New Approach to Gumboro Disease Control
Recent findings and field application.

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Ceva Animal Health
Introduction

« I. Complex » vs « rHVT-VP2 »
Introduction

«I. Complex» vs «rHVT-VP2»

«Cevac Transmune» vs «Vectormune IBD»
Introduction

« I. Complex » vs « rHVT-VP2 »

« Cevac Transmune » vs « Vectormune IBD »
WHY ?
Diseases & Vaccinations
Protection & Control

From the Past to the Future
Gumboro Disease & Vaccination

Gumboro Virus + Susceptible chicken = Diseased Chicken

Gumboro Virus + Vaccinated chicken = Protected Chicken
Vaccination = Protection

Is it only that?

Is this still only that?
DISEASE ?

Contact

[Image of a chicken with a red arrow pointing towards it]
DISEASE?

Challenge
DISEASE?

1 – Infection

2 – Clinical expression

3 – Re-excretion
VACCINATION?

1 - Infection

2 - Clinical expression

3 - Re-excretion

RESISTANCE TO INFECTION

CLINICAL PROTECTION

PROTECTION AGAINST RE-EXCRETION

EVOLUTION OF THE VIRUS

EVOLUTION OF THE DISEASE
Today, Vaccination (= vaccine + administration) has changed Vaccination must bring more than clinical protection!
Vaccination: from «Protection» to «Control»
“Protection” vs “Control”

Virus

Chicken

CHALLENGE
“Protection” vs “Control”

To work on this (by decreasing the probability of challenge, the timing, the dose, etc.) is:

PREVENTION + PROTECTION = CONTROL

To work on this (by increasing the resistance to infection, reducing the lesions, etc.) is:

Virus

Chicken
“Protection” vs “Control”

UNTIL RECENTLY

SANITARY POLICE & BIOSECURITY

VACCINATION

PREVENTION + PROTECTION = CONTROL
“Protection” vs “Control”

BUT NOW...

SANITARY POLICE & BIOSECURITY

VACCINATION

PREVENTION + PROTECTION = CONTROL
Gumboro Disease

Control strategy
Gumboro Disease or Gumboro Diseases?
“the Gumboro Disease”

Gumboro Virus + Susceptible chicken = Diseased Chicken
“the Gumboro Disease”

Gumboro Virus + Susceptible chicken = Diseased Chicken

“type”

Pathotype
(clinical, subclinical, immunodepressive...)

Virulence
(very virulent, virulent, avirulent...)

Antigenotype

Genotype
“the Gumboro Disease”
"the Gumboro Disease"

Gumboro Virus + Susceptible chicken = Diseased Chicken

“type”
“dose”
“the Gumboro Disease”
"the Gumboro Disease"

Gumboro Virus + Susceptible chicken = Diseased Chicken
“the Gumboro Disease”

Gumboro Virus + Susceptible chicken = Diseased Chicken

Gumboro Virus + Vaccinated chicken = Protected Chicken
“the Gumboro Disease”

Gumboro Virus + Susceptible chicken = Diseased Chicken

Gumboro Virus + Vaccinated chicken = Protected Chicken
Gumboro Disease is not Newcastle Disease!
“Epizootic” vs “Enzootic”

NDV

IBDV
“Epizootic” vs “Enzootic”
“Epizootic” vs “Enzootic”
“Epizootic” vs “Enzootic”
"Epizootic" vs "Enzootic"
“Epizootic” vs “Enzootic”

NDV
“Epizootic” vs “Enzootic”
“Epizootic” vs “Enzootic”

ND is an Epizootic disease:
Challenge will come or not, early or late, independantly of the immune status
"Epizootic" vs "Enzootic"

ND is an Epizootic disease:

In other words:

It is not because your farm was hit by ND yesterday, that it will be hit again tomorrow.
“Epizootic” vs “Enzootic”
“Epizootic” vs “Enzootic”
“Epizootic” vs “Enzootic”

IBDV
“Epizootic” vs “Enzootic”

IBDV
“Epizootic” vs “Enzootic”

IBDV
“Epizootic” vs “Enzootic”

IBDV
"Epizootic" vs "Enzootic"

IBDV

SHEDDING
“Epizootic” vs “Enzootic”
“Epizootic” vs “Enzootic”

CLEANING + DISINFECTION + DOWN PERIOD

IBDV
“Epizootic” vs “Enzootic”

