl. perfringens* alpha toxin. Significantly higher levels of *Cl. perfringens* alpha toxin antibodies were observed in eggs collected from vaccinated hens (Fig. 1). This confirms active transfer of specific antibodies from hen serum into their eggs.

Progeny chicks hatched from eggs of vaccinated hens also demonstrated significantly higher levels of *Cl. perfringens* alpha toxin antibodies. The chicks were from eggs collected on Site 1 when hens were 30, 35 and 45 weeks of age and on Site 2 when the hens were 27 and 32 weeks.

No *Cl. perfringens* associated gut lesions were observed in chickens from vaccinated hens. In contrast, 5.7% of controls from one site and 17.8% of controls from the other displayed lesions and *Cl. perfringens* was isolated in gut samples taken when NE was suspected.

Throughout the entire study, mortality in broilers was slightly higher among controls compared to the vaccine group, except for hatch-week 35 at Site 1 due to yolk sac infection (Fig. 2).

In addition, one hatch of birds from vaccinated hens had a statistically higher mean weight compared to the control group.

As for clinical studies conducted in the USA and Canada, no systemic reactions or unanticipated reactions were observed in vaccinated pullets/hens. Some minor local reactions were observed, but they were not serious enough to raise concerns about the welfare of the animals.

## Conclusion

On the basis of results from all these studies we can expect that for the near future NE control may include vaccination against the disease, as well as general measures that promote good gut health and reduce the *Cl. perfringens* challenge. ■