THE LATEST TECHNOLOGY OF CONTROLLING NEWCASTLE DISEASES

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Outlook of the presentation

- Major changes in the Asia Poultry Industry
  - Fast growth of poultry industry
  - Disease Challenge

- Role of New technology vaccine for Newcastle Disease control
  - Vector vaccines
    - Evaluation of Efficacy
    - Compatibility

- Conclusions
On October 31st 2011

Current World Population

7,196,115,884
By 2050
> 9 billion people will be living on Earth
Nearly 60% in Asia
How can we feed 9 billion?
Main Source of Protein

Broiler meat & Eggs
2011

80.8 (million tones)

2050

E 140 (million tones)
## Growth of Broiler Meat Production (1,000 MT)

<table>
<thead>
<tr>
<th>Country</th>
<th>2003</th>
<th>2012</th>
<th>Growth (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>9,898</td>
<td>13,700</td>
<td>+ 38.4</td>
</tr>
<tr>
<td>India</td>
<td>1,500</td>
<td>3,160</td>
<td>+ 110.7</td>
</tr>
<tr>
<td>Thailand</td>
<td>1,340</td>
<td>1,550</td>
<td>+ 15.7</td>
</tr>
<tr>
<td>Indonesia</td>
<td>1,118</td>
<td>1,540</td>
<td>+ 37.7</td>
</tr>
<tr>
<td>Malaysia</td>
<td>835</td>
<td>955</td>
<td>+ 14.4</td>
</tr>
<tr>
<td>Philippines</td>
<td>635</td>
<td>790</td>
<td>+ 24.4</td>
</tr>
<tr>
<td>Vietnam</td>
<td>373</td>
<td>750</td>
<td>+ 101.1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>15,699</td>
<td>22,445</td>
<td>+ 43.0</td>
</tr>
</tbody>
</table>

**Source:** USDA; [http://www.indexmundi.com](http://www.indexmundi.com)
Changes in the Asia Poultry Industry

Larger production units

Strong disease pressure

High stocking density

Increased farm density

Complicated automation equipment

Farms with different biosecurity standards closely located

Pressure to reduce the use of anti-infectives

Poorly qualified labour

Reduced downtime period

Marginally efficient respiratory system

Pressure to reduce the use of anti-infectives

Poorly qualified labour

Reduced downtime period

Marginally efficient respiratory system
Disease Challenge

Courtesy: Dr Francesco Bonfante

vvNDV
Newcastle Disease Challenge

WARNING
ENDEMIC
Phylogenetic analysis of the NDV:
Based on the 374 base pairs long (47-420 bp) nucleotide sequence of the F gene of NDV.

Genotype VII associated with many outbreaks in Asia
The role of new technology vaccines (rHVT-ND) for the control of Newcastle Disease
Recombinant ND vaccines

Donor = NDV

Vector = HVT virus

Insertion site
(nonessential sites on HVT genome)

F protein

F gene

F = Fusion
How to evaluate a vaccine?

- Type of immune response
- Onset of immunity
- Duration of immunity
- Level of protection
- Ability of evade MDA
- Reduce re-excretion
- Spectrum of immunity
- Compatibility
How to evaluate a vaccine?

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- Ability to evade MDA
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- Compatibility
**Active Immune Response**

- HI test is the most sensitive and specific method for the reliable detection of the immune response induced by rHVT-NDV vaccine.

**Source:** Palya et al. Monitoring the vaccination with a rHVT-NDV vectored vaccine in commercial broilers through serological methods. Poster at AAAP Meeting, San Diego – CA, 2012.
Active Immune Response

- Cell-mediated immunity.