IBDV
“Epizootic” vs “Enzootic”

IBDV
“Epizootic” vs “Enzootic”

The Gumboro Cycle

IBDV
The Gumboro Cycle

- Delivery
- Growing
- Infection
- Waning of MDA
- Cleaning Disinfection Down time
- Shedding
- Depletion
- Gumboro Cycle
“Epizootic” vs “Enzootic”

IBD is an Enzootic disease:
Challenge will come immediately after protection by MDA has reached unprotective level and IBDV will persist, cycle after cycle if...
IBD is an Enzootic disease:

*In other words:*
If a farm was with Gumboro yesterday, then, it will have it again tomorrow

**Conclusion:**
If vaccination prevents shedding, then virus pressure for the next cycle will be lower
Gumboro Disease

Parameters of challenge and levers of action
FARM IBDV
Passive Immunity (MDA)

Protection level

CHALLENGE

Protection

Age

FARM IBDV

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Passive Immunity (MDA) vs. Vaccine (active) Immunity

Protection level

VACCINATION

FARM IBDV

CHALLENGE

YG - 140428
Passive Immunity (MDA)  

Vaccine (active) Immunity

**No protection gap**

Protection level

Protection

Age

VACCINATION  
FARM IBDV
THE 4 KEY FACTORS OF IBD CONTROL

Protection

Passive Immunity (MDA)

Vaccine (active) Immunity

Protection level

Age

FARM IBDV
THE 4 KEY FACTORS OF IBD CONTROL

1 – FARM IBDV

2 – VIRUS PRESSURE

3 – PASSIVE IMMUNITY

4 – VACCINE IMMUNITY
THE 4 KEY FACTORS

1. Farm IBDV
2. Virus Pressure
3. Passive Immunity
4. Vaccine Immunity
THE 4 LEVERS OF ACTION

1. Farm IBDV
2. Virus Pressure
3. Passive Immunity
4. Vaccine Immunity
Stop the Gumboro Cycle!

THE 4 LEVERS OF ACTION

1. Farm IBDV
2. [Image]
3. [Image]
4. [Image]
GENETIC VARIANTS / TYPES

30 SURVEYED FARMS

30 INFECTED FARMS

AR 265 (3/30 = 10 %)

T1 (AL-2) (7/30 = 23 %)

Del. E (1/30 = 3 %)

Del. A (4/30 = 13 %)

MO 195 (9/30 = 30 %)

STC (6/30 = 20 %)

Ritter D. & Gardin Y., AAAP 2010
Fig. 3. Dendrogram developed using nucleotide sequences of the hypervariable region of VP2 and the UPGMA method. IBDV strains isolated in this study are designated by state abbreviation followed by a number. Previously sequenced IBDV strains used for comparison and their GenBank accession numbers are Del-E variant (AF133904), T1 (AF281238), V1 (AF281235), AF281232 (Lukert), Bursine 2 (AF281232), Bursine (AF281231), vvIBDV ABIC MB71 (AF457103), vvIBDV BD 3/99 (AF362776), AF457014 (228E), Cu-1 (AF362747), STC (D00499), OH serotype 2 (U30818), and Penguin serotype 2 (AY539855).
THE 4 LEVERS OF ACTION

1. Farm IBDV
2. Virus Pressure
3. Passive Immunity
4. Vaccine Immunity
Passive Immunity (MDA) vs. Vaccine (active) Immunity

No protection gap

Protection level

Age
Passive Immunity (MDA) vs. Vaccine (active) Immunity

Protection level

Protection

Age

VACCINATION

FARM IBDV
**Protection**

- **Passive Immunity (MDA)**
- **Vaccine (active) Immunity**

**Protection gap**

**Protection level**

**Age**

**VACCINATION**  
**FARM IBDV**

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THE 4 LEVERS OF ACTION

1 Farm IBDV
2 Virus Pressure
3 Passive Immunity
4 Vaccine Immunity
Passive Immunity (MDA)

Protection

Age

US

ROW / EU

YG - 140428
Protection

Quantity & Quality

Passive Immunity (MDA)

Age

FARM IBDV
Cross protection studies were conducted in the late 80’s early 90’s to investigate protection afforded by various killed IBD vaccines against challenge with various IBDV strains.

