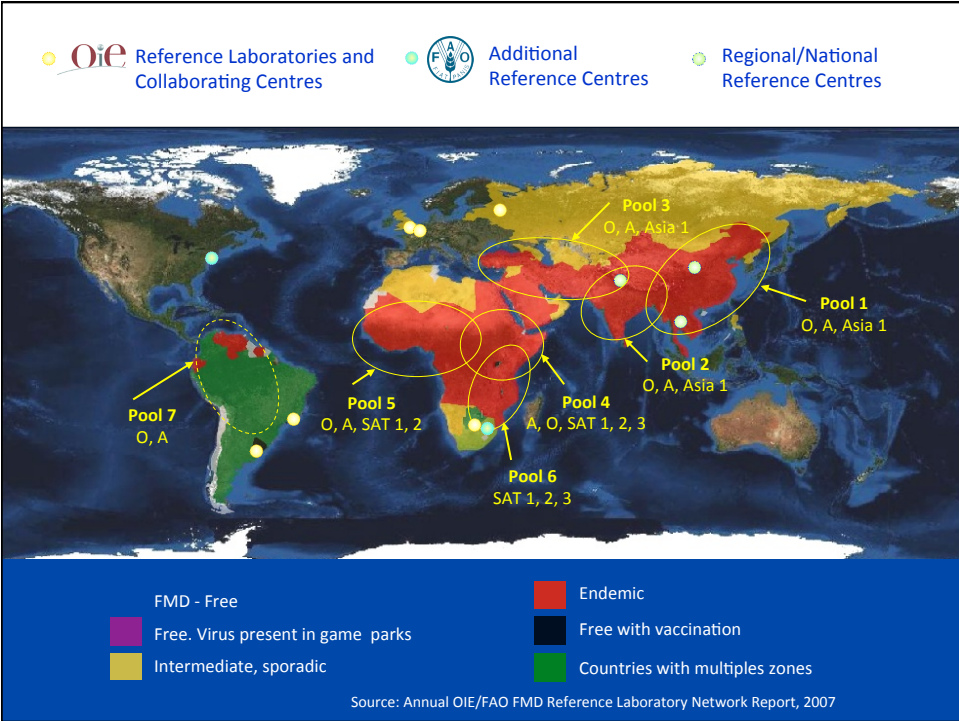


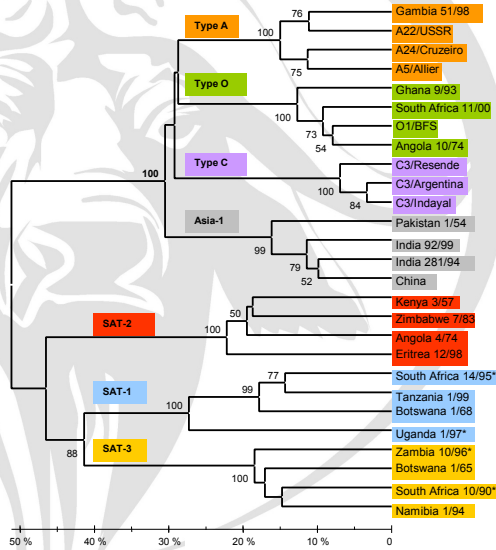
# Vaccine Matching and Development of Appropriate Vaccines

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## Or Two clusters of FMD virus



- 4 Eurasian serotypes: A, O, C & Asia 1

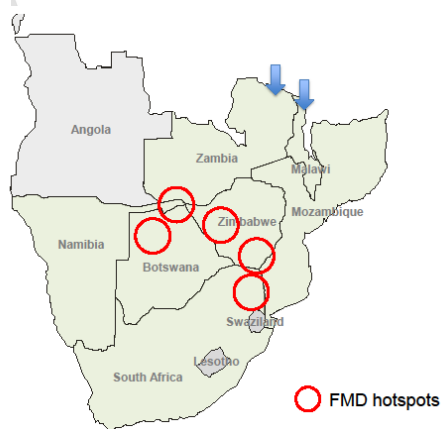
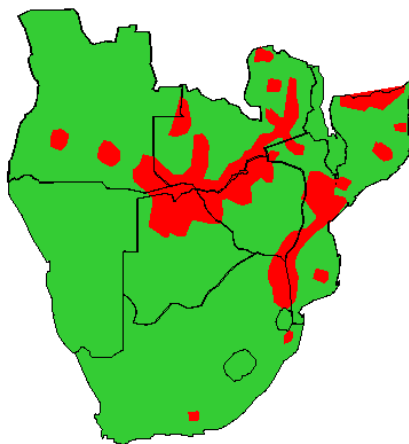
- Separated >500 years ago?

