

Essential oils: possibilities for prevention and treatment of foot and mouth disease and other veterinary infections

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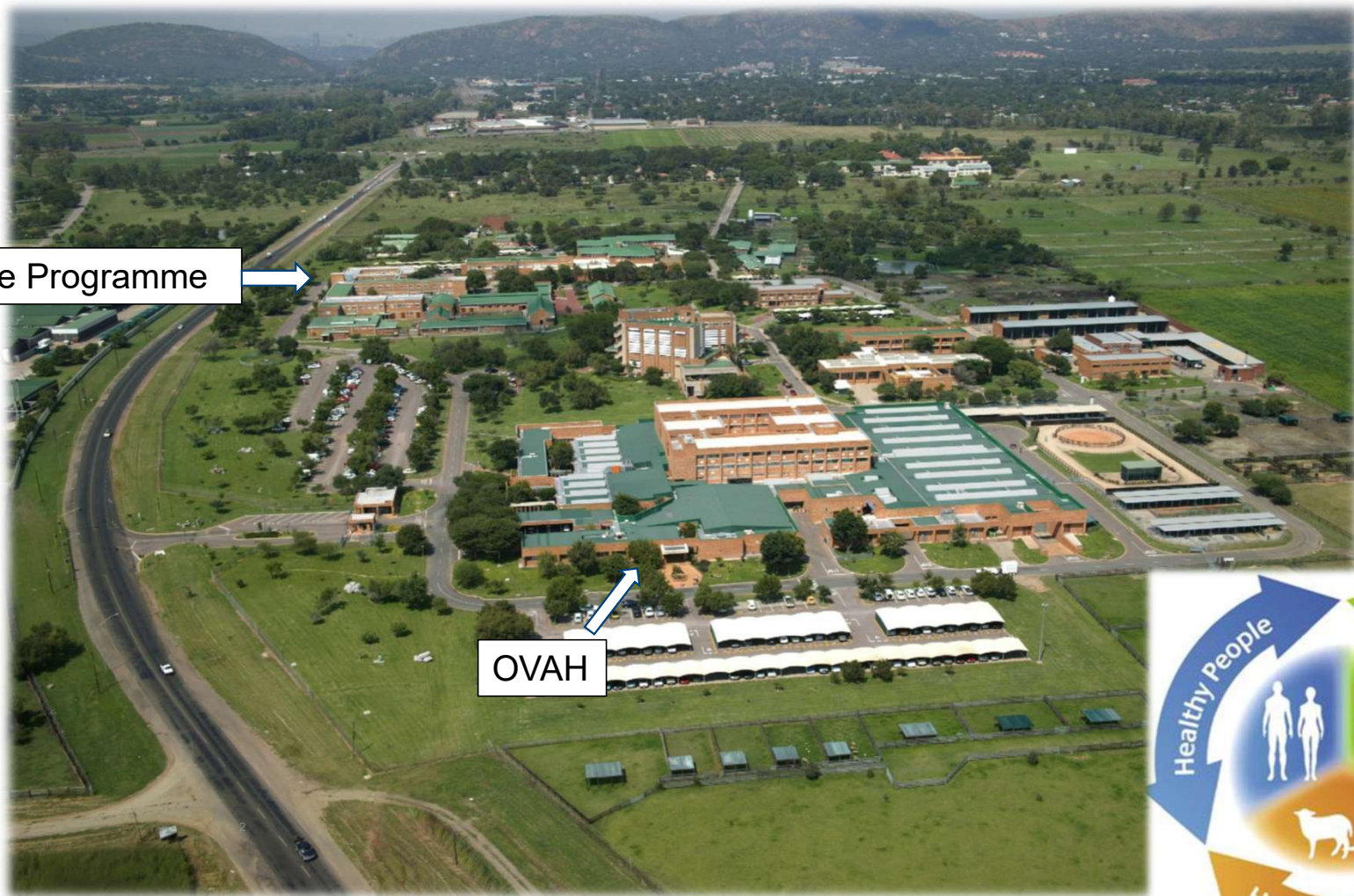
