Unlocking the science of foot-and-mouth disease (FMD)

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Promoting Knowledge Management and Culture

Livestock

- The livestock industry is one of the important sub-sectors of agriculture in Uganda



- Increase in livestock activities is documented at 8.8% in Uganda in 2023/24(UBOS, 2024)

- **Transboundary Animal Diseases** (TADs) impede livestock sector growth
  - by affecting trade and markets
  - expenditures like treatment
  - affect production



Foot-and-Mouth Disease (FMD)

Language	Foot-and-mouth disease
Luganda	*Kalusu*
Runyankore	*Ejwa*
Lusoga	*Kalusu*
Luo	*Aluny*
Ateso	*ochinchin,omulat*





Foot-and-mouth disease

- Highly contagious disease that affects all cloven hooved animals (animals with divided hooves) E.g cattle, goats, sheep, pigs and wild life like buffalos, impalas etc

- Low mortality and high morbidity

- The most spent on animal disease in Africa (Leboucq et al.,2004) - in 2013, **USD 800 million** (Knight-jones & Rushton, 2013).

- Countries miss out on revenues from world trade markets



Impact of FMD

- Disruptes markets
- Affects social aspects of society
- Causes significant economic consequences (123USD/y/head of cattle in Uganda (Baluka et al., 2014)
- Affects food security (Rout et al, 2012) ie meat, fish, poultry, beans (Kerfua et al, 2023)



Nebbi suspends sale of meat, animal products

The Independent | February 14, 2025 | NEWS | Leave a comment



Nebbi district bans transportation and sales of animals to combate the spread of foot and mouth decease, this photo was taken during the restocking program in 2022 at nebbi district headquarters . PHOTO URN

Nebbi, Uganda | THE INDEPENDENT | Nebbi district authorities have suspended the sale of meat and animal products following an outbreak of Foot and Mouth Disease (FMD). According to officials in the veterinary department, the first FMD cases were reported in Kucwiny sub-county, Lee Parish, towards the end of November last year, where 26 animals were confirmed dead in the early stages of the outbreak.

Ban on meat raises prices for fish in Nebbi

Tuesday, October 31, 2017 — updated on January 14, 2021



On demand. *Women check on their angara fish in Pakwach Town on Monday. The demand for fish has gone up due to a ban on the sale of meat. PHOTO BY PATRICK OKABA.*

Signs of FMD

- Fever
- Lesions/sores in mouth
- Lesions/sores in feet
- Lesions/sores on the udder
- Excessive Salivation
- Limping/lameness
- Lack of appetite
- Nasal discharge
- Reduction of milk production
- Abortion
- Death

