The cost benefits of vaccination in poultry production

by Dr Stephane Lemiere DVM, Global Avian Technical Director, Merial, 29 Avenue Tony Garnier, 69 007 Lyon, France.

Vaccination in poultry production is vital to protect the birds against the main viral diseases: Marek's disease, infectious bursal disease or Gumboro disease, infectious bronchitis, Newcastle disease, avian influenza, etc, as well as bacterial diseases: colibacillosis, mycoplasma infections, etc and also coccidiosis.

If we refer more specifically to broiler chicken meat production worldwide, the implemented vaccination programs aim at controlling these diseases, and help improve liveability for the most highly impacting diseases such as Newcastle disease or highly pathogenic avian influenza.

They also help prevent the consequences of poor control of less acute forms of these diseases, such as: condemnation of broilers at the slaughterhouse, increased cost of medication and use of antibiotics, negative impact on overall growing performances, decreased meat production and overall economic value.

Sub-acute forms of the disease may also have a strong impact on productivity, such as in the case of subclinical necrotic enteritis, that was estimated as decreasing the value of 20,000 chickens by about US$878 for 4.63lb birds, and up to US$1,480 for 7.94lb birds, as calculated in Skinner's publication in the 2010 Avian Disease scientific journal.

There is no way to save the cost of control of clearly identified diseases which induce mortality in chickens, or liveability would immediately drop.

Preventing economic losses is associated with control of immunosuppression syndrome in chickens, as stated already in Fussel's publication in the Poultry Science journal in 1998.

Breeder vaccination programs to passively protect progeny is the first approach; the second approach is to protect the growing chickens against immunosuppressive diseases and their economic consequences.

Immune foundation induced by early vaccination in presence of maternally derived antibodies, against Marek's disease and infectious bursal disease, both of which are main viral causes of immunosuppression, is induced by a unique concept of vaccination which began to be used worldwide back in 2006: the injection, either in ovo, or at day-old, of a vector vaccine based on the HVT strain, the HVT-IBD vector vaccine, VAXXITEK HVT+IBD.

The economic benefits of the use of this vaccine are reviewed in the following experiences in different continents and different disease challenge conditions. ■

1. Case study in China

Increased feed efficiency

One major consequence of immunosuppression is decreased feed efficiency, for example with the development of syndromes such as necrotic enteritis.

Many causes of immunosuppression may occur, but one of them is well known and perfectly diagnosed: very virulent IBD infection. Immunosuppression due to high levels of IBD challenge and vvIBD outbreaks are often described throughout China.

An illustration is given by standard white broilers and coloured broilers large-scale HVT-IBD vector vaccine efficacy field trials across China.

Growth performance (final bodyweight, age at slaughter, feed conversion rate and mortality) was recorded throughout the observation periods.

Increased performance with the HVT-IBD vector vaccine was shown in comparison to traditional live IBD vaccine programs. In standard broilers vaccinated with the HVT-IBD vector vaccine, mortality rates were significantly ($p<0.001$) inferior compared to controls for the first round of vaccination (4.90% versus 5.90%), and significantly ($p<0.001$) inferior for the second round, with an observed difference of 0.20%.

In addition, an increased average live weight, increased daily weight gain, decreased feed conversion ratio, and overall increased performance index of production was observed in that population of chickens.

Overall, vaccination with the HVT-IBD vector vaccine results in an economic benefit of 0.35 Chinese Yuan (RMB) per bird for the first round and of 0.28 RMB per bird for the second round in standard broilers, and 0.64 RMB per bird in the coloured bird populations.

These observations demonstrate the interest of inducing an early protection of the bursa, the target organ of the vvIBD and Marek's disease. Feed cost for the production of chicken meat was diminished with a decreased feed conversion rate.

The cost of medication was also decreased, thanks to improvement of bursa health and enhanced general immunity of the birds. ■

2. Case study in Brazil

Decreased incidence of condemnation

Broiler performance may be evaluated during the rearing phase, as well as in the processing plant. It is obvious that control of IBD induced immunosuppression results in a decrease in lesions caused by bacterial secondary infections and a decrease in carcase condemnation at the chicken processing plant.

Condemnation rate is an important factor that affects the indexes and profit of a chicken slaughter house. This parameter is directly linked to the overall health status of the chickens during the rearing period in the farms and their transfer to the slaughter house.

Causes of condemnation are numerous: airsacculitis, arthritis, cellulitis, colibacillosis, cachexia and dermal lesions recorded as dermatosis and dermatitis.

Let us study the case in the Brazilian condemnation recording system; the data are divided into full bird condemnation and partial bird condemnation. The 'Serviço Inspeção Federal' officially inspects carcases immediately after the evisceration stage and before market classification: partially condemned carcases are accepted by the internal market for processing, while only full bird carcases are accepted for export (mainly to the EU).

Continued on page 21

Visible protection (right) of the immune system bursa obtained with the HVT-IBD vector vaccine application in the hatchery.

