Control of Newcastle and Infectious Bursal diseases in Poultry: Vaccines, Vaccination and Bio-security

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OUTLINE OF PRESENTATION

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2. DEFINITIONS
3. PROBLEM OF ND & IBD CONTROL
4. ADMINISTRATION OF ND & IBD VACCINES
5. BIO-SECURITY
6. THE ROLE OF AU-PANVAC
Livestock forms an important component of the livelihoods of some 600 million people today, representing 70% of the world’s poor.
INTRODUCTION

Diseases have become a major threat to the livestock-industry and are often considered to be the biggest constraints to improving livelihoods and Resilience.
One of the most threatened livestock sectors is the Poultry industry and Newcastle (ND) and Infectious Bursal diseases (IBD) are the two most important diseases threatening especially the rural Poultry Industry in Africa.
Newcastle Disease (ND) is a highly contagious and fatal disease of mostly chickens, affecting the respiratory and nervous systems.

It is caused by a paramyxovirus, with the most virulent strains isolated in Africa.
ND VIRUSES

- Newcastle disease viruses belong to a single and unique serotype, serotype 1 (APMV1).
- Slight antigenic variations but do not have any effect in on vaccination or protection
ND VIRUSES

ND strains grouped into five:
1. **Viscerotropic velogenic**: Highly pathogenic form with haemorrhagic intestinal lesions
2. **Neurotropic velogenic**: High mortality usually following respiratory and nervous signs
3. **Mesogenic**: Respiratory signs, occasional nervous signs, but with low mortality

4. **Lentogenic** or respiratory: Mild or subclinical respiratory infection;

5. **Asymptomatic**: Subclinical enteric infection.
INFECTIOUS BURSAL DISEASE (IBD) DEFINITION

- IBD also known as ‘Gumboro’ is a severe acute disease of 3–6-week-old birds is associated with high mortality, but a less acute or subclinical disease is common in 0–3-week-old birds.

- It is caused by a member of the genus Avibirnavirus of the family Birnaviridae.
IBDV is made of two serotypes designated serotypes 1 and 2 but clinical disease has been associated with only serotype 1 and all commercial vaccines are prepared against this serotype.

- Variants of IBD serotype 1 described and may require special vaccines for maximum protection.
These two diseases combined are considered as the major cause of mortalities in rural chickens.

They are identified as a major constraint to the development of the Poultry industry in Africa, particularly village poultry production.
Problems of ND & IBD control

- Commercial poultry industry: ND & IBD adequately managed by private veterinary services support

- Rural poultry sector: Lacks both government and private veterinary services support
Problems of ND & IBD control

- small flock sizes
- multi-age birds
- scattered flocks over a vast area, birds may not be adequately housed
- conventional vaccines are not available either in small-doses or in small-lot ampoules
Like all viral diseases, vaccination and appropriate Bio-security is the only viable control mechanism for ND & IBD.

Several vaccine seed strains are available and recommended by the OIE for the control of ND and IBD.

These represent the different types of ND and IBD vaccines available for control.
Presently, 3 major types of vaccines are available for the control of both ND & IBD:

- Live attenuated vaccines
- Killed/Inactivated vaccines
- New generation vaccines
There are two major types of vaccines for the control of ND:

1. Live vaccines
   - Lentogenic
   - Mesogenic
   - Recombinant vaccines

2. Inactivated vaccines
1. LIVE ND VACCINES

- Replicate in the host & virus can spread on its own from one bird to another
- May require cold chain
- Applied in either drinking water or eyes

1. Lentogenic vaccines
   - HB1 – initial vaccination
   - Lasota – moderate vaccinal reactions
1. LIVE ND VACCINES

2. Heat tolerant vaccines
   - Asymptomatic enteric viruses greater heat resistance than more conventional lentogenic viruses
     - NDV4-HR vaccine – Malaysia
     - ND I-2
1. LIVE ND VACCINES

3. Mesogenic vaccines
   ▪ These produce severe vaccinal reactions in an immunologically naïve population
   ✓ Komarov – secondary vaccines
1. LIVE ND VACCINES

4. Recombinant vaccines
   - Insertion of two surface glycoproteins, fusion [F] and haemagglutinin/neuraminidase [HN] into other viruses
   - Host may have better stability than NDV
   - Insertion of multiple pathogens into the same host virus for different diseases
   - Monitoring of vaccine response independent of wild virus
2. INACTIVATED VACCINES

