



SAT – Serotype FMD Vaccinology

COMMODITY-BASED TRADE OF BEEF AND ENHANCED MARKET ACCESS: THE VITAL ROLE OF THE DEPARTMENT OF VETERINARY SERVICES
Gaborone, Botswana – 6-7 February 2018

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FMD VACCINES PRODUCTION & BVI



- Established as a result of widespread outbreaks of **FMD SAT viruses in N/Botswana**

- **Technical partnership** with Merial signed May 1978 (10 year renewal)

- Objective to **research on viruses circulating in the country** to make appropriate vaccines to safeguard beef trade

- 100% Shareholding to **GoB**

- **OIE RRL** for Sub-Saharan Africa for FMD since 1985



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BVI Products Development



***Product discontinued since global eradication in 2011**



3

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Summary of FMD outbreaks in Botswana: 1963 - 2017



Zones	1963-66	67	68	69-76	77-80	81-01	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
1										2	2		2		2						2		
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BVI vaccines development

4

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Why vaccinate for FMD??



- ❖ Reduce the incidence of FMD during an outbreak
 - ❖ To avoid further spread
 - ❖ Reduce production losses
- ❖ Progressively reduce the circulation of FMDV
 - ❖ To achieve freedom with/without vaccination
- ❖ To maintain freedom from FMD
 - ❖ For countries/zones free with/without vaccination
- ❖ To regain freedom from FMD
 - ❖ To regain disease free status

5

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FMD vaccination....issues to consider



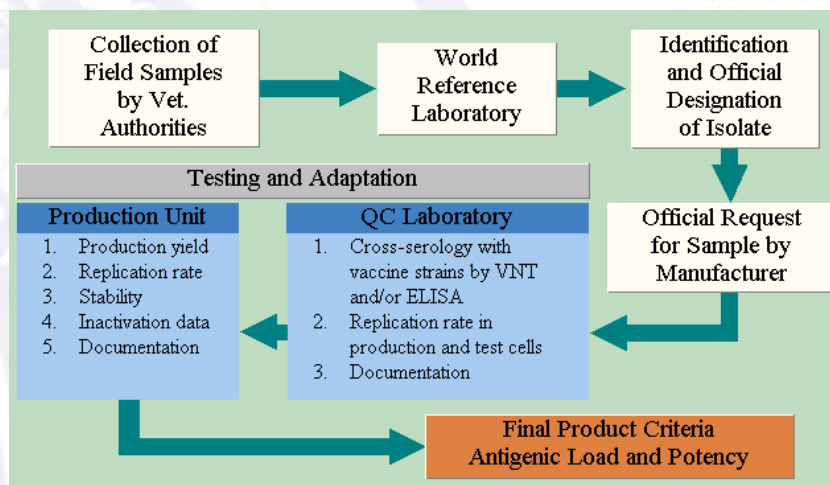
- ❖ In southern Africa, African buffalo (*Syncerus caffer*) are maintenance hosts of the SAT serotype FMDV
- ❖ Persistently infected buffalo populations not only maintain co-infection of different SAT virus serotypes, but also facilitate genetic and antigenic evolution of the virus
- ❖ This large genetic and antigenic variability, as well as regional differences in the distribution and prevalence of the SAT serotypes hamper efficient FMD control
- ❖ The SAT 2 type viruses are responsible for most FMD outbreaks in southern Africa followed by SAT1 viruses

6

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- ❖ The wildlife/livestock interface remains a potential source of FMD infection, therefore vaccination will remain pivotal to FMD control in southern Africa.
- ❖ Manufactures of FMD vaccines therefore have a role to play in providing **affordable, fit-for-purpose** vaccines and in **time**.
- ❖ However, the production of such vaccines requires profound scientific and technical knowledge and extensive experience
 - ❖ The manufacturer must adhere to internationally accepted standards of **Quality Assurance** and **Good Manufacturing Practices**
 - ❖ They must know how to **select** and **adapt new vaccine strains** cost effectively at the required level of **potency** and **purity**.

Pathway for Vaccine strain selection



Vaccine / Field Strains



- It is imperative that “Immunodominant strains” are selected for vaccine production
 - The probability of finding an immunodominant strain is quite low
 - Regular submission of field materials to FMD reference laboratories is therefore crucial
 - The cost and duration of adapting a new isolate into a vaccine strain must be taken into consideration
- Fortunately most vaccine strains older 20 years have retained their value and are still able to protect against current circulating field strains

9

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Increasing Antigenic Spectrum

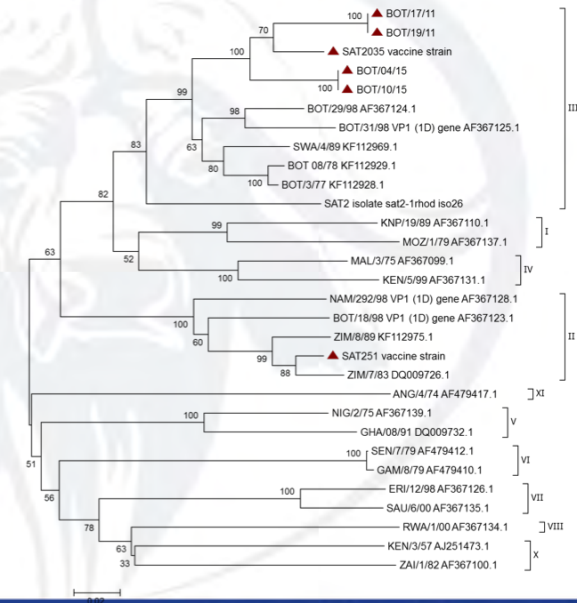


- ❖ A combination of strains of the same serotype in the vaccine can increase the antigenic spectrum
 - ❖ SAT 1: - SAT105 & SAT 109
 - ❖ SAT 2: - SAT251 & SAT 2035
 - ❖ SAT 3:- SAT 306 & SAT 309

10

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Phylogenetic Analysis



Nucleotide sequencing can provide an indication of how closely related the field isolate is to the vaccine strains.