- 3 African serotypes
- SAT1, SAT2 & SAT3

(by Gavin Thompson)

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## Buffalo distribution and FMD hotspots



○ FMD hotspots

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## How does this relate to control



- **we know that**

- there is no cross protection between serotypes
- protection within serotype might be limited (topotypes)

- **Implications**

The role of **Manufacturers** for a **timely** supply of **affordable** and **fit-for-purpose** vaccines in **all** regions of the world is therefore pivotal for FMD control by vaccination



***Vaccine matching to field isolate is critical for FMD control***

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## Vaccine Matching tools



- **Molecular epidemiology**

- Involves sequencing of VP1 and correlation of amino acid changes in relation to vaccine and locally known viruses
- Help identify new or emerging strains against which further vaccine matching might be necessary
- 

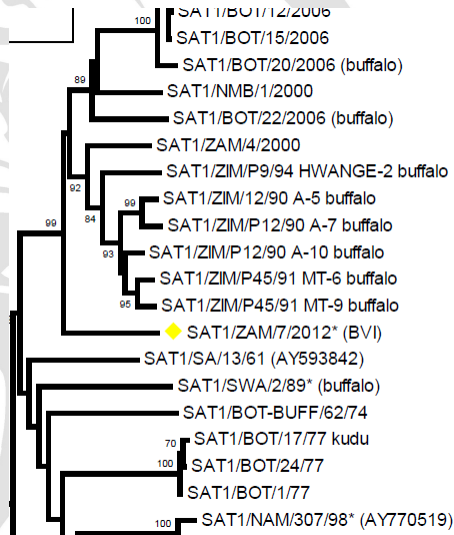
- **Limitations**

- Does not indicate whether changes are taking place at antigenically important sites

- **Combined with other epidemiological information it is very useful early on in determining whether to vaccinate or not**

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## Examples – SAT 1



III

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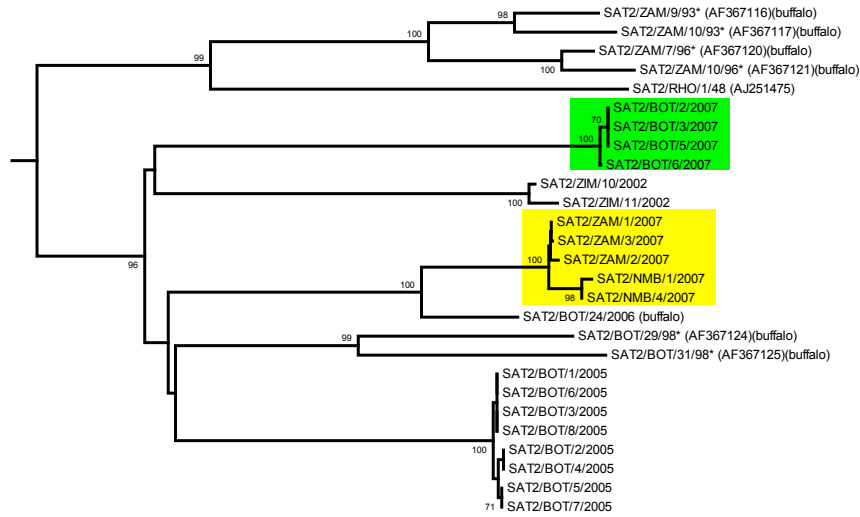
## Example – SAT 1