Ismail N.M. and Saif Y.M., 1991
Immunogenicity of IBD in chickens. Av.Dis. 35: 460–469
Importance of the quality of Passive Protection

**Materials and methods**

- SPF chicken

- **Vaccination** with various IBD killed vaccines made from various IBDV strains

- **Challenge** 3 weeks later with:
  - Classical IBDV (STC) or Delaware E variant IBDV
  - High or low dose

- **Evaluation of the protection**:
  - 5 and 10 days post challenge
  - Body weight
  - Bursa / Body weight ratio
  - Gross lesions of the BF
  - Histology (lesions)

Ismail N.M. and Saif Y.M., 1991

Immunogenicity of IBD in chickens. Av.Dis. 35: 460–469
**Materials and methods**

Vaccines made from following IBDV strains:

<table>
<thead>
<tr>
<th>ABBREV.</th>
<th>FULL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>SAL</td>
<td>Poulvac Bursine</td>
</tr>
<tr>
<td>D 78</td>
<td>Nobilis D 78</td>
</tr>
<tr>
<td>UV</td>
<td>Univax BD</td>
</tr>
<tr>
<td>BLN</td>
<td>IBD Blen (W. 2512)</td>
</tr>
<tr>
<td>MD</td>
<td>Variant MD</td>
</tr>
<tr>
<td>OH</td>
<td>Serotype 2 OH</td>
</tr>
<tr>
<td>STC</td>
<td>Standard Classical Challenge strain</td>
</tr>
<tr>
<td>Variant E</td>
<td>Delaware variant E</td>
</tr>
<tr>
<td>Variant A</td>
<td>Delaware variant A</td>
</tr>
</tbody>
</table>
Importance of the quality of Passive Protection

Results

<table>
<thead>
<tr>
<th>CHALLENGE WITH</th>
<th>KILLED VACCINE MADE FROM:</th>
</tr>
</thead>
<tbody>
<tr>
<td>STC</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td>High</td>
</tr>
<tr>
<td>Variant. E</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td>High</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dose</th>
<th>SAL</th>
<th>D78</th>
<th>UV</th>
<th>BLN</th>
<th>MD</th>
<th>OH</th>
<th>STC</th>
<th>Var. E</th>
<th>Var. A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>NP</td>
<td>P</td>
<td>P</td>
</tr>
<tr>
<td>High</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>NP</td>
<td>P</td>
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<tr>
<td>Low</td>
<td>P</td>
<td>P</td>
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<td>P</td>
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<td>P</td>
<td>NP</td>
<td>P</td>
<td>P</td>
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<tr>
<td>High</td>
<td>NP</td>
<td>NP</td>
<td>NP</td>
<td>NP</td>
<td>NP</td>
<td>P</td>
<td>NP</td>
<td>NP</td>
<td>P</td>
</tr>
</tbody>
</table>

P = Protected    NP = Not Protected
THE 4 LEVERS OF ACTION

1. Farm IBDV
2. Virus Pressure
3. Passive Immunity
4. Vaccine Immunity
Control of Gumboro Disease: Immune Complex or rHVT-VP2?
"I. Complex" vs "rHVT-VP2"


I. Complex vs rHVT-VP2

a) Mechanism of action
rHVT-VP2 and Immune Complex IBD vaccines work according to 2 completely different protection mechanisms.
rHVT-VP2 vector vaccine is injected

The rHVT vector replicates,

VP2 antigen is expressed,

and immunity is induced

This immunity is mostly composed of antibodies that will neutralize the VP2 epitope on the Gumboro virus
I.Complex mechanism of immunization

Winterfield 2512 IBDV strain + Specific antibodies VPI (Virus Protecting Factor)
The Immune Complexes are injected and then captured by FDC from the spleen.

VPI are catabolyzed and W2512 vaccine virus is progressively released.

When MDA level is low, W2512 reaches the bursa and replicates.

All follicles of the BF are stimulated and protected.

This immunity makes the follicles resistant to infection by IBDV, whatever this IBDV.
rHVT-VP2 and Immune Complex IBD vaccines work according to 2 completely different protection mechanisms.

Immunity induced by rHVT-VP2 is mostly based on antibody response. It is more efficacious against homologous VP2 and does not prevent replication and shedding.