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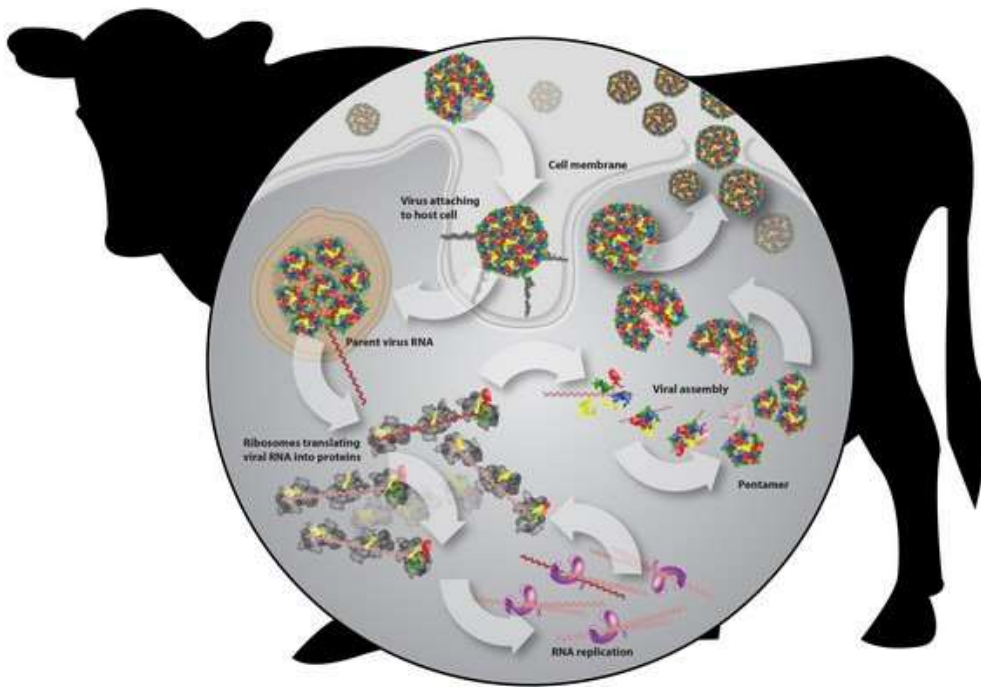
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Foot and mouth disease