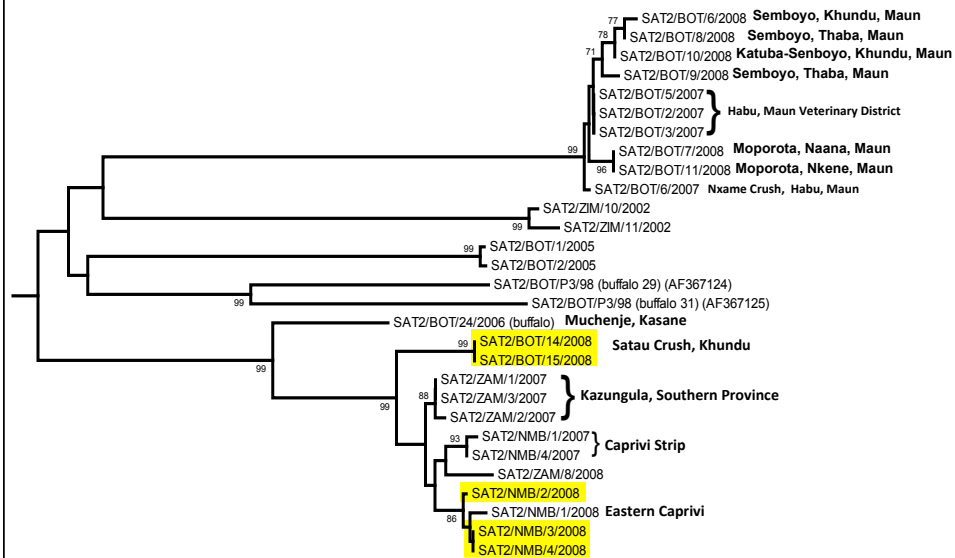
| Pos. | Virus name                  | Filename | No. nt comp. | No. nt match. | No. of ambig. | % Id. | % Diff. |
|------|-----------------------------|----------|--------------|---------------|---------------|-------|---------|
| 1    | SAT1/BOT/1/77               | BOT77-01 | 622          | 545           | 0             | 87.62 | 12.38   |
| 2    | SAT1/BOT/1/68 (AY593845)    | BOT68-C1 | 622          | 538           | 0             | 86.50 | 13.50   |
| 3    | SAT1/BEC/1/48 (AY593838)    | BEC48-01 | 622          | 523           | 0             | 84.08 | 15.92   |
| 4    | SAT1/RHO/5/66 (AY593846)    | RHO66-05 | 622          | 477           | 0             | 76.69 | 23.31   |
| 5    | SAT1/RV/11/37 (AY593839)    | RHO37-11 | 622          | 473           | 0             | 76.05 | 23.95   |
| 6    | SAT1/T155/71                | TAN71155 | 622          | 472           | 0             | 75.88 | 24.12   |
| 7    | SAT1/UGA BUFF/21/70 buffalo | UGA70-21 | 622          | 462           | 0             | 74.28 | 25.72   |
| 8    | SAT1/ZIM/23/2003            | ZIM03-23 | 622          | 458           | 0             | 73.63 | 26.37   |
| 9    | SAT1/NIG/11/75 (AF431711)   | NIG75-AA | 619          | 446           | 0             | 72.05 | 27.95   |
| 10   | SAT1/ETH/3/2007 (FJ798154)  | ETH07-03 | 622          | 447           | 0             | 71.86 | 28.14   |

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### Relationship between outbreaks of FMDV type SAT 2 in Botswana, Namibia and Zambia in 2007



Mid-point-rooted Neighbor-joining tree (Kimura 2-parameter model) constructed using MEGA 3.1 based on complete VP1 nt sequences.



# Vaccine Matching tools



- **Serological tests**

- VNT, ELISA, NIT
- measure the cross-reaction of a bovine vaccinal sera with the field strain in question
- calculate relationship values ( $r_1$  values) estimated from comparative reactivity with sera
- Cut off depends on test used (VNT – 0.3, ELISA 0.4)

- **Limitations**

- May require live virus
- Homologous reagents may be required
- Test variability
- How do they relate to actual field protection