11

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Vaccine Matching

Relationship co-efficients (r-values) also provide an estimate of the likely cross-protection between a Vaccine Strain and a field isolate



Test used = 2dVNT

Interpretation

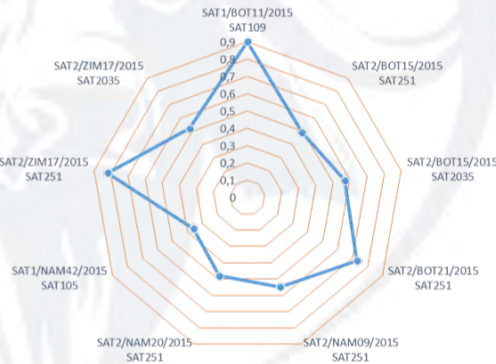
r-value > 0.3

Close relationship between field isolate and vaccine strain

r-value < 0.3

The field strain is significantly different from the vaccine strain

r-values for 2015 isolates from Southern Africa



12

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Vaccine Potency



- "REGULAR" ($>3 PD_{50}$) Potency vaccines are recognized as fit-for-purpose when consistently used in endemic settings in view of controlling clinical disease.
 - Vaccine performance here is highly dependent on:
 - Proper cold chain maintenance
 - Proper vaccination techniques
 - Adequate vaccination coverage
 - Adequate vaccination intervals
 - Routine/consistent vaccination program
- "HIGH" ($>6 PD_{50}$) Potency vaccines are particularly useful in emergency situations as they can provide protection in cattle as early as four (4) days post vaccination.

=> Beware of primo-vaccinates in your population (booster vaccinations)!!!

=> Beware of congregation of animals in the midst of an outbreak!

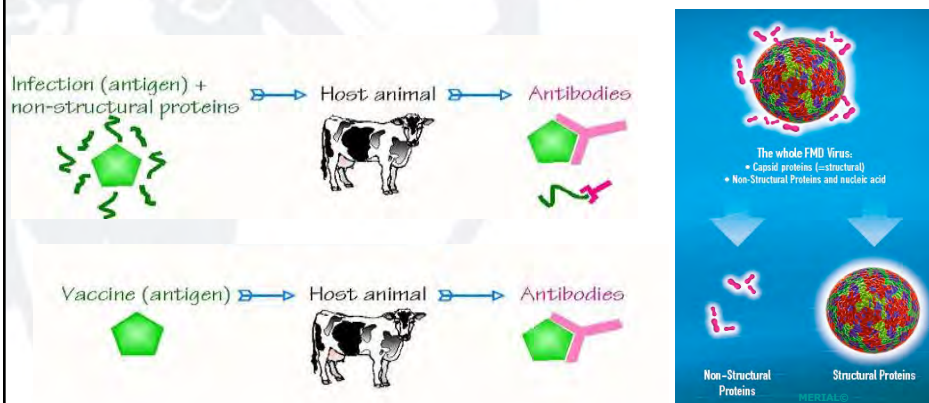
13

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DIVA Vaccines



Transfer of the purification process for DIVA Vaccines
(Differentiation between Infected and Vaccinated Animals)



14

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Vaccination Protocol

As recommended by vaccine manufactures....



		Primo Injection	Booster
Cattle	From Non-Vaccinated Dams	From 14 days old: 2 vaccinations 3 to 4 weeks apart	every 4 - 6 months
	From Vaccinated Dams	at 2 months: 2 vaccinations 3 to 4 weeks apart	

- In reality...

- => It is impractical to follow up calves (primo vaccinates) in extensive systems

- => Booster vaccination depend on vaccination coverage achieved!!

- => Boosters must be guided by risk of contact with infectious host (buffalo)

RESOURCES!!!

RESOURCES!!!

RESOURCES!!!

15

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Conclusions



- Vaccination is one of the main tools in the management of FMD**

- it must be properly applied
 - Up to date information on circulating virus strains in any geographical location must be known for selection of appropriate vaccine strains
 - The vaccine must be of desirable quality and composition
 - Susceptible animal species in the country or location
 - The design of the vaccination program

- Vaccination must be supported by other control measures**

- Animal herding
 - Animal identification
 - Movement protocols

16

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- **Many factors can influence the effectiveness of vaccination against FMD**
 - Hence the need for a monitoring program
 - Planning and coordination between users and vaccine manufacturers is essential
 - Need for bilateral and regional coordination in FMD outbreak control and implementation of vaccination programs is crucial
- **The cost of vaccine and vaccination accounts for 90% of the FMD control program**
 - Hence the need for proper planning and evaluation

17

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**THANK YOU
FOR
YOUR ATTENTION**



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