Common causes of vaccine failure

Zimbabwe: 03/07/2014

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What is Vaccination?

- the *administration* of antigenic material *to stimulate* an individual's *immune system* *to develop adaptive immunity* *to a pathogen*.

- The process of administering a vaccine.
How do live vaccines work?

Must replicate within the host

- attach
- invasion
- replicate

Immune response

- antibodies
- white blood cells
Why vaccinate?

• Effective vaccine application is a crucial part of modern poultry production

• Vaccination and immunization are not the same.

• Immunization is the result of an effective vaccination procedure.
Types of vaccines

- Conventional live vaccines
- Inactivated vaccines
- Recombinant vaccines
- Immune complex vaccines
Vaccination methods

- **Oral/ drinking water**
  - i.e. IBV, NDV, IBDV

- **Spray**
  - i.e. IBV, NDV, ILT

- **Eye drop**
  - i.e. IBV, NDV, ILT, *M. gallisepticum*

- **Wing web**
  - i.e. Poxvirus, AE, CAV (live)

- **Intramuscular**
  - ND, IBV, IBD inactivated and/or Reovirus combinations

- **Subcutaneous**
  - Several combinations
  - Fowl Cholera, Infectious Coryza, Salmonella spp....
Vaccination failure

Causes- When and where?

- Poor cold chain maintenance
- Vaccine reconstitution
- Vaccine administration
- Health status of the birds
- Human factor/ personnel
- Post vaccination
Vaccination failure

Causes of vaccination failure

• **Poor cold chain maintenance**
  • Vaccine storage
  • Vaccine transportation

• **Vaccine reconstitution**
  • Water quality
  • Exposure to UV light (direct sunlight)
Vaccination failure

Causes of vaccination failure

- Vaccine administration
  - The vaccine
  - Timing of vaccination
  - Farm or house management conditions - the environment
  - Bird activity during the vaccination process
  - Vaccination technique
  - Duration of vaccination
Vaccination failure

Causes of vaccination failure

• Health status of the birds
  • Presence of respiratory diseases
  • Fungal diseases
  • Immunosuppressed flocks

• Human factor
  • Rushed vaccinations
  • Bad handling birds
  • Missed birds

• Post vaccination
  • Bird activity post vaccination
“Poor Vaccine Administration is the Most Common Cause of Vaccine Failure”

“Natural inclination to blame the vaccines”
Vaccination failure - How?

Poor cold chain maintenance

• Vaccine storage
  • Temperature fluctuations outside normal range
    • Electricity outages
    • Frequent opening of refrigerator door

• Vaccine transportation
  • Transportation without cooler boxes and ice-packs
  • Ice packs in direct contact with vaccine bottle
Live Vaccines

Recommendations:
Storage temperatures between 2-8 degrees Celsius
• Enough ice packs
• Stored in appropriate containers
Record expiration date and serial number
Vaccine reconstitution
• Quality and temperature of the diluents
• Time from re-suspension to use
  – IBV: 50% decrease in titer after 1 hour
Inactivated Vaccines

Recommendations:
- Storage temperature
  - 2 to 8 degrees Celsius
- Avoid direct contact with sunlight
- Avoid freezing temperatures
  - Prior to use:
    - Overnight at room temperature
    - Warmed before administration
      - Decrease viscosity
      - Lower inflammatory reaction
Vaccination failure

Vaccine reconstitution

- Water quality
  - Heat- high water temperature
  - Heavy metals
  - Chlorine
  - Disinfectants and detergents
  - Organic Matter

- Exposure to UV light (direct sunlight)
  - Direct exposure kills live vaccines
Live vaccines

Protection of live vaccines
Water treatment with skimmed milk powder
Vac-Safe™

Dissolving effervescent tablet
Neutralises chlorine levels (up to 5 ppm)
Contains a blue dye
Substitutes the use of skimmed milk powder
Acts as a pH buffer in alkaline water
Can be used
  • automatic dosing systems
  • spray
Contains no animal residues
Vaccination failure

Vaccine reconstitution

• Reconstitution of too much vaccine
  • Vaccine staying reconstituted for too long before vaccination

• Time taken to reconstitute vaccine
  • Mareks vaccines should be re-constituted within 1 minute
  • Convectional lyophilized vaccines should be re-constituted as soon as possible
Vaccination failure

Causes of vaccination failure

Vaccine administration

• The vaccine
  • Vaccine expired.
  • Using the inappropriate strain e.g IBDV vaccines
  • Using left over vaccine, ether live or killed vaccines.

• Timing of vaccination
  • Ambient temperature during vaccination
  • Effect of maternal antibodies
  • Usual onset of field infections
Water consumption nipple vs bell
Stability of Emulsified Vaccines: Water in Oil

- **Normal**: Shake and Use
- **Creaming**: Shake and Use
- **Settling**: Shake and Use
- **Breaking**: Do Not Use
Vaccination failure

Causes of vaccination failure

Vaccine administration

• Farm or house management conditions - the environment
  • Poor ventilation/high ammonia levels vs. respiratory reactions after vaccination
  • IBV, NDV, ILT and/or M. *gallisepticum*
  • House temperature vs. immune response after vaccination
  • Comfortable conditions for vaccination crew or vaccinated birds?
Poor Litter Condition

Dusty Houses
Low Temperatures (Brooding)
Uneven Light Intensity
High Temperatures (Brooding)
Vaccination failure

Causes of vaccination failure

Vaccine administration

• Bird activity during the vaccination process
  • High bird activity
  • Stress during vaccination
Vaccination technique

- **Drinking water**
  - Ambient temperature
  - Length of water withdrawal time
  - Water temperature
  - Type of drinker system
  - Drinker space
  - Stability of the water
Staining of Tongue
Vaccination failure

Vaccination technique

- Spray vaccination
  - Droplet behaviour
  - Impact of droplet size
  - Water quality
  - Climatic conditions
  - House layout
Vaccination failure

Vaccination technique

- **Spray vaccination**
  - Vaccination site (hatchery/ farm)
  - Equipment used for spray vaccination
  - Experience of the vaccinator
  - **Vaccine loss**— due to settlement, evaporation and drift of the droplets.
Vaccination failure

Spray vaccination

• Settlement
  • Loss of vaccine solution due to droplets which land on the ground.