### NDV specific cell mediated response

<table>
<thead>
<tr>
<th>Weeks post-vaccination</th>
<th>Groups&lt;sup&gt;a&lt;/sup&gt;</th>
<th>rHVT-ND</th>
<th>Live ND</th>
<th>rHVT-ND/live ND</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Negative</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>&lt;2.00&lt;sup&gt;b&lt;/sup&gt;A</td>
<td>&lt;2.00&lt;sup&gt;A&lt;/sup&gt;</td>
<td>&lt;2.00&lt;sup&gt;A&lt;/sup&gt;</td>
<td>&lt;2.00&lt;sup&gt;A&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>0/5&lt;sup&gt;c&lt;/sup&gt;A</td>
<td>0/5&lt;sup&gt;A&lt;/sup&gt;</td>
<td>0/5&lt;sup&gt;A&lt;/sup&gt;</td>
<td>0/5&lt;sup&gt;A&lt;/sup&gt;</td>
</tr>
<tr>
<td>3</td>
<td>&lt;2.00&lt;sup&gt;b&lt;/sup&gt;B</td>
<td>30.60 ± 16.45&lt;sup&gt;A&lt;/sup&gt;</td>
<td>32.81 ± 16.45&lt;sup&gt;A&lt;/sup&gt;</td>
<td>34.78 ± 14.52&lt;sup&gt;A&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>0/5&lt;sup&gt;b&lt;/sup&gt;B</td>
<td>4/5&lt;sup&gt;A&lt;/sup&gt;</td>
<td>5/5&lt;sup&gt;A&lt;/sup&gt;</td>
<td>5/5&lt;sup&gt;A&lt;/sup&gt;</td>
</tr>
<tr>
<td>4</td>
<td>&lt;2.00&lt;sup&gt;b&lt;/sup&gt;B</td>
<td>33.86 ± 38.42&lt;sup&gt;AB&lt;/sup&gt;</td>
<td>36.13 ± 21.61&lt;sup&gt;AB&lt;/sup&gt;</td>
<td>47.92 ± 38.98&lt;sup&gt;A&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>0/5&lt;sup&gt;b&lt;/sup&gt;B</td>
<td>4/5&lt;sup&gt;AB&lt;/sup&gt;</td>
<td>4/5&lt;sup&gt;AB&lt;/sup&gt;</td>
<td>5/5&lt;sup&gt;A&lt;/sup&gt;</td>
</tr>
<tr>
<td>5</td>
<td>&lt;2.00&lt;sup&gt;a&lt;/sup&gt;A</td>
<td>16.54 ± 16.14&lt;sup&gt;A&lt;/sup&gt;</td>
<td>15.70 ± 10.62&lt;sup&gt;A&lt;/sup&gt;</td>
<td>13.33 ± 16.74&lt;sup&gt;A&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>0/5&lt;sup&gt;a&lt;/sup&gt;B</td>
<td>5/5&lt;sup&gt;A&lt;/sup&gt;</td>
<td>3/5&lt;sup&gt;AB&lt;/sup&gt;</td>
<td>2/5&lt;sup&gt;AB&lt;/sup&gt;</td>
</tr>
<tr>
<td>7</td>
<td>2 weeks pch</td>
<td>S.M.</td>
<td>27.56 ± 17.33&lt;sup&gt;A&lt;/sup&gt;</td>
<td>34.53 ± 5.67&lt;sup&gt;A&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>5/5&lt;sup&gt;A&lt;/sup&gt;</td>
<td>3/5&lt;sup&gt;A&lt;/sup&gt;</td>
<td>2/5&lt;sup&gt;A&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

S.M. = specific mortality.

<sup>a</sup> Different uppercase superscript letters indicate a significant (P < 0.05) difference between the groups (per line).

<sup>b</sup> Data represent mean ± standard deviation of S.I. that was calculated for each antigen-responding bird by dividing the O.D. values of antigen-activated splenocytes (if equal or greater than 0.1) by the O.D. of non-activated splenocytes. An O.D. and a S.I. equal to or greater than 0.1 and 2, respectively, were considered as evidence of specific antigen-activation.

<sup>c</sup> Data represent frequency (number antigen-positive/mitogen-positive chickens) of splenic cellular response to antigen-activation.
How to evaluate a vaccine?

Type of immune response

Onset of immunity

Duration of immunity

Level of protection

Ability of evade MDA

Reduce re-excretion

Spectrum of immunity

Compatibility
Protection against vvNDV challenge
(Clinical protection)

- Broiler day-old chicks vaccinated with one full dose of rHVT-NDV vaccine.
- NDV challenges: Malaysian isolate ref. D1524/1/1,2/MY/10, viscerotropic velogenic NDV strain, genotype VII, 5 log_{10} EID_{50}/bird, nasal route (200 µl).

Source: Extracted from Palya et al. Compatibility of Vectormune® ND with Cevac® Transmune in day-old commercial broilers. SIS # 02/2012/P/SSIU CP, October 26, 2012.
Layer day-old chicks vaccinated with one full dose of rHVT-NDV & live ND vaccines.

NDV challenges done at 14, 21 and 28 days of age with a velogenic ND virus (Thai Lopburi strain – ICPI 1.86) at a dosage of $10^5$ EID$_{50}$ per bird by intramuscular injection.

In high ND challenge areas, it is recommended to associate the rHVT-NDV with a live ND vaccine at day of age. In some cases, a booster in the farms should be added.