Foot and Mouth disease virus lifecycle



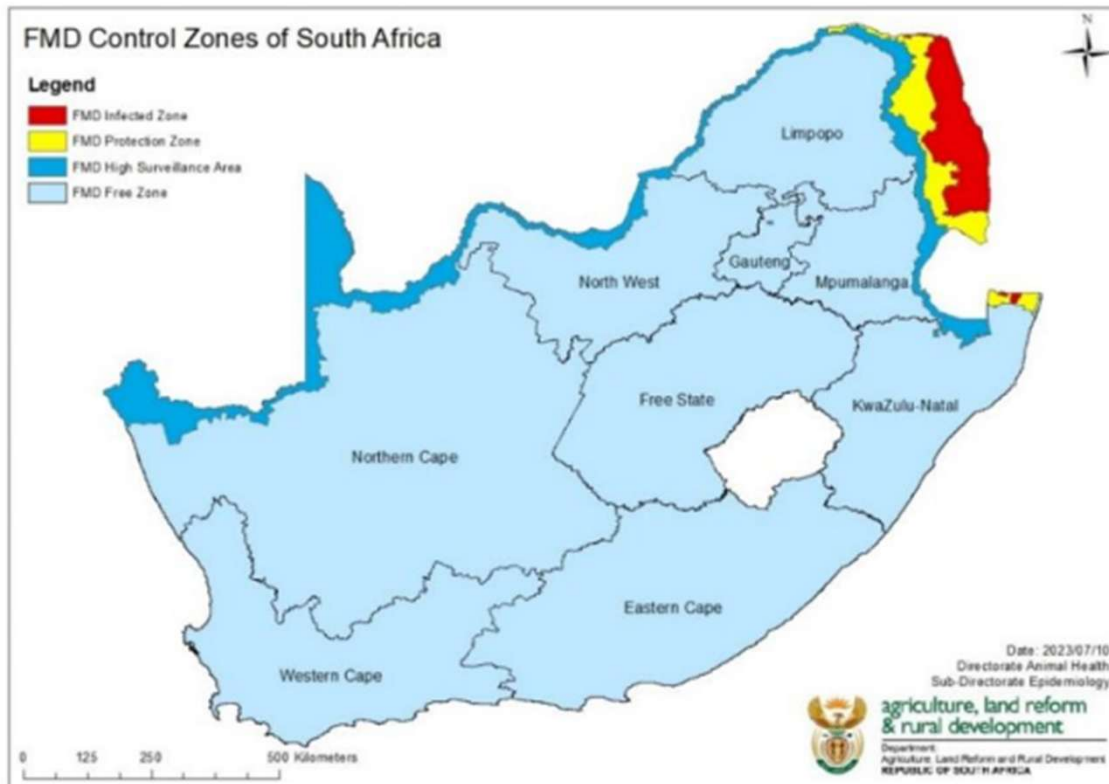
- Non-enveloped RNA virus
- Controlled disease (notifiable)
- Highly contagious
- Spreading disease occurs through direct animal contact, contaminated feed, water and farm equipment
- Seven different serotypes
- In South Africa: SAT 1, SAT 2, SAT 3
- If animal immune to one variant, can still be affected by others
- Difficult to control disease
- Human movements between farms can spread FMD
- Affects livestock and wildlife, not humans
- Severe impact on communities, farms