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## VACCINE/FIELD STRAINS

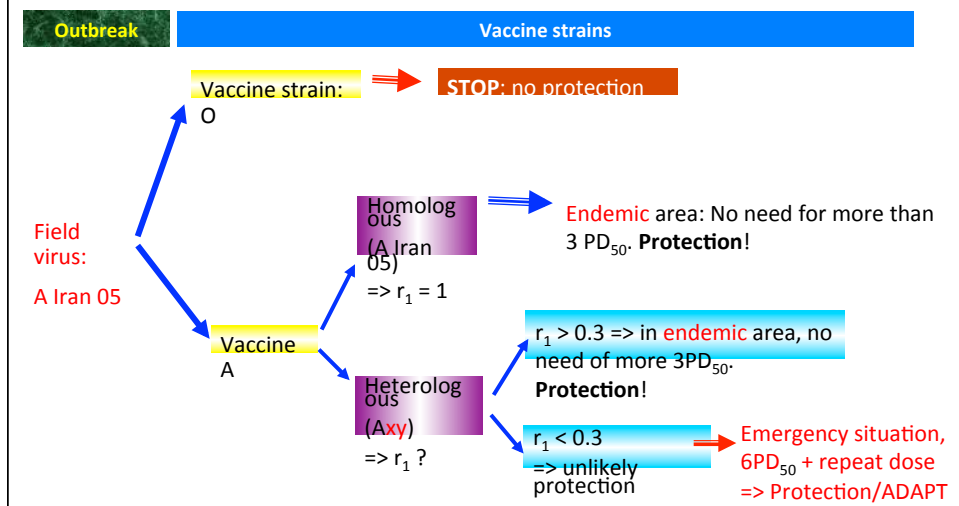


By the Manufacturer based on

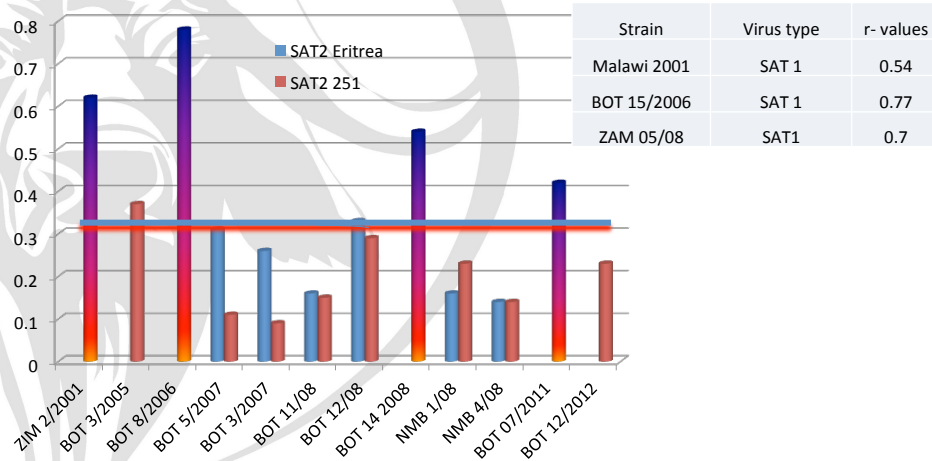
- $r_1$  value
- vaccine potency



## Relationship between $r_1$ value and $PD_{50}$



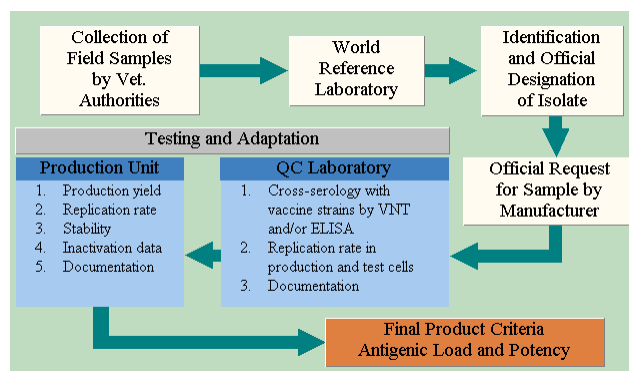
## R-values and recent outbreaks



- New vaccine strain adaptation started Mar 2007
- Took more than 2 years
- Cost very huge — equipment, inputs, time
- Production and testing 2011
- Use in Field 2012
- Testing continuing

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## Pathway for Vaccine strain selection



## Vaccine Matching tools- Other



- **Expected Percentage Protection (EPP)**

- Estimates likelihood of protection against challenge of 10 000 infective doses
- Can get EPP for single or booster vaccination
- Requires robust data from challenge
- Correlation between serological response and protection deduced by logistic regression
- Sera from 16 cattle collected after primo and booster vaccination is tested for its ability to cross react with vaccine and field viruses
- EPP then determined from correlation tables
- This is a very thorough method

- **Antigenic cartography**

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## Ela tlhoko



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## Concluding Remarks



- Vaccine matching is a developing science (if its science) and its better to use complementing tools
- Whether a vaccine will offer protection depends on;
  - Its ability to elicit strong immunity i.e. potency
    - Potency depends on antigenicity of strain, antigen load or mass, adjuvant and formulation
  - Relationship or closeness of vaccine strain to field strain
- Virus surveillance is the starting and most critical point and should be done on a continuous basis**

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Chillaxe



IMAGINOVA