**Source:** Satra et al. Efficacy of several vaccination programs against ND challenge. - WVPA Congress, Cancun, 2011.
Broiler day-old chicks were vaccinated subcutaneously with comparable doses of the two rHVT-ND vaccines.

A recent velogenic NDV isolate belonging to genotype VII (D1524/1/1,2/MY/10) was used for challenges.

Clinical protection against NDV challenge was tested weekly from 3 to 6 weeks of age.

Results

Clinical protection

Protection against vvNDV challenge

How to evaluate a vaccine?

- Type of immune response
- Onset of immunity
- Duration of immunity
- Level of protection
- Ability of evade MDA
- Reduce re-excretion
- Spectrum of immunity
- Compatibility
Material & Methods

- Commercial laying pullets.

**Challenge with a Genotype VII strain (Malaysian isolate)**
5.0 log_{10} EID_{50}/bird by intranasal route (0.1 ml)

<table>
<thead>
<tr>
<th>Weeks of age</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 3 4 6 10 15 25 33* 40 55 72</td>
</tr>
</tbody>
</table>

- Group 1: rHVT-NDV
- Group 2: rHVT-NDV + Live ND vacc
- Groups 3: rHVT-NDV + Live ND vacc
- Groups 4: Negative & Positive Control groups - No vaccination

- Monitoring parameters (during 14 days):
  - Daily observations for NDV specific clinical signs, mortality and egg production (33 wk challenge)

*Effect of NDV challenge on the egg production*
Clinical protection

Under the conditions of this trial, the rHVT-NDV vaccine alone induced a strong immunity (clinical signs + shedding controls) up to 72 weeks of age.

NB: VTM-ND & Vitapest & LaSota & killed group was challenged only 4 weeks after LaSota booster (before vaccination with the killed ND vaccine) and at 55 wks of age.
How to evaluate a vaccine?

- Type of immune response
- Onset of immunity
- Duration of immunity
- Level of protection
- Ability of MDA to evade
- Reduce re-excretion
- Spectrum of immunity
- Compatibility
- Commercial broilers (20 per group)
- \( rHVT-NDV \) SQ or in-ovo (-3d)
- Challenge:
  - \( 10^5 \text{ EID}_{50} \) Chimalhuacan NDV strain (Genotype V)
  - at 3 or 4 or 6 weeks of age
  - IN + ON route
- Oropharyngeal and Cloacal swabs taken
  - 3 and 7 days post challenge
- Virus quantification using RT-PCR
Clinical protection

Results

- Clinical protection

![Clinical protection chart showing different groups and their clinical protection levels.](chart.png)
Reduction of shedding

Challenge at D27

Results

- Reduction of shedding

Challenge at D27

![Graph showing results of challenge at D27]

- Reduction of shedding
Reduction of shedding

Challenge at D40

**Results**
How to evaluate a vaccine?

- Type of immune response
- Onset of immunity
- Duration of immunity
- Level of protection
- Ability of evade MDA
- Reduce re-excretion
- Spectrum of immunity
- Compatibility
Spectrum of immunity

Does it protect against various types of NDV?

Yes! Yes! Yes! Yes!

Genotype I

Genotype II

Genotype III

Genotype IV

Genotype V

Genotype VI

Genotype VII
How to evaluate a vaccine?

- Type of immune response
- Onset of immunity
- Duration of immunity
- Level of protection
- Ability of evade MDA
- Reduce re-excretion
- Spectrum of immunity
- Compatibility
Compatibility

rHVT-ND ↔ Rispens
Results – Protection against MDV-1 (RB1B challenge)

Protection against MD spec. lesions

- Rismavac+CA126
- Rismavac+VTM ND (delayed)
- Rismavac+VTM ND (simult.)
- Control

Relative protection

- Rismavac+CA126
- Rismavac+VTM ND (delayed)
- Rismavac+VTM ND (simult.)
- Control

Survival rate after MDV-1 (RB1B) challenge

- Rismavac+CA126
- Rismavac+VTM ND (delayed)
- Rismavac+VTM ND (simultaneous)
- Layer control
Compatibility studies

rHVT-ND
CONCLUSIONS
Conclusions

The poultry industry has developed remarkably in the recent years.
  - Genetic improvement, nutrition, husbandry, housing systems, animal health etc.

New technology vaccine plays an important role in the control of Newcastle Disease
  - Safe
  - Prevent clinical signs
  - Reduces shedding
  - Induces strong and persistent immunity
THANKS FOR YOUR KIND ATTENTION

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