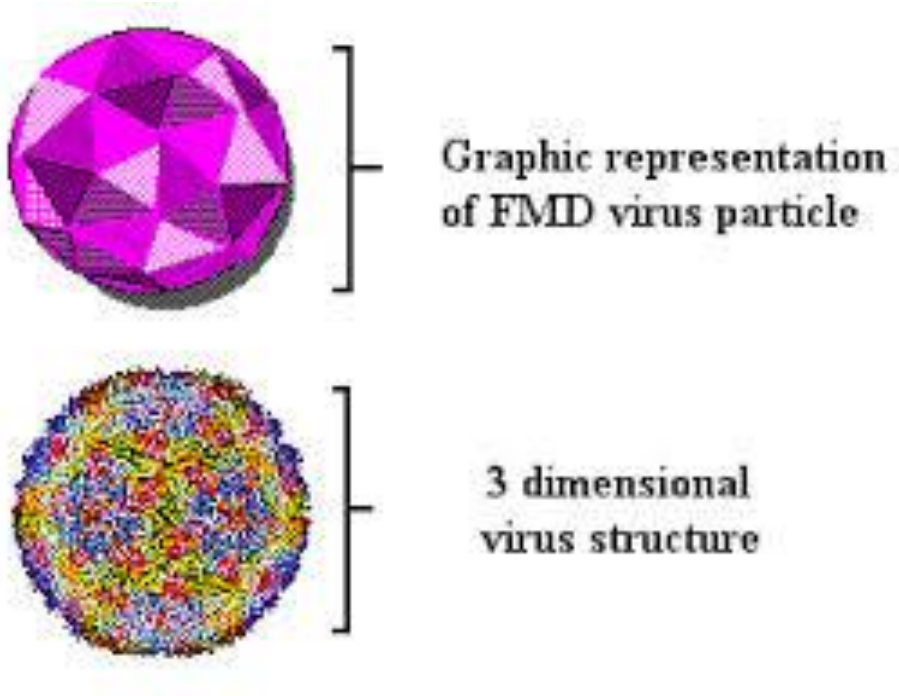






FMD Virus

- The virus has seven serotypes, O, A, C, Southern African Territories (SAT) 1-3, Asia 1.



Adapted from fao.org

- The serotypes have distinct global distribution,

✓ **O** and **A** (global),

✓ **SAT 1-3** (Sub Saharan Africa),

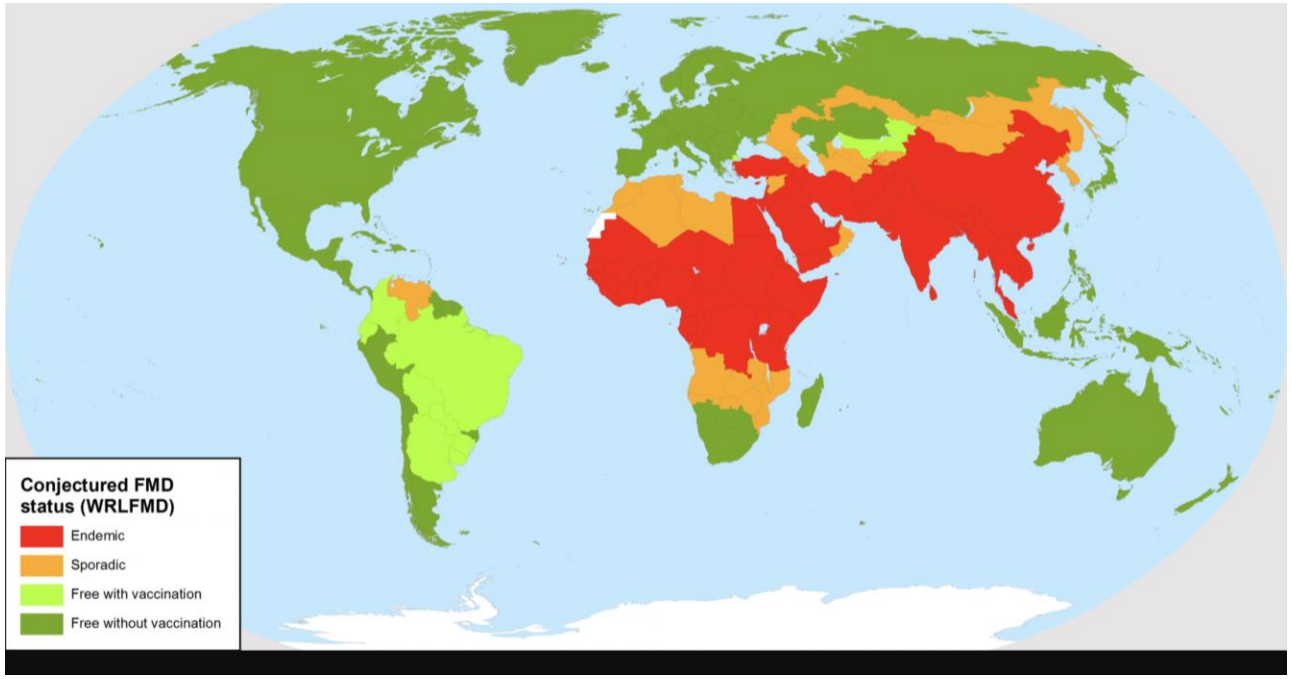
✓ **Asia 1** (Asia)

✓ **C** (in 2004 in Kenya),extinct?