Continued from page 19

The average percentage of carcase weight lost after partial condemnation depends on the reason for condemnation. It may range from 3% for a single abscess to 32% for airsacculitis. This study looked at 840 flocks selected from the records of a broiler meat producer. Out of these, 397 flocks, representing approximately 9 million broilers, were vaccinated against IBD with an IBD complex with antibodies live hatchery vaccine. Some 431 flocks representing approximately 9.2 million birds, were vaccinated with the HVT-IBD vector vaccine. Flocks were quasi-contemporaneous. Total carcase condemnations and partial condemnations were recorded. The condemnation rates that could be directly related to immunity of broilers, bacterial contamination and skin resistance were analysed.

Condemnation rates resulting from the slaughtering process were disregarded. Overall mean condemnation rates (total and partial) were 5.41% for the control flocks and 4.13% for the flocks vaccinated with the HVT-IBD vector vaccine.

There was a calculated economic saving of about $175K in carcase condemnations in the flocks vaccinated with the HVT-IBD vector vaccine compared to control flocks vaccinated with the IBD complex vaccine. ■

3. Case study in Egypt

Decreased cost of medication

One detrimental effect of poor control of immunosuppression is indirectly recorded by the increased cost of medication, and especially by the increased cost of antibiotics for secondary bacterial infection treatment and prevention.

In the context of high viral pressure and challenge in terms of secondary bacterial infection control, HVT-IBD vector vaccine administration under field conditions in day-old broiler chickens in Egypt was compared to classical live IBD vaccination programs.

Zootechnic parameters of flock performance were evaluated and the economic effects were calculated. Field infection of the flocks by very virulent (vv) infectious bursal disease (IBD) virus and other respiratory viruses was confirmed by serological and molecular biology (RT-PCR) examination of samples.

The zootechnic records showed no significant difference in viability. The overall average daily weight gain (+1.13g) of broilers processed at the same age showed a difference in favour of the HVT-IBD vector vaccine for the three successive cycles.

The overall average bodyweight (-0.002kg) was considered as equivalent in both populations. For birds vaccinated with the HVT-IBD vector vaccine, overall feed conversion was 0.05 points lower and the overall production index was 10 points higher, for the three successive cycles.

These pointed differences led to an overall difference in live weight production at 35 days, with a price difference of 12 Egyptian Pounds (EGP)/kg of bodyweight, equivalent to $US0.245/kg of bodyweight.

The increased immune protection offered by the HVT-IBD vector vaccine therefore led to better economic results. IB variant virus circulation was evidenced throughout the study, and the decision was taken to adjust the vaccination program according to this newcomer in the virus mix.

The target bodyweight, 1.6kg per bird, was obtained earlier and more homogeneously using the HVT-IBD vector vaccine.

This target weight was used in calculating the economic results of the study. Higher than average mortality rates were recorded for the period of this study.

Feed conversion ratios decreased in birds vaccinated with the HVT-IBD vector vaccine, which also contributed to the economic benefit in production (0.162 EGP per 1.6kg of bodyweight, equivalent to $US0.028).

The cost of medication, including vaccination, was decreased in birds vaccinated with the HVT-IBD vector vaccine (-0.02 EGP per 1.6kg of bodyweight, equivalent to -0.37 $US cents). ■

4. Case study in USA

Increased uniformity of carcases

It is well known that in highly advanced poultry operation systems with a lot of automation, especially at the processing plant, the impact of carcase uniformity on the economic result of the industry may be huge. The effect of vaccination with the HVT-IBD vector vaccine on body weight, flock uniformity and virus shedding was investigated in a commercial broiler flock.

A flock of day-old broiler chicks was divided into two equal groups and placed in a commercial broiler house. The control group was administered Marek's disease vaccines in ovo at 19 days of incubation. The control group was not vaccinated for IBD. The treated group was administered HVT-IBD vector vaccine in ovo at 19 days of incubation. The flocks were weighed at five time points. At least 200 birds were individually weighed in each test group at each time point.

Mean weights and coefficients of variation (CVs) were calculated for each test group. Flock uniformity was calculated as the number of birds within a range of ±15% of the mean weight. At each time point cloacal swabs were collected from 90 birds per group and tested for the presence of IBD virus using a molecular biology approach (RT-PCR). Serum samples were collected from 25 birds per group and tested for IBD antibodies using ELISA. Bursal tissue samples were collected from six birds per group. Fresh bursal tissue was tested for IBD virus using antigen recovery by capture ELISA. Formalin-fixed bursal tissues were examined for histopathological IBD lesions. At 38 days of age, 120 birds per test group were selected for processing.

Mean weights and CVs for each test group were determined for live weight, ready-to-cook (RTC) weight, and cut up parts weights (wings, breasts, tenders, legs and racks). Yields were calculated as a percentage of live weight and RTC weight.

The treated group had a higher mean weight, lower CV and better uniformity than the control group. It had lower mean bursal scores and better follicular restitution as well as higher geometric mean titres by ELISA at each time point. More birds in the control group were found to be shedding virus at 28 and 35 days. The treated group had higher live, RTC, and cut-up parts weights and higher yields for RTC, wings, breasts and tenders. ■

Visible uniformity of carcases with decreased condemnation.