Generally used for both ND and IBD:

1. Produce longer immunity – high, long lasting & uniform levels of antibodies
2. Require priming of animal with live vaccine before administration
3. Require individual administration through injection
4. Usually require adjuvants and are more expensive than live vaccines to produce
VACCINE ADMINISTRATION

1. Spray
2. Eye drop
3. Drinking water
4. Injection
5. Feed
ADMINISTRATION IN DRINKING WATER

Provokes lower immunity than eye-drop, less uniform uptake and requires more frequent application. Ensure:

- Remove water at least -2 hours prior
- Provide water that the chickens will be able to finish in one hour (c 5-7 mL per bird).
- Use clean, chlorine free water, add milk if necessary.
## ADMINISTRATION OF ND VACCINES

<table>
<thead>
<tr>
<th>AGE</th>
<th>TYPE OF VACCINE</th>
<th>METHOD OF ADMIN</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Day old</td>
<td>ND H-B1</td>
<td>SPRAY/i-o</td>
</tr>
<tr>
<td>18 – 21 days</td>
<td><strong>ND H-B1</strong> /Lasota</td>
<td>Spray or Drinking water</td>
</tr>
<tr>
<td>35-42 days</td>
<td>Lasota (Revacc.)</td>
<td>Drinking water</td>
</tr>
<tr>
<td>10 Weeks</td>
<td>Inactivated/Mesogenic</td>
<td>Injection</td>
</tr>
<tr>
<td>16 – 20 weeks</td>
<td>ND Inactivated</td>
<td>Injection</td>
</tr>
</tbody>
</table>
POST ND VACCINATION MONITORING

Essential to monitor immune response at flock level after vaccination:

. Haemagglutination Inhibition (HI) –
  o Single vacc. (Lentogenic) 4–6 log2
  o Oil emulsion vaccines- up to 11 log2

. ELISA
All Live IBD vaccines produced from serotype 1 IBDV and are fully or partially attenuated.

There are 3 main types of live attenuated vaccines against infectious bursal disease:

- ‘mild’,
- ‘intermediate’, or
- ‘intermediate plus’ (‘hot’).
Vaccines should be selected based on types of viruses present in area

- live vaccines produce slight to moderate reactions, depending on strain and immune status
- The inactivated, recombinant and heat tolerant clones of vaccines do not induce vaccinal reactions.
IBD VACCINES

- A live recombinant vaccine expressing the VP2 antigen of IBDV has also been licensed recently.
- It is important that live vaccines be stable, with no tendency to revert to virulence on passage.
- To be effective, the inactivated vaccines need to have a high antigen content.
# ADMINISTRATION OF IBD VACCINE

<table>
<thead>
<tr>
<th>AGE</th>
<th>TYPE OF VACCINE</th>
<th>METHOD OF ADMIN</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Day old</td>
<td>IBD Mild</td>
<td>SPRAY</td>
</tr>
<tr>
<td>10 – 14 days</td>
<td>IBD Mild/Intermediate</td>
<td>Spray or Drinking water</td>
</tr>
<tr>
<td>17 -24 days</td>
<td>IBD (Revacc.) Mild/Intermediate</td>
<td>Spray or Drinking water</td>
</tr>
<tr>
<td>8 Weeks</td>
<td>IBD Mild/intermediate</td>
<td>Spray, Drinking water or injection</td>
</tr>
<tr>
<td>18 weeks</td>
<td>IBD Inactivated</td>
<td>Injection</td>
</tr>
<tr>
<td>18 days incubation</td>
<td>IBD Ag/Ab complex</td>
<td>Inoculation into embryonated eggs</td>
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</tbody>
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Biosecurity involves all procedures and practices used to prevent the introduction and spread of disease-causing organisms in poultry flocks.