Foot and mouth disease

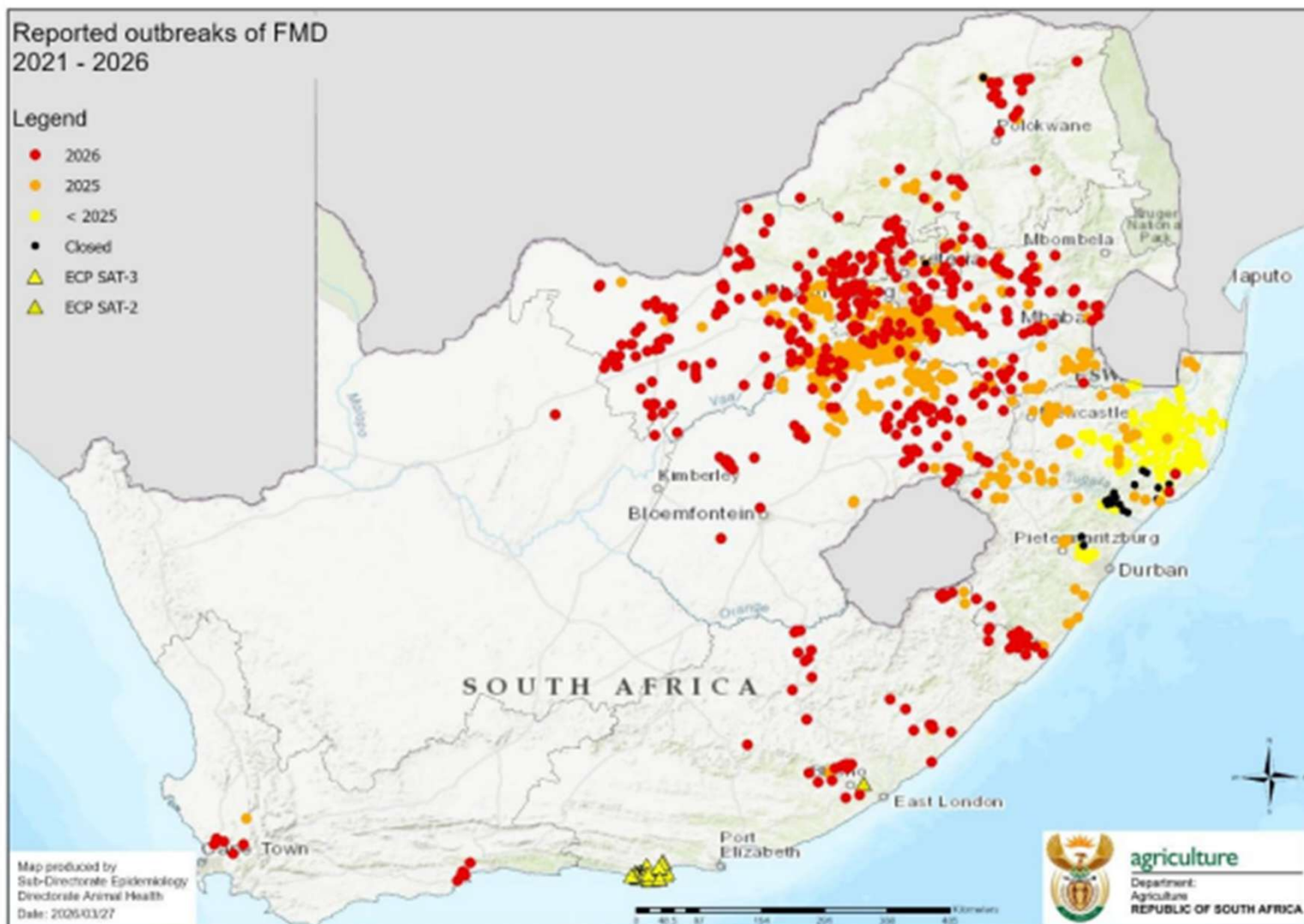


- **Symptoms**
 - Fever, reduced appetite, blisters on mouth, tongue, teats, between hooves
 - Lesions leading to secondary infections, weight loss
 - Can be severely fatal in young animals
- **No treatment**
- **Prevention**
 - Prevention protocols, biosecurity
 - Vaccination

Foot and mouth disease



- SA: FMD-free without vaccination until 2019
- Current FMD epidemic originated in KwaZulu-Natal in May 2021, following movement of infected animals from Phalaborwa area



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A familiar foe in formidable
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Presented by
Prof Armanda Bastos



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CONTROL MEASURES RELATING TO OUTBREAKS OF FOOT AND MOUTH DISEASE

University of Pretoria Faculty of Veterinary Science



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Essential oils: possibilities for prevention and treatment of foot and mouth disease and other veterinary infections



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- Essential oils – **exciting potential**
- Antibacterial, antiviral, antifungal, anti-inflammatory, antioxidant and digestion-stimulating effects
- Natural feed additives used as alternatives to antibiotic growth promoters, and to improve animal health
- Oregano and thyme oil used to control pathogens (e.g., *E. coli* and *Salmonella* species); improve livestock growth

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SAEOPA brochure 2024

- Animal feed essential oils market:
 - Experiencing rapid expansion due to restrictions on antibiotic use, shift towards natural additives, sustainable production goals, increasing demand for functional solutions supporting animal performance
- Global market size:
 - Clarity Markets Insights, based on its report on market size and trends, states that market size was US\$1.2 billion in 2024
 - Market expected to grow at a CAGR (compound annual growth rate) of 8.7%, reaching US\$2.3 billion by 2033

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▪ Examples:

