Recent progress in prevention and control of FMD in large scale livestock farms in China

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# Part 1: FMD epidemic situation in China

## Serotype and topotype epidemic in China since 1999

<table>
<thead>
<tr>
<th>Year</th>
<th>O Serotype</th>
<th>A Serotype</th>
<th>Asia1 Serotype</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before 1999</td>
<td>Cathay (O/or-80, O/GX-07)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1999-2000</td>
<td>Pan-Asia (O/JMS-2000)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2004</td>
<td></td>
<td>G-V(Asia1/JSL05)</td>
<td></td>
</tr>
<tr>
<td>2009</td>
<td>Mya98(O/BY-2010)</td>
<td>SEA-97 G1 (A/WH-09)</td>
<td>No case since then</td>
</tr>
<tr>
<td>2013</td>
<td></td>
<td>SEA-97 G2 (A/GDMM13)</td>
<td></td>
</tr>
<tr>
<td>2017</td>
<td>Ind-2001d</td>
<td></td>
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</tr>
</tbody>
</table>

Since 2000, the epidemic of FMD has been more and more complicated, and there have been three serotypes (O, A, Asia1) epidemic or sporadic so far.

2017/11/17
Part 2: Challenge of FMD prevention and control in large scale farms in China
1、Large scale farms in China

1) Pig breeding size and amount of farms

- High density
  - Pig production: 680 million in 2016
  - Sow inventory: 40 million in 2016

- Large scale
  - The biggest farm: 0.5 million
1、Large scale farms in China

261 farms – more than 50,000 head
4388 farms -- 10000 to 49999 head
1. Large scale farms in China

2) Large scale dairy farms:

The total number of cows is about 8 million and there are nearly 1000 farms with more than 2000 cows.

- 8 million
- in 2016
- 986 farms
- 2000 cows

The largest dairy farm

- 40 thousand cattle

Cattle farm scale:
- 1.53 million cows
- the largest 20 dairy enterprises
- others

20%
### Challenge of FMD prevention and control in large scale farms in China

The large-scale farms are facing the great challenges of FMD control, because of:

<table>
<thead>
<tr>
<th>CHALLENGE</th>
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<tbody>
<tr>
<td>Vast territory, breed variety, cross-breeding of various livestock, and multiple breeding patterns</td>
</tr>
<tr>
<td>Very large and high density breeding brings great risk of biological safety</td>
</tr>
<tr>
<td>The presence of other diseases in the farm</td>
</tr>
<tr>
<td>The risks to introduce of new topotypes of FMD strains from the adjacent regions</td>
</tr>
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</table>
The older type of FMD vaccines cannot meet the needs of FMD control in large-scale enterprises.

Before 2010, the following problems existed in the production of FMD vaccines in China.

### Disadvantages of traditional vaccine

<table>
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<th>Problem</th>
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<tbody>
<tr>
<td><strong>Outdated upstream and downstream process</strong></td>
</tr>
<tr>
<td><strong>The safety of vaccines were extremely poor</strong></td>
</tr>
<tr>
<td><strong>Low efficacy often leading to inadequate level of protection and immune failure</strong></td>
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</tbody>
</table>

Therefore, large-scale farms were urgently demanding high quality FMD vaccines.
Part 3: Upgrading of the Process and the Development of High Quality Vaccines

Take the lead in upgrading the production process and product quality of vaccines

- Upstream process completed in 2008.
- Downstream process completed in 2009.
- Determination of critical technical parameters, active detection and monitoring of key stages in the whole production process.
- Quantitative and quality tests of finished vaccines.
Part 4: Characteristics of highly effective vaccine and its application

High safety
- Non FMDV proteins < 200µg/dose
- Endotoxins < 1EU/dose

High potency
- High payload antigen, O > 18µg/dose; A > 12µg/dose
- Inducing innate immunity at 4-5 days
- High antibody titer
- A longer duration of immunity

DIVA vaccine
- Removal of 3ABC NSP

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Endotoxin</td>
<td>&lt; 1EU/dose</td>
</tr>
<tr>
<td>Non FMDV protein</td>
<td>&lt; 200µg/dose</td>
</tr>
<tr>
<td>3ABC antibody</td>
<td>Not detected</td>
</tr>
<tr>
<td>Total antigen payload</td>
<td>20-50µg</td>
</tr>
<tr>
<td>Potency (PD50/dose)</td>
<td>30-80</td>
</tr>
<tr>
<td>Duration of antibody</td>
<td>5-6 months</td>
</tr>
<tr>
<td>Rapid immune response</td>
<td>4-7 days</td>
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2017/11/17
From 2011-2016, 0.5 billion doses of Jinyu high payload vaccine have been used for pigs and 16 million doses for cows. Antibody titer positive rate was more than 90% for sows, 80% for finishing pigs and 95% for cows respectively. There is good cross protection to Ind2001 and there are no reports of FMD outbreaks in these cattle farms.
Part 5: The Future of FMD Prevention and Control in China

Commercial and other pressures on small farms is resulting in fewer and fewer small farms surviving. So, eventually, the farming industry will be composed only of large scale farming premises.

To achieve this will require:

- High quality and high density immunization campaign
- Strengthening the predicting and forecasting of FMD and the early warning and the reporting of outbreaks

Control and prevention in China will benefit from collaborations with all neighboring countries and regions.
Part5: The Future of FMD Prevention and Control in China

- JINYU is totally committed in the achievement of these goals and will continue to provide support for the Chinese farming community and the government veterinary authorities through the supply of high quality FMD vaccines.

Jinyu International Biotechnology Industrial Park is being built now. It will be the animal vaccines production base for swine, ruminants, poultry, and companion animals.
"One world, one disease, one health!"