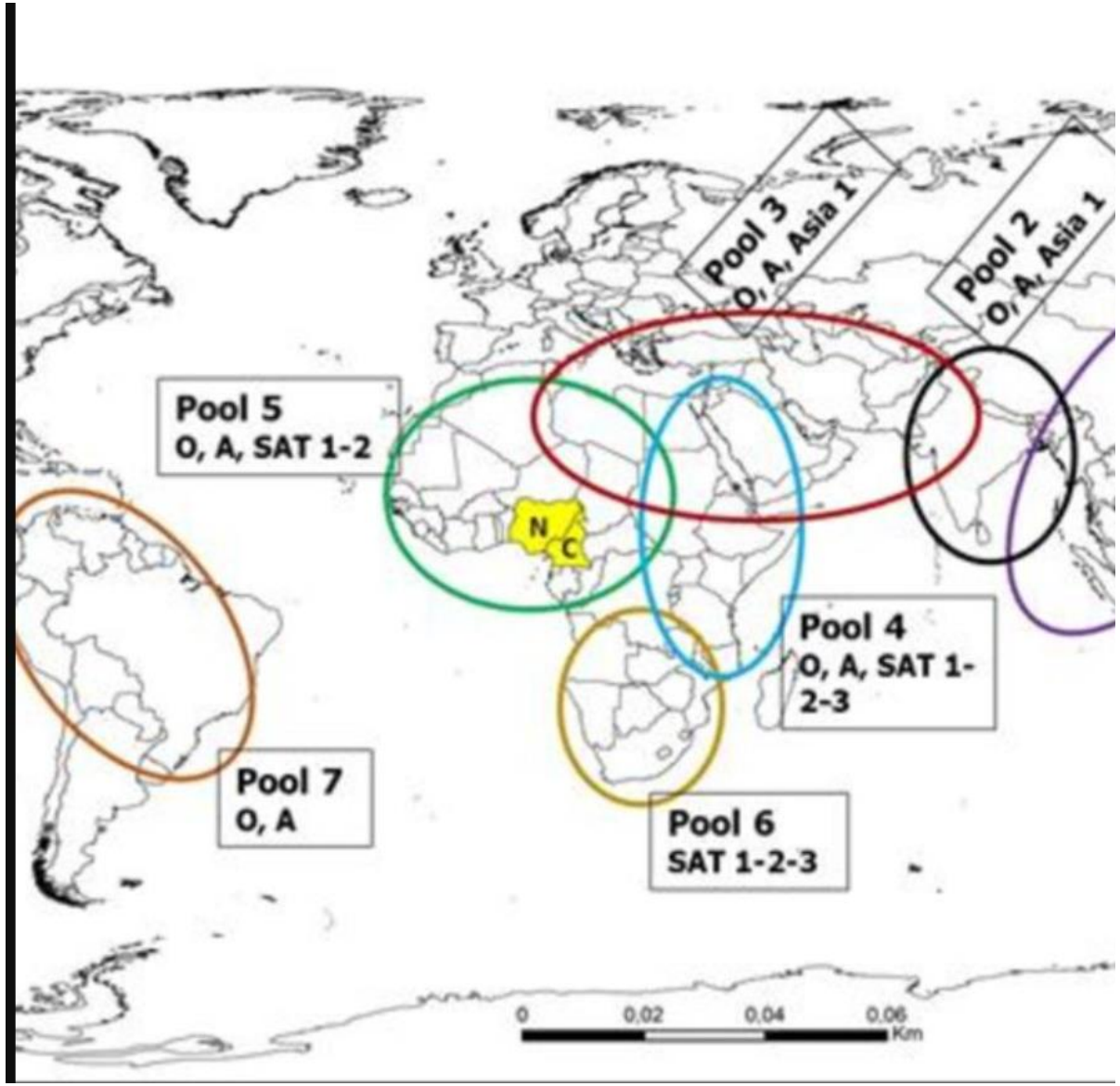
- Serotypes are further divided into topotypes and then lineages