- **Clove (eugenol):** Antioxidant benefits, protects sensitive nutrients (vitamins, amino acids) from oxidizing in fortified feeds
- **Oregano (carvacrol & thymol):** Used in poultry and swine diets to reduce diarrhea and improve feed efficiency by 5 - 8%
- **Cinnamon (cinnamaldehyde):** Provides antifungal protection, improves nutrient digestibility, and reduces hepatic lipids
- **Peppermint (menthol & menthone):** Enhances feed palatability, encourages consumption, helps reduce heat stress in dairy cows

To be cost-effective and safe, essential oils increasingly microencapsulated
Also nanoemulsions, microsomes

➡ This technology protects volatile active compounds from degrading during feed processing and ensures controlled release in animal's small intestine

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SAEOPA brochure 2024

- **South African examples:**
- *Salvia* species
Indigenous sages have strong antimicrobial activity
When added to feed, help stabilize gut microbes and optimize nutrient absorption
- *Plectranthus* species:
Antimicrobial properties, help protect livestock against environmental pathogens
- Limonene-rich local oils
Many South African aromatic plants contain high percentages of limonene; antioxidant that reduces systemic oxidative stress and metabolic inflammation in production animals

Lippia javanica, *Pelargonium*, Cape Chamomile...

Essential oils as antiviral agents

Possible mechanisms...

- **Direct antiviral activity:** Damage viral envelope (where applicable)
Alter capsid proteins
Prevent attachment
- **Inhibit viral entry:** Block receptor binding
Prevent membrane fusion
- **Inhibit viral replication:** Polymerase inhibition
Protease inhibition
Interference with viral RNA synthesis
- **Host-directed effects:** Immunomodulation
Anti-inflammatory activity
Antioxidant effects

As FMDV is a **non-enveloped picornavirus**, direct disruption of lipid envelope irrelevant
Antiviral effect may involve interference with viral attachment, entry, replication, or host responses
Most published research on *in vitro* activity against respiratory viruses

Essential oils against other veterinary pathogens

Viral diseases

e.g., Newcastle disease virus, Avian influenza, Bovine herpesvirus, Canine parvovirus, African swine fever

Bacterial infections

e.g., Mastitis pathogens, *Dermatophilus congolensis*, *Staphylococcus aureus*, *Escherichia coli*, *Salmonella* spp.

Fungal infections

e.g., Dermatophytes, *Candida*, *Aspergillus*

Essential oils often exhibit broad-spectrum antimicrobial activity



attractive candidates for managing mixed infections as well as secondary infections



Toxicity risks

- Using essential oils on or around animals may carry significant, sometimes life-threatening risks:
- **Cats:** Felines lack specific liver enzymes (glucuronyl transferase) required to break down phenols and hydrocarbons found in many oils. Oils like tea tree, citrus, and eucalyptus can cause acute liver failure, seizures, or death
- **Dogs:** Dogs don't have same specific enzyme deficiency as cats, but still highly susceptible to poisoning, central nervous system depression, and gastrointestinal ulcers if oils are ingested or absorbed dermally
- **Birds:** Unique respiratory tract makes them extraordinarily sensitive to airborne particles and aerosolized oils (diffusers), can result in fatal respiratory distress



Essential oils: future prospects in promoting animal health

- Trend towards antibiotic-free, natural growth promoters
- Focus on Animal Health and Gut Integrity:
Gut health is the most important determinant of feed utilization and overall performance. Essential oils improve digestive health by suppressing pathogenic microorganisms, supporting the growth of beneficial bacteria, and strengthening the intestinal barrier
- Combating Heat Stress and Environmental Pressures:
Global warming and intensive production conditions are increasing stress-related performance declines in animals. Essential oils are natural support in combating heat stress and oxidative stress
- Increased Performance and Productivity:
Essential oils increase feed utilization rates and support growth performance = economic advantage



Conclusion

Potential utility as feed additives to enhance host immune function

Antimicrobial, antiviral, anti-inflammatory, anti-parasitic, antioxidant and digestion-stimulating effects

Assist in reducing impact of disease, including secondary infections

“Treasures of the past leading to the trophy of the future”



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