Immune Complex stimulates all the follicles of the bursa, and make them refractory to subsequent infection with IBDV, whatever the challenge virus.
“rHVT-VP2” vs “Immune-Complex”

2 DIFFERENT MECHANISMS OF PROTECTION

IBDV

rHVT-VP2 neutralizes IBDV with AB
As long as AB are homologous

Immune Complex makes BF resistant to IBDV
Whatever IBDV type

Target organ = BF
b) Dynamic of immunization
Onset of Immunity
PROTECTION FROM IMMUNE COMPLEX TYPE LIVE IBD VACCINE

Active Immunity induced by:
Intermediate Plus type vaccine (Immune Complex form)

No protection gap
Protection level

Passive Immunity (MDA)

Protection

Age
Protection from Immune Complex Type Live IBD Vaccine

- Passive Immunity (MDA)
- Active Immunity induced by: Intermediate Plus type vaccine (Immune Complex form)

Protection level
PROTECTION FROM IMMUNE COMPLEX TYPE LIVE IBD VACCINE

Protection

Passive Immunity (MDA)

Active Immunity induced by:
Intermediated Plus type vaccine
(Immune Complex form)

Protection level

Age
Protection from Immune Complex Type Live IBD Vaccine

- **Passive Immunity (MDA)**
- **Active Immunity induced by:**
  - Intermediate Plus type vaccine (Immune Complex form)

- *No protection gap*

- Protection level
PROTECTION FROM LIVE RECOMBINANT rHVT-VP2 TYPE VECTOR IBD VACCINE

Passive Immunity (MDA)

Active Immunity induced by: rHVT-VP2 vector vaccine

Protection level

No protection gap
PROTECTION FROM LIVE RECOMBINANT rHVT-VP2 TYPE VECTOR IBD VACCINE

Active Immunity induced by: rHVT-VP2 vector vaccine

Protection level

Age
PROTECTION FROM LIVE RECOMBINANT rHVT-VP2 TYPE VECTOR IBD VACCINE

Protection

Passive Immunity (MDA)

Active Immunity induced by: rHVT-VP2 vector vaccine

Protection gap

Protection level

Age
"rHVT-VP2" vs "Immune-Complex"

Onset of immunity of Immune Complex **adapts** to lower level of MDA because of an earlier take of the vaccine virus.

Onset of immunity of rHVT-VP2 **cannot adapt** to lower level of MDA because the mechanism is independent of MDA.
Onset of immunity of Immune Complex adapts to lower level of MDA because of an earlier take of the vaccine virus. Onset of immunity of rHVT-VP2 cannot adapt to lower level of MDA because the mechanism is independent of MDA.

For rHVT-F (Vectormune ND), this possible gap is compensated by application of 1 or 2 live vaccines in the early days to trigger mucosal immunity. This is not possible for rHVT-VP2.
PROTECTION FROM LIVE RECOMBINANT rHVT-VP2 TYPE VECTOR IBD VACCINE

Protection

Passive Immunity (MDA) FOR BROILERS

Active Immunity induced by: rHVT-VP2 vector vaccine

protection gap

Protection level

Age
PROTECTION FROM LIVE RECOMBINANT rHVT-VP2 TYPE VECTOR IBD VACCINE

Protection

Passive Immunity (MDA)

FOR BROILERS
FOR LAYERS

Active Immunity induced by:
rHVT-VP2 vector vaccine

Protection level

Age

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PROTECTION FROM LIVE RECOMBINANT rHVT-VP2 TYPE VECTOR IBD VACCINE

Protection

Passive Immunity (MDA)
FOR BROILERS
FOR LAYERS

Active Immunity induced by: rHVT-VP2 vector vaccine

No protection gap
Protection level

For layers, security margin is better
c) Level of protection
Materials and methods

- **Broiler chickens** (Hubbard flex) provided with passive immunity (VN = 11.85 / ELISA = 7026)

- **Vaccination at Day 1 – SQ route:**
  - Immune Complex vaccine
  - rHVT-VP2 vector vaccine

- **Challenge:**
  - at 2, 3, 4 or 5 weeks of age
  - vvIBD (10^4 EID_{50} – D407/2/04/TR strain)

- **Evaluation of the protection:**
  - Clinical observation
  - Bursa / Body weight index
  - Histology (lesions)
  - Virology (RT-PCR / RFLP)
Comparison Immune Complex – rHVT-VP2