Biosecurity has three major components:

- Isolation
- Traffic Control
- Sanitation
Introduction of disease is usually done through contamination of existing flock

- Introduction of new Animals
- Equipment and Personnel
- Rodents, pests and wild birds
- Bad animal husbandry practices
Introduction of disease is usually done through contamination of existing flock

- Quarantine new flock before introduction
- Segregate apparently sick or infected animals in the flock
- Inspect flock daily
TRAFFIC CONTROL

- Regulate the movement of visitors into the farm area (Persons & Vehicles)
- Limit visitation to other farms
- Keep other animals out of the poultry farm area
  - Sound rodent and pest control
  - Avoid contact with wild birds and other poultry
SANITATION

- Ensure good husbandry practices
  - Farm equipment
  - Appropriate use and disinfection of PPE by personnel
  - Maintaining good hygienic practices and keeping farm environment clean
  - Appropriate housing and Nutrition
1. AU-PANVAC is the only Organization in Africa responsible for the Independent Quality Control of all Veterinary vaccines including ND & IBD vaccines in Africa
2. Supplies seed strains to all AUMS vaccine production laboratories in Africa free of charge.
3. Presently AU-PANVAC has in its repository the ND Hitchner HB1, Lasota and ND I-2 strains only

4. AU-PANVAC is making efforts to acquire IBD vaccine seeds for distribution to AUMS laboratories
Establishment of AU-PANVAC

BRIEF OVERVIEW OF AU-PANVAC

- **1983 – 1986**: Concept of Independent Center to ensure QC of all RP Vaccines batches to support the Pan African Rinderpest Campaign (PARC)

- **1986 – 1993**: FAO TCP (TCP/RAF/6766 & TCP/RAF/6767), 2 Regional Vaccine QC and Training Center to ensure Vaccine QC.
  - Dakar (Senegal) for Central and Western Africa
  - Debre Zeit (Ethiopia) for Eastern and Southern Africa
Establishment of AU-PANVAC

BRIEF OVERVIEW OF AU-PANVAC

- **1993**: The two centers were combined into one site at Debre Zeit (Ethiopia) to be known as the Pan African Veterinary Vaccine Centre (PANVAC)

- **2004**: Institutionalized under the African Union as a specialized Centre of AU and became known as AU-PANVAC
“The success of PARC and PACE clearly demonstrated that no amount of vehicles, syringes, trained personnel and communication materials would have eliminated Rinderpest if the vaccine batches used were of poor quality. .....It was the secondary and independent level of quality control assessment assured by PANVAC which played a major role in this success ......”.
AU-PANVAC Mandate

1. Provide International Independent Quality Control of Veterinary Vaccines
2. Facilitate the standardization of veterinary vaccines production and harmonization of their quality control techniques in Africa
3. Promote the transfer of appropriate vaccine production technologies to Africa
4. Provide training and technical support services to veterinary vaccines and quality control laboratories

5. Produce and distribute essential biological reagents for animal disease diagnosis and surveillance
AU-PANVAC : MISSION

To Promote the availability of safe, effective and affordable veterinary vaccines; facilitate the development and the introduction of improved or new vaccines and strengthen Africa’s capacity building in veterinary vaccine and reagent development, production and quality assurance.
AU-PANVAC : MISSION

“To promote the use of good quality vaccines and reagents for the control and eradication of animal diseases in Africa.”
Laboratory Analysis of IBD & ND vaccines

All tests based on the OIE Manual 2008-20012

1. IDENTITY TEST : PCR
2. STERILITY TEST

- Bacterial
- Viral
- Fungal
VACCINE QUALITY CONTROL TESTS FOR IBD & ND

3. SAFETY TEST: in 2 weeks old chicks
VACCINE QUALITY CONTROL TESTS FOR ND

4. POTENCY TEST
   i. Titrations in embryonated chicken eggs

5. STABILITY TEST
   a. Vacuum test
   b. Residual Moisture Estimation
   c. Accelerated Stability Studies
1. AusAID, KYEEMA Foundation and AU-PANVAC project on “Control Newcastle disease in village chickens using the I-2 vaccine”
2. GALVmed and AU/PANVAC working on the transfer of a Tablet thermostable vaccine technology to Africa
3. Annual training of laboratory technicians on Vaccine Production and Quality Control
4. Technical assistance to laboratories in need
CONCLUSION

The use of good Quality Vaccines, good vaccination protocols and implementation of appropriate Bio-security measures will contribute significantly to the control of Newcastle and Infectious bursal diseases on the African continent.
THANK YOU

Assuring Good Quality Vaccines for better Animal Protection !!!