- Over 65 strains (Louis-Rogers etal, 2008)

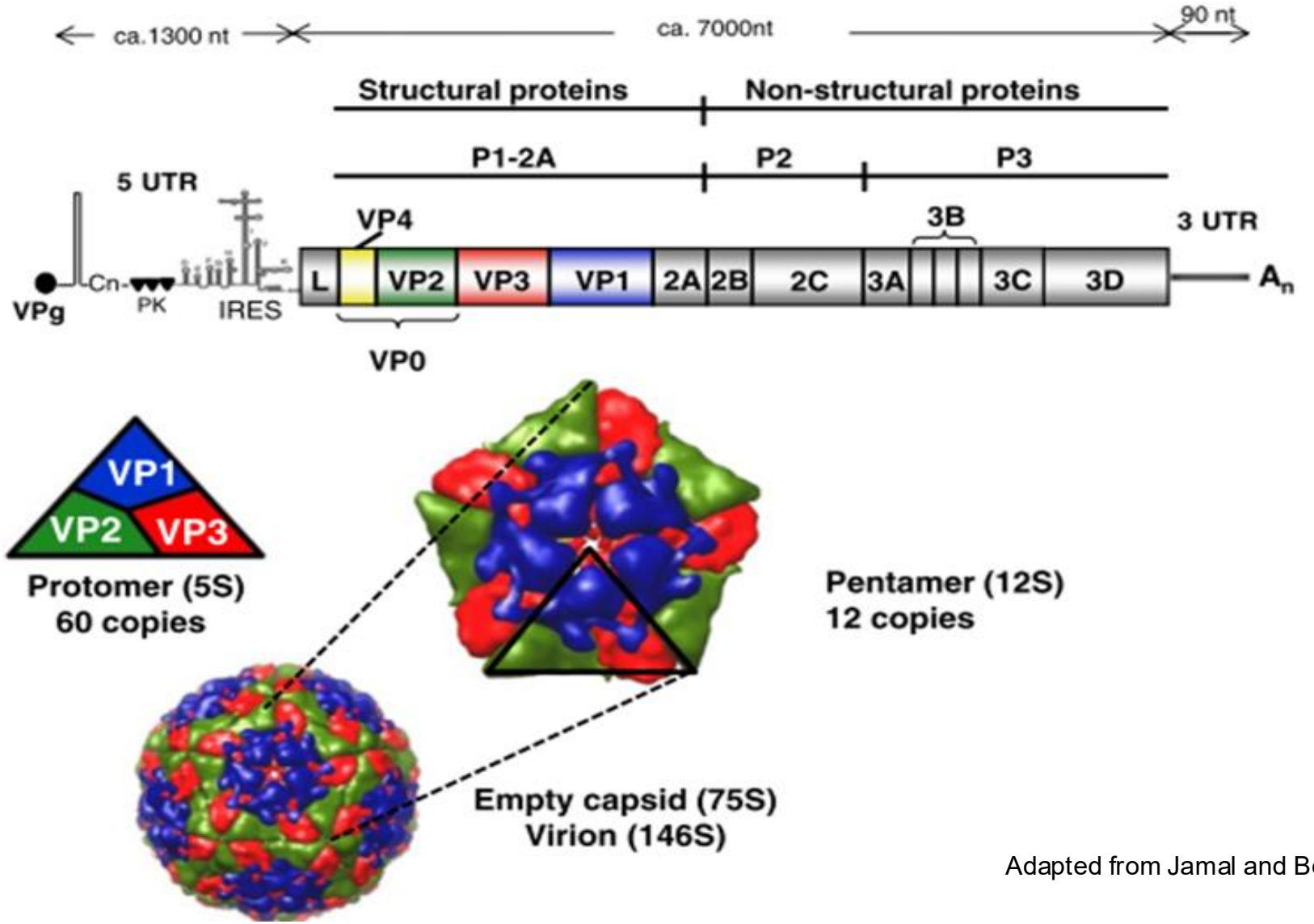
Global FMD distribution



WRL-FMD website, retrieved July 2025



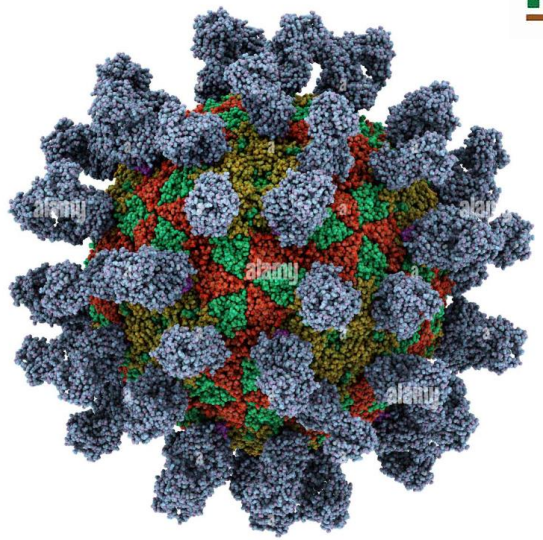
FMDV genome organization



Adapted from Jamal and Belsham, 2013

Virus evolution

- High mutation rate of 10^{-3} to 10^{-5} per replication cycle
- FMDV, with its high antigenic diversity very limited cross-reactivity between strains and serotypes