Results

Clinical protection

<table>
<thead>
<tr>
<th>Age at challenge (days)</th>
<th>Immune Complex</th>
<th>rHVT-VP2</th>
</tr>
</thead>
<tbody>
<tr>
<td>14</td>
<td>20</td>
<td>40</td>
</tr>
<tr>
<td>21</td>
<td>60</td>
<td>80</td>
</tr>
<tr>
<td>28</td>
<td>80</td>
<td>100</td>
</tr>
<tr>
<td>35</td>
<td>100</td>
<td>100</td>
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</table>
Comparison Immune Complex – rHVT-VP2

Results

Protection against Shedding

<table>
<thead>
<tr>
<th>Age at challenge (days)</th>
<th>Protection (%)</th>
</tr>
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<tr>
<td>14</td>
<td>Immune Complex</td>
</tr>
<tr>
<td></td>
<td>rHVT-VP2</td>
</tr>
<tr>
<td>21</td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>28</td>
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<tr>
<td>35</td>
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Comparison Immune Complex – rHVT-VP2

Protection against Shedding

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<td></td>
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<tr>
<td>21</td>
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<td>35</td>
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</table>
Comparison Immune Complex – rHVT-VP2

Results

Challenge demonstrates that protection of the follicles with a rHVT-VP2 vaccine is of the « plus / minus » type.

(After Z. Penzes et al., 2008)
Following administration of a rHVT-VP2 vaccine, the protection starts building up soon after application and keeps on increasing, at least for several weeks.

The protection against infection and re-excretion of the challenge virus also keeps increasing but never (?) reaches 100%.
Protection of bursa against infectious by challenge virus after vaccination with rHVT-VP2

Vaccination with rHVT-VP2 IBD vaccine does not prevent infection

<table>
<thead>
<tr>
<th>Chicken type</th>
<th>Chg Age</th>
<th>Vac Prog</th>
<th>3 dpi</th>
<th>5 dpi</th>
<th>7 dpi</th>
<th>10 dpi</th>
<th>14 dpi</th>
<th>21 dpi</th>
<th>28 dpi</th>
<th>35 dpi</th>
<th>42 dpi</th>
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<tbody>
<tr>
<td>SPF</td>
<td>4 wk old</td>
<td>No vac</td>
<td>NT</td>
<td>NT</td>
<td>3/3</td>
<td>NT</td>
<td>3/3</td>
<td>3/3</td>
<td>3/3</td>
<td>3/3</td>
<td>2/3</td>
</tr>
<tr>
<td>Com. Broiler</td>
<td>2 wk old</td>
<td>rHVT IBD (io)</td>
<td>2/3</td>
<td>3/3</td>
<td>2/3</td>
<td>2/3</td>
<td>2/3</td>
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</tr>
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<td>3/3</td>
<td>NT</td>
<td>1/3</td>
<td>NT</td>
<td>3/3</td>
<td>3/3</td>
<td>3/3</td>
<td>3/3</td>
<td>2/3</td>
</tr>
</tbody>
</table>

“rHVT-VP2” vs “Immune-Complex”

Picture: Ping-Yin Kuan and Jessica Lee: BF from chickens vaccinated with rHVT-VP2 – Malaysia.
“rHVT-VP2” vs “Immune-Complex”

Picture: Bursa of Fabricius of 31 day-old broiler flock vaccinated with rHVT-VP2 vaccine - Russia
Conclusions

Following administration of an **Immune Complex** vaccine, the protection starts immediately after vaccine virus replication, which occurs after MDA have reached moderate level.

The protection against infection and re-excretion of the challenge virus most of the time reaches 100%.
“rHVT-VP2” vs “Immune-Complex”

rHVT –VP2

Immune Complex

Picture: Mango Chen (China): Bursa of Fabricius of 42 day-old broiler flocks vaccinated either with rHVT-VP2 or Immune Complex vaccines
Comparison Immune Complex – rHVT-VP2

Conclusions

Immune Complex as well as rHVT-VP2 vaccines can significantly protect the chickens against clinical signs,

but only Immune Complex vaccine prevent against infection and shedding.
d) Spectrum of protection
Comparison Immune Complex – rHVT-VP2

Materials & methods

- **Broiler chickens** (Ross 708 x Ross 708)
- Vaccination and isolation:
  - rHVT-VP2
  - Immune Complex

