

Designer Vaccine for poultry: a New Vision

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Summary:

Commercial poultry birds are susceptible to environmental exposure to a large number of pathogens. Prevention by vaccination has been always an integral part of health management routine. Current poultry vaccines in use are either live attenuated organisms or on killed organisms. Newer vaccines are under way to combat the stress and changing environment and protect against the pathogens. Designer vaccine production is the most recent advancement made in this sector which includes use of the specific pathogen present in a farm to produce a tailored vaccine against the same disease pathogen.

Introduction:

With the advancement in poultry production in terms of quality breeding, nutrition, housing management, bio-security, disease resistance, meat and egg quality, the birds are becoming more sensitive, prone and vulnerable to stress and diseases. Every year, major financial losses are caused by the major epidemic diseases of poultry such as avian influenza; Newcastle disease etc. and losses have been enormous for both the commercial and the public sectors. Therefore focuses on preventive measures are more in present days and thereby vaccines play a paramount role in providing bio-security in a farm. Vaccines are, in fact, an important component of poultry disease prevention and control worldwide. Commercial vaccines are being used from time immemorial in poultry production against many deadly diseases of poultry. Vaccines against Marek's disease, Ranikhet Disease, IBD, Fowl pox, IB, ILT are some of the important commercial vaccines available and are been used in vaccination for poultry birds. Vaccination must be carried out under veterinary assistance and all the standard procedures must be followed so as to avoid any vaccination failure. Even after taking care of all the standard measures, vaccine failures are observed in certain cases

and outbreak of diseases occur. Probable reasons may also include development of resistance of the pathogenic bacteria or virus, changes in the virus configurations, mutations, immune compromised in birds immune system etc. Moreover vaccinations of poultry involve a huge amount of cost and vary depending on several factors such as type of production, local pattern of diseases, managemental practises.

In this context, researchers have developed tailored vaccines and these are gaining much importance in poultry industry due to its effectiveness in most of the developed countries of the world. Vaccination of poultry using tailored vaccines also termed as Designer vaccines, Auto-vaccines are practised in poultry farms against many pathogens and it showed drastic results in terms of improved immunity and better performance.

The concept of Designer Vaccine involve improvement of the vaccine efficacy via modification of the vaccine, its administration pattern, modification in the capacity of the host and modifications in the environmental factors. These vaccines can provide a solution to many pathogenic strains. Autovaccine contains a pathogen specific to a farm; pathogens are collected, multiplied on gels in the lab until the desired number of doses is reached. The pathogens are then harvested and killed off therefore an autovaccine is always 'dead'. After that, the pathogens are mixed with an adjuvant. This is a solvent that increases the vaccine's effectiveness and influences the immunity period. Two types of adjuvants for poultry are used, one has an oil base and the other has an aluminium hydroxide base. Oil provides a stronger immune reaction than aluminium hydroxide but can also cause more inoculation reactions, such as vaccine spots. Adjuvant to be used is mostly chosen by the farmer and vet depending on the problem occurred. Quality control test for the prepared vaccine is always carried out before administration on a small flock of birds before applying to the whole flock.

Advantages of designer vaccine

1. Designer vaccine consists of the specific pathogen that protects the birds against the specific disease occurring at the farm.
2. To treat bacterial problems such as *E. coli* infections, *Erysipeloid* and *Pasteurella* to which the birds are prone when they are reared in extensive system. The *E. coli* bacterium which is known to have 200 various strains represents the largest share



of autovaccine production, because there is no registered vaccine available for some strains.

3. Farm-specific vaccines do not have to be registered except in few countries like Germany that means that it remains unknown how many farmers white using them.
4. Autovaccine can be administered along with the conventional vaccines against viral disease like Newcastle Disease, Infectious Bronchitis, Infectious Laryngotracheitis combined with bacterial pathogens within the raering period of 12-15 weeks of age.
5. Autovaccine can be tailored according to the specific farm diseases and potency of the pathogen.
6. Autovaccines can be administered in all poultry species and breeds including duck, turkey etc.
7. Producing an autovaccine from a bacterial pathogen usually takes 4 to 6 weeks, while a registered vaccine is often immediately available from stock. While the development of a registered vaccine can take years because of company legal requirements surrounding both its effectiveness and safety.

Popularity, Production and use of designer vaccine

Increase use of designer vaccine has been seen in recent years with veterinary assistance as reported by a Dutch Veterinarian Dr. Marcel Boereboom. A small number of Dutch companies have also specialised in producing farm-specific vaccines.

In Germany, 18 companies altogether are involved in this vaccine production business. However certification to produce vaccines is mandatory in Germany, stating the specific animal species and the pathogen concerned. Cascade regulation is applicable in Netherlands in designer vaccine production and poultry farmers can use this vaccine in close consultation with the vet. Jeroen Leus, a poultry vet in the east of the Netherlands, regularly has been using autovaccine for his clients based on the clinical cases observed in the farms. With this type of vaccine production is gaining in popularity in these countries but it is still in its early stage of production and is only expected to grow manifold in the future.

Dopharma, a company in Denmark has been producing autovaccines since 2013. Dopharma vet Kim van Dinther assists poultry vets with farm-specific vaccines of which, 70% have an *E. coli* pathogen, for *Erysipeloid* and *Pasteurella*, the rates vary between 5%



and 10%. Field veterinarians perform the diagnostic, collect the isolates of the pathogen and further sent to laboratory for analysis. Producing an autovaccine from a bacterial pathogen usually takes around 4 to 6 weeks. The European Union has proposed a regulation on the use of autovaccines that will be effective from 2022. Several autovaccine producers from various countries have joined with the Association of European Manufactures of Autogenous Vaccines and Sera to provide input for implementation of this new regulation. Among the producers are Dopharma, Ripac, Vaxxinova.

Cost of production

The cost depends on the pathogen, the adjuvant, the number of doses and the number of different pathogens and it varies between € 70 and € 300 per 1,000 doses. The additional cost per hen is estimated at about € 0.10 is also incurred.

Considerations for vaccination

Auto vaccines must be used under the guidance and assistance of veterinarian. An autovaccine should not be used as a standard preventative measure. It should only be used after bacteriological investigation to determine the dose and thereby, a vaccine tailored to the situation is produced.

Conclusion:

Any new vaccine produced must be easily deliverable and relevant to the market. Future studies should adopt a methodical approach to maximise the production, robustness repeatability and minimizing birds used.

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