Avian influenza – the value of vaccination in changing times

During the XIX World Veterinary Poultry Association Congress in Cape Town, South Africa, experts from around the world gathered to share experiences in managing the threat of avian influenza (AI) to global poultry stocks.

In this two-hour symposium, hosted by Ceva Animal Health, experts from the United States, China, the Netherlands and France gathered to present updated information on the avian influenza status and control in their countries.

The discussion of critical issues covered by the panellists helped to have a better understanding of the evolution of the disease and the continuous threat posed by AI and the value and possibilities of different control measures applied, including vaccination, in changing times.

A growing challenge

A total of 309 individual outbreaks of AI in 2015 have been reported by the World Organisation for Animal Health (OIE), which is a staggering 147% increase on the outbreaks reported in 2014.

In the United States alone, during the last six months, more than 48 million domestic poultry (layers and turkeys) have been culled due to AI, where the disease spread across 15 states. It has been the worst epidemic of Highly Pathogenic Avian Influenza (HPAI) ever in the United States and despite the outbreak is seemingly under control, there are fears that AI could reappear this autumn which might add up to the 31 countries affected already this year.

Dr Mark Davidson.

AI has proven to be a major threat for the global poultry industry, disrupting international trade and causing high levels of mortality and economical losses in infected flocks. Emerging markets especially struggle to fight and recover from the disease, and decreasing public funds only compound the issue. Nevertheless, there is still a debate raging amongst poultry industry experts and government officials, on the necessity and epidemiological relevance of AI vaccination.

Avian influenza in the USA

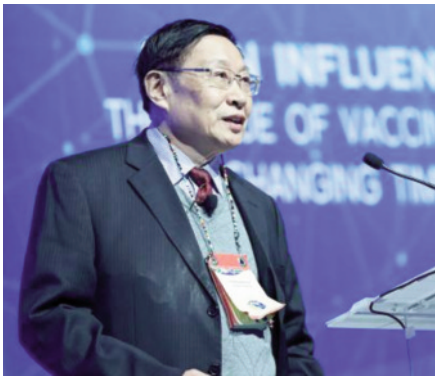
Dr Mark Davidson, Associate Deputy Administrator of the National Import Export Services at the United States Department of Agriculture described the situation of AI in the United States since the first outbreak reported in December 2014.

Several control measures including quarantine, mass depopulation, cleaning and disinfection and strengthened biosecurity were implemented to contain the outbreaks. The importance of regionalisation to reduce the impact on trade was also highlighted. Other planning activities in preparation for a potential reappearance of the disease were also mentioned, such as: enhance wild bird surveillance, ensure the availability and location of needed equipment, hiring additional staff, stockpiling vaccines and improvement in communication.

Dr Davidson stated that: "We have taken tremendous effort to prepare for this fall, on the potential that there may be additional introductions (of AI) as the migratory birds come back from the north." He continued, "We will be prepared to vaccinate if necessary."

Avian influenza in China

Professor Liu Xiufan, researcher and professor at Yangzhou University in Jiangsu, China, highlighted the fact that China has multiple AIV sub-types present in the country. Currently, the H5 and H9 virus sub-types are the most prevalent in the country and can be isolated in most provinces. Other 8 AIV sub-types may be isolated in some provinces in the country.



Professor Liu Xiufan.

Before 1990, these AIV sub-types were only isolated from wild waterfowl, but not from poultry. The description of the dynamics of the genetic evolution of the AI viruses in China illustrates the capability of these viruses to reassort their segmented genome with other AI viruses generating novel sub-types with different invasivity and virulence. Some of these natural re-assortant AI viruses have acquired the ability to bind human-type receptor.

Since the emergence of the H5N1 HPAI virus subtype in domestic geese in the Guandong province in China in 1996, this virus sub-type has evolved into 10 genetic clades, making it more difficult to control. Some of these newly generated clades are able to coexist with the previous ones for a period of time.

The H9 virus sub-type differs from the H5 virus sub-type in its slow transmissibility, spread and genetic changes seen in comparison with the rapid changes in the H5 virus sub-type. A compulsory mass vaccination program in poultry in mainland China supported by the government has been implemented since 2004.

Professor Xiufan stated that: "We learnt several lessons from the vaccination programme employed in China in response to the AI outbreaks. Firstly, for the H5N1 HPA1, the best control strategy is to stamp out the outbreaks at the early stage.

"Vaccination can raise the level of flock

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protective immunity, increase the resistance to infection, and reduce virus replication and shedding but the variation of dominant clades every year and the coexistence of several clades in a region make the control by conventional vaccines very difficult.