Solution

• Group the birds together before vaccination
Spray vaccination

- **Evaporation**
  - Affects all droplets between emission and impact.
  - Reduction in droplet size, or droplets to evaporate completely.
  - Evaporation of droplets is faster if the droplets are small.
  - High ambient temperature and low relative humidity enhances evaporation.
Spray vaccination

- **Drift**
  - Loss of droplets caused by movement of air.
  - All droplets smaller than 200 micron are susceptible to drift.

**Solution**

- Turn off the ventilation during spraying.
- Close curtains when spraying in open houses.
Vaccination failure

Spray vaccination

Diagram showing the process of spray vaccination with labels for:
- Emission
- Losses by Drift
- Losses by Evaporation
- Impact
- Nozzle
- Jet emitted
- Losses by Settlement
- Useful fraction
Vaccination technique

• **Eye drop vaccination**
  • One drop per chicken in the eye/ positioning of dropper
  • Correct size of the drop
  • Scratching the eye
  • Touch the eye with the dropper
  • Dropping on the eyelid, closed eye
Vaccination failure

Vaccination technique

- Wing web injection
  - Site of inoculation: middle of wing web
  - Avoid feathers and intramuscular inoculation
  - Replace the needles periodically
  - Check the level of the reconstituted vaccine inside the vial
  - Needle dents should be completely immersed in the vaccine
Vaccination failure

Vaccination technique

• **Subcutaneous injection**
  - Incorrect site of inoculation
  - Missing the subcutaneous space
  - Needle: 18 gauge, ½ to ¼ inch
  - Replacing every 1,000 doses
  - Direction: parallel to the neck
Subcutaneous Inoculation
Correct
Vaccination technique

- Intramuscular injection
  - Proper needle: 16 or 18 gauge, ¼ inch
  - Replaced at least every 1,000 doses
  - Site of inoculation:
    - Superficial pectoral muscle
Vaccination failure

Vaccination technique

- **Intramuscular injection vaccination**
  - 1 to 1.5 inches lateral to the keel bone
  - Direction of the needle: caudally at a 45° angle
  - Avoid inserting the needle perpendicular to the body
  - Liver puncture
  - Vaccine deposited in the abdominal cavity
  - Complete the injection before withdrawing the needle
Vaccination failure

Vaccine administration

- Duration of vaccination
  - Vaccine should be consumed within 1.5 hours, max 2 hours
  - Live Mareks vaccine should be injected within 1 hour of reconstitution
  - Injectable inactivated vaccines should be administered within 2 hours
Health status of the birds

- Presence of respiratory diseases
  - Field challenge
  - Rolling reactions
- Fungal diseases
  - Aspergillosis
- Immunosuppressed flocks
  - IBD, CAV, Marek’s, ALV, Mycotoxins
  - Secondary bacterial infections
Health Status Prior to Vaccination
Vaccination failure

• Human factor
  • Rushed vaccinations
  • Missed birds

• Post vaccination
  • Bird activity post vaccination
    • Minimise activity post vaccination
    • Immediately opening curtains after vaccination
    • Immediately increasing light intensity
Causes of vaccination failure

- Poor vaccine storage
- Inappropriate vaccine transportation
- Poor water quality
- Exposure to UV light (direct sunlight)
- Poor vaccine condition
- Inappropriate choice of vaccine
- Wrong timing of vaccination
Vaccination failure- Summary

Causes of vaccination failure

- Poor vaccination technique
- Poor house environment- microclimate
- Duration of vaccination too long
- Presence of respiratory diseases
- Immunosuppressed flocks
- Missed birds
- Immediate and excessive bird activity- during and post vaccination process
Serological Evaluation

Look for antibody response

- ELISA tests
- Vaccination is successful if
  - antibody levels (or titre) are high and uniform
- Establish baseline titers
  - take average titre for the last 12 months
- Compare the manufacture’s baseline with your baseline
IBD-XR ELISA Titers

Titer Groups

13 wks: GMean = 925; % CV = 75.6
17 wks: GMean = 18704; % CV = 17.7
30 wks: GMean = 15492; % CV = 14.3
Reovirus ELISA Titers

13 wks: GMean = 4692; % CV = 49.1
18 wks: GMean = 16797; % CV = 40.6
32 wks: GMean = 13426; % CV = 21.5
AE ELISA Titers

Coefficients of Variation (%)

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Commercial vaccines are safe and efficacious

- Regulated by various regulatory authorities
  - Purity, safety, potency and efficacy testing
- Proper storage, handling, transportation and administration is critical to their success
It is crucial to periodically train and evaluate vaccination crews

- Goal: development of an adequate local, humoral and cellular immunity
  - Protect breeders and layers during production
  - Protect progenies against early challenge in the field

It is critical to avoid the loss of properly trained personnel in charge of vaccine administration

- Fundamental for the success of any poultry company
THANK YOU!
TATENDA!
SIYABONGA!
BAIE DANKIE!
MUCHAS GRACIAS!
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