**Challenge**: at 28 days with $10^{4.0}$ EID$_{50}$/Ck of:

- vvIBDV TUR (TR)
- sc IBDV USA (Del.E)
- sc IBDV Mexico (MX)
- sc IBDV RSA (ZA)
- sc IBDV Brazil (BR)
- sc IBDV USA (AVS-EL)

**Criteria**:
- Clinical observations
- Histopathology of the BF
- B:BW ratio & B:B Index
- serology
- virology

4 & 14 dpc

(SSIU Ceva Phylaxia – January 2014)
Comparison Immune Complex – rHVT-VP2

Results – Histopathology
Protection of the BF 4

% of fully protected chickens

TR  DEL. E  MX  ZA  BR  AVS-EL

- 4 dpc Im.Complex
- 4 dpc rHVT-VP2
- 4 dpc Controls
- 14 dpc Im.Complex
- 14 dpc rHVT-VP2
- 14 dpc Controls
Comparison Immune Complex – rHVT-VP2

Results – Histopathology
Protection of the BF 4 & 14 dpch

[Bar chart showing % of fully protected chickens for different groups at 4 and 14 days post challenge (dpch)].
Comparison Immune Complex – rHVT-VP2

Results – Histopathology
Protection of the BF 4 & 14 dpch

FULL PROTECTION with I.Complex

PARTIAL PROTECTION with rHVT-VP2

% of fully protected chickens

TR  DEL. E  MX  ZA  BR  AVS-EL
## Comparison Immune Complex – rHVT-VP2

### Results – Serology before & after challenge

<table>
<thead>
<tr>
<th>Challenge groups</th>
<th>Before challenge (day 28)</th>
<th>After challenge (day 42)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Im. Cplex</td>
<td>rHVT-VP2</td>
</tr>
<tr>
<td>TR</td>
<td>5 815 - 20/20</td>
<td>419 - 8/20</td>
</tr>
<tr>
<td>Del. E</td>
<td>5 794 - 20/20</td>
<td>432 - 5/20</td>
</tr>
<tr>
<td>MX</td>
<td>6 665 - 20/20</td>
<td>357 - 5/20</td>
</tr>
<tr>
<td>ZA</td>
<td>6 442 - 20/20</td>
<td>619 - 11/20</td>
</tr>
<tr>
<td>BR</td>
<td>6 354 - 20/20</td>
<td>642 - 11/20</td>
</tr>
<tr>
<td>AVS-EL</td>
<td>6 360 - 20/20</td>
<td>411 - 4/20</td>
</tr>
</tbody>
</table>

*(Biochek ELISA)*
## Comparison Immune Complex – rHVT-VP2

### Results – Serology before & after challenge

<table>
<thead>
<tr>
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<th>Before challenge (day 28)</th>
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*(Biochek ELISA)*
## Comparison Immune Complex – rHVT-VP2

### Results – Serology before & after challenge

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## Results – Serology before & after challenge

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*(Biochek ELISA)*
Summary & Conclusion
Stop the Gumboro Cycle!

PREVENTION + PROTECTION = CONTROL
The objective of Gumboro vaccination is to protect the chickens, lower the challenge, and exert no pressure on farm IBDV population i.e. to ensure:

PREVENTION + PROTECTION = CONTROL

Stop the Gumboro Cycle!
"rHVT-VP2" or "Immune-Complex"?

Summary of the properties

<table>
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<tr>
<th>Criteria</th>
<th>rHVT-VP2</th>
<th>Im. Complex</th>
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<tbody>
<tr>
<td>Onset of Immunity</td>
<td>Dependant on HVT replication with no flexibility</td>
<td>Individually adapted to level of passive immunity</td>
</tr>
<tr>
<td>Protection against classical IBDV</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Protection against variant IBDV</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Prevention of infection</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Prevention of shedding</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Reduction of Farm challenge pressure</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Selective pressure on farm IBDV population</td>
<td>Yes</td>
<td>No</td>
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Stop the Gumboro Cycle!

Only Immune Complex ensures

PREVENTION + PROTECTION = CONTROL
Stop the Gumboro Cycle!

« I. Complex » vs « rHVT-VP2 »

« Cevac Transmune » vs « Vectormune IBD »

IBDV

HVT
Stop the Gumboro Cycle!

« I. Complex » vs « rHVT-VP2 »

« Cevac Transmune » vs « Vectormune IBD »
THANK YOU
FOR YOUR ATTENTION