- New variants can quickly emerge and evade vaccine responses.
- Dynamic evolution continues during the persistent phase with chances of recombination
- Understanding of viral dynamics is essential



FMD Diagnosis

- Clinical diagnostics – not definitive
- Laboratory diagnosis – definitive

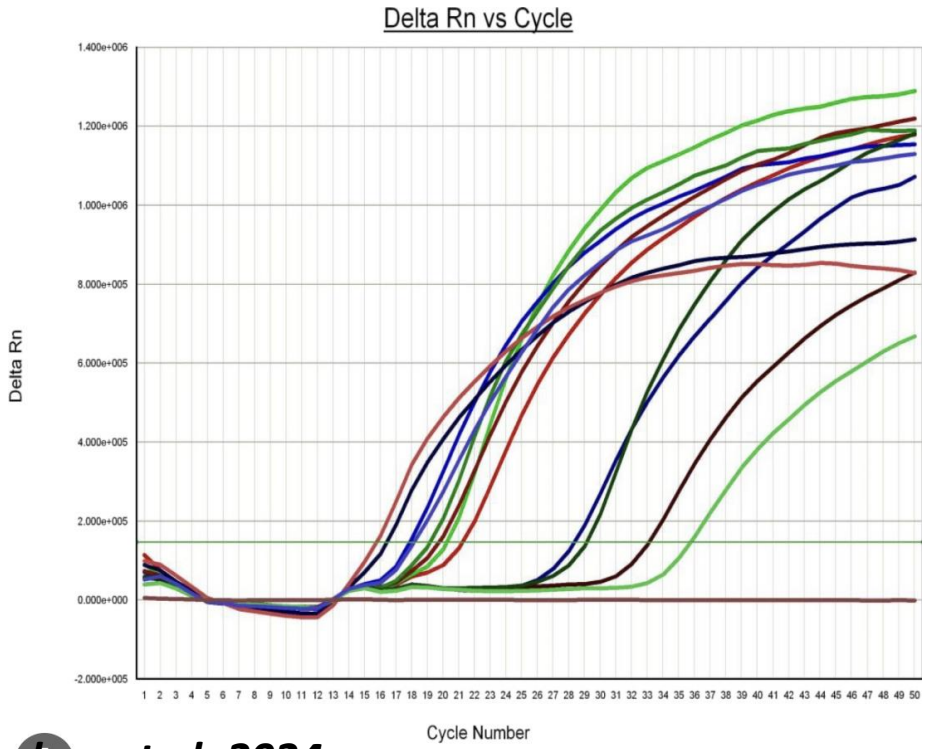
✓ Polymerase Chain Reaction (conventional and PCR)