"However vector vaccines may be better. Secondly, vaccination must be incorporated with other methods such as biosecurity in farms, live bird markets and control of movements."

Avian influenza in Europe

Dr Andre Steentjes, Poultry Veterinarian and member of the Poultry Veterinary Study Group of the EU, presented the sequence of events and actions taken to control the highly pathogenic H5N8 outbreaks in the Netherlands in 2014.

A catastrophic experience suffered in the Netherlands in 2003 was caused by a HPAI H7N7 with a total of 255 outbreaks and 30 million birds culled. The economic losses were estimated at €500 million. A total of 86 human cases were recorded including one poultry veterinarian fatality.

Dr Andre Steentjes.

After this dramatic experience, surveillance and monitoring programs, early and rapid diagnostics and communication system as part of their established contingency plan helped them to rapidly control the five outbreaks caused by a HPAI H5N8 sub-type virus in 2014.

Despite the immediate implementation of the three-day stand still strategy implemented after the confirmation of the nature of the HPAI virus, there were 345,000 birds culled, no human cases, and a total cost estimated at €49 million.

The established regionalisation with restricted areas and corridors for movement of the birds helped them to control the outbreak in a period of two weeks (from 16-30th November).

Dr Andre Steentjes concluded: "Countries need a good AI monitoring system, especially with free range birds and an early warning system – decide when you should make warnings public." He also commented on the inconsistencies in public opinion, because often "people want the birds to be outside and do not realise they are at risk of catching AI."

Killed conventional or reverse genetics AI vaccine	Vector rHVT-H5 vaccine (Vectormune AI)
Vaccine must be constantly updated to keep its efficacy	Cross-clade protection
Take is impaired in MDA+ birds	Breaks through MDA
Vaccination must be at farm = poor coverage	Hatchery vaccination
Immunity is short lasting and boosting is necessary	One injection – life long protection
DIVA cannot be applied to vaccinated populations	DIVA can be applied

Table 1. Benefits of using a vector vaccine compared to killed vaccine.

AI control in the future

Avian influenza has dramatically and deeply changed in recent years and is now induced by more types of viruses than before, also present in more countries than before.

These more recent viruses are also better 'adapted' to wild waterfowl populations. They are not behaving as HPAIV in wild waterfowl so that they can be carried on much longer distances. This is unfortunately helping the spread of the disease and has changed the vision we had of AI and its control. The risk is much higher than it was and it is really the right time to forget about the old dogmas and adapt to this new situation.

Dr Yannick Gardin, Director of Science and Innovation at Ceva Animal Health discussed the issue of current approaches and perception on AIV vaccination as a tool to control AIV.

Vaccination against AIV will increase the resistance against the infection, will protect against clinical losses and reduce the oral and faecal shedding, slowing and preventing the spread of the disease.

Dr Gardin made the analogy why vaccination is not an option with classical inactivated vaccines in comparison with a vector vaccine using the HVT virus as a vehicle to induce immunity in the birds. This vector vaccine (Vectormune AI) has been shown to protect against a wide diversity of H5 sub-type virus clades in contrast with the need to constantly update the inactivated vaccine master seed to maintain its efficacy. Other benefits are listed in Table 1.

Another consideration was given to the effect of maternal antibodies in birds which significantly reduce the efficacy of inactivated vaccines in contrast with the ability of the vector vaccine (rHVT-AI H5) to induce immunity in the presence of maternally derived immunity.

Difficulties in obtaining a uniform immunity when vaccinating at the farm using conventional inactivated vaccines is much better managed when vaccinating at the hatchery. Immunity induced by conventional inactivated vaccines is short lasting and boosting is necessary to maintain immunity compared with the lifelong immunity induced after one injection at the hatchery with the vector vaccine (rHVT-AI H5).

Finally, the differentiation between infected and vaccinated birds (DIVA) is not possible when vaccinating with conventional inactivated AI vaccines. Using the rHVT-AI H5 vector vaccine makes it possible to differentiate serologically the vaccinated birds vs. field infected birds.

In Dr Yannick Gardin's closing remarks he stated: "Many dogmas have grown up surrounding the control of AI. Countries who decided to vaccinate were viewed as the bad countries; this is no longer appropriate. Today vector vaccines present an excellent alternative to replace old dogmas on bird immunisation and an advance in the first line of defence against this devastating disease." ■

All sessions are available on video www.avian-influenza-vaccines.com