✓ Detection of Antigen (ELISA)

✓ Detection of Non Structural Proteins (ELISA)

✓ Lateral flow devices – to be validated

✓ Virus culture



Bandaw et al, 2024

FMD Control

- ✓ Animal movement restriction
- ✓ Animal product movement restriction
- ✓ Vaccination
- ✓ Biosecurity
- ✓ Culling *



Progressive Control Pathway for FMD

- Uganda at stage 2
- Vaccination is very critical
- A good national vaccination program is important

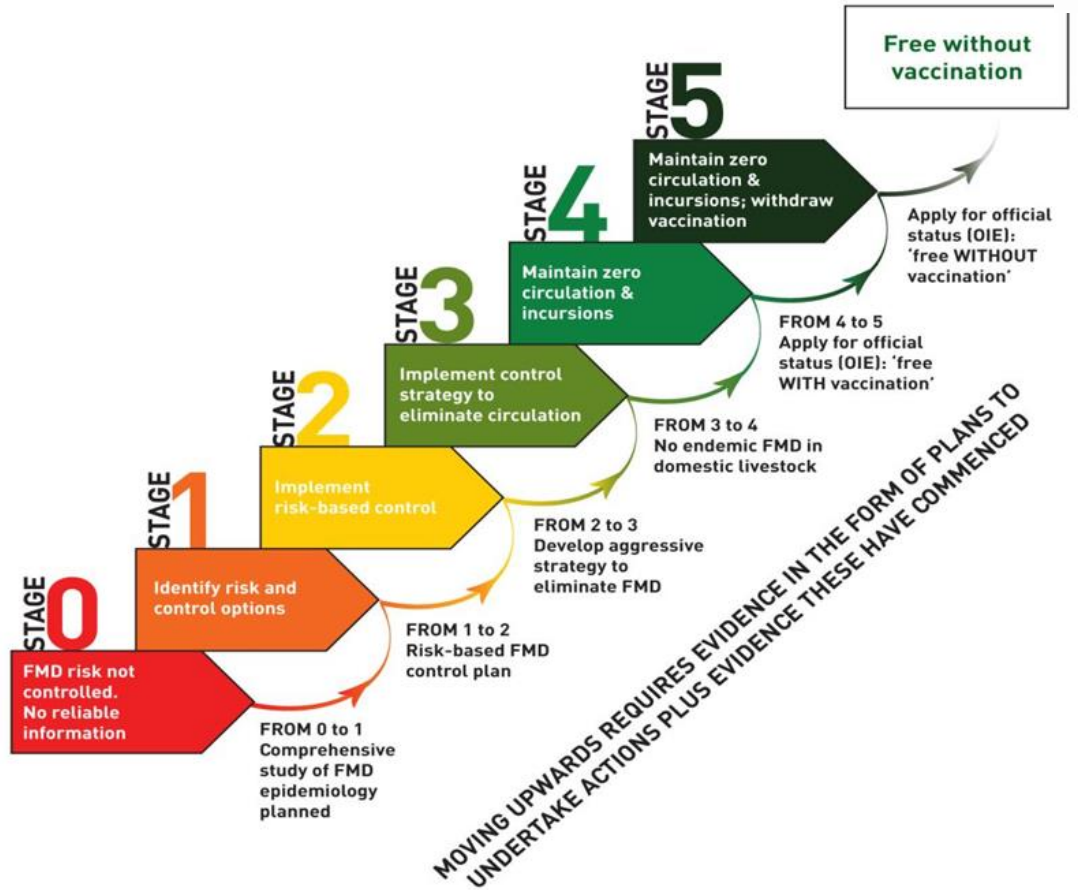
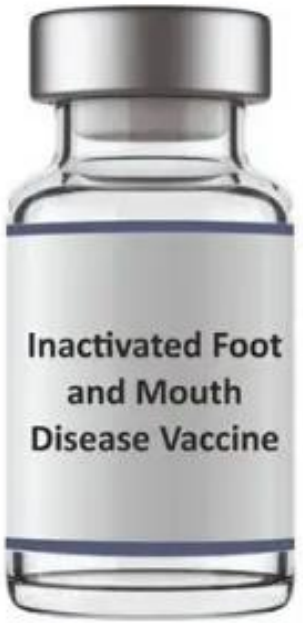


Figure 1: Stage progression in the Progressive Control Pathway

Vaccination for FMD control

- **Not a silver bullet:**

- Vaccination significantly reduce the severity of the disease and the amount of virus shed by infected animals. Part of the bigger plan



- **Strain-specific:**

- Vaccines are specific to certain serotypes and strains of the FMD virus.

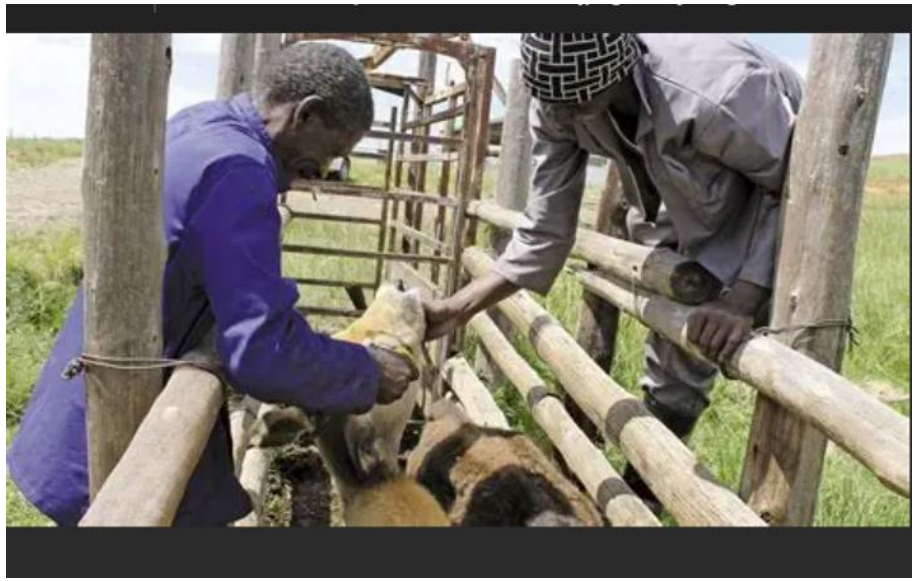
- **Discriminatory diagnostics:**

- Vaccinated animals can be distinguished from naturally infected animals using specific antibody tests, allowing for targeted control measures.

Vaccination for FMD control

Cost considerations:

In Uganda, farmers are now responsible for the cost of the vaccines, shifting from a previous system of free and compulsory vaccination.



- **Routine vaccination:**

Requires a primary course of two doses followed by boosters, with frequency varying depending on the species and husbandry practices.

Age: Different age groups may respond differently to vaccines.

Factors that may affect FMD vaccine efficacy

Age: Different age groups may respond differently to vaccines.

Health Status: Underlying health conditions can influence immune response.

Vaccine Storage and Handling: Proper storage conditions are crucial for maintaining vaccine potency.

Dose administered: Should be as per manufacturers' instructions

Vaccine strain: If different from circulating strains

Animal Breed: Locals vs exotic

Research at NaLIRRI

- Epidemiologocal studies in cattle, small ruminants and domestic pigs
- FMD Virus evolution
- FMD Vaccine evaluation studies
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- FMD Vaccine development studies
- Socio-economic impact of FMD
- Stakeholder engagement studies for FMD control

Acknowledgements



NARO

MAAIF
Ministry of Agriculture
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USDA United States Department of Agriculture

WRLFMD®

- FMD Scientists/Researchers
- Veterinary and laboratory professionals
- Farmers

Thank you