



Reducing antibiotic use: Essential Oils as potential alternative treatments for Ovine footrot

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Abstract number 29696





Introduction

Method

Results

Discussion

- Ovine footrot (OFR) causes 80% of lameness cases in UK Sheep Flock
- Costs between £24-80 million p.a.
- Losses arise from reduced growth rates, infertility, reduced number of lambs born and adult deaths

- OFR - a complex disease caused by *Dichelobacter nodosus*
- OFR - is dual infection of the interdigital skin requiring prior colonisation by *Fusobacterium necrophorum*
- OFR is also linked to contagious ovine digital dermatitis (CODD)



Plate 1: Footrot

- Management methods for OFR range from foot bathing & trimming, antibiotic treatments and vaccination
- Routine foot trimming significantly increases incidence & costs of OFR
- Antibiotic use within 3 days of lameness can lead to rapid recovery
- Recommended best practice - prompt antibiotic treatments, minimal foot bathing, no trimming



Plate 2: Foot trimming damage

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- Global challenge of antibiotic resistance so need to find alternative treatments
- Industry has noted strong anti-bacterial and anti-microbial properties of essential oils (EO)
- Aim of study
In vitro investigation carried out to determine efficacy of Tea Tree (TT), Citronella (Ci) and Bergamot (Bg) oils to combat growth of *F. necrophorum* a precursor to OFR



Plate 3: Herbs & essential oils

- *F.necrophorum* grown on agar enriched with 5% sterilized blood
- EO diluted to 1% and 10% concentration. Bergamot additionally diluted to 0.1% concentration
- Applied 1ml per plate 21 plates per treatment incubated at 37°C, 4 days in anaerobic gas pack chamber
- Colony forming units (CFU) counted and compared to control culture *F. necrophorum* diluted at 100:1

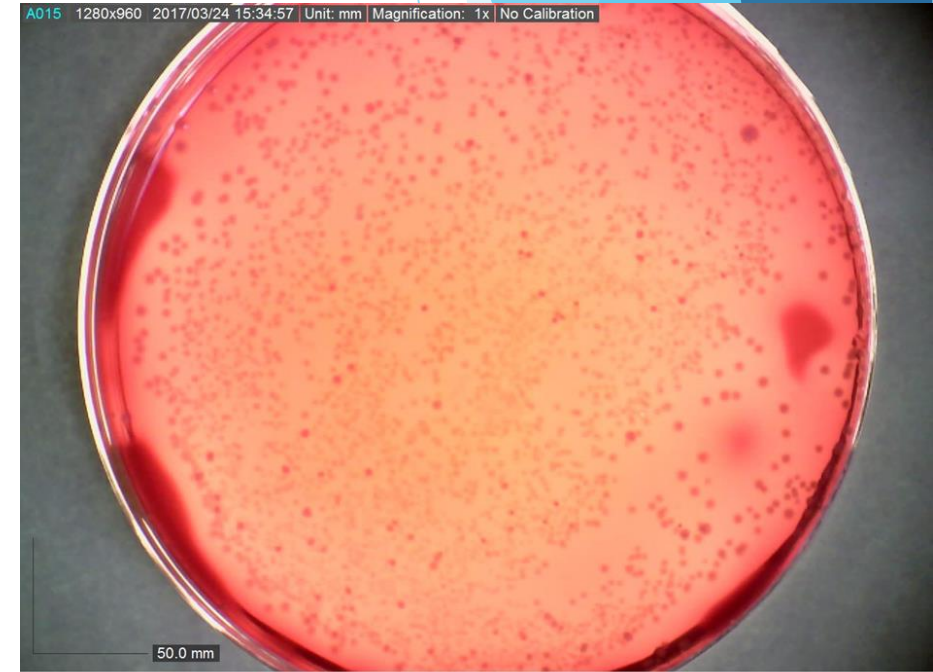


Plate 4: Control plate with *F. necrophorum*

All three oils significantly reduced CFU's at 1% and 10% concentration ($p < 0.0001$) when compared to the control samples at 797 CFU

Colony Forming units CFU	10% Concentration	1 % Concentration
Bergamot (Bg)	5	70
Citronella (Ci)	47	200
Tea Tree (TT)	33	45

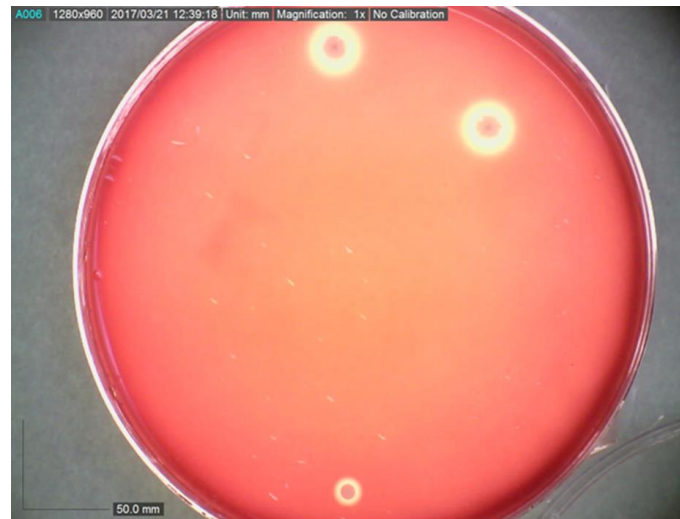


Plate 5:
Efficacy of 1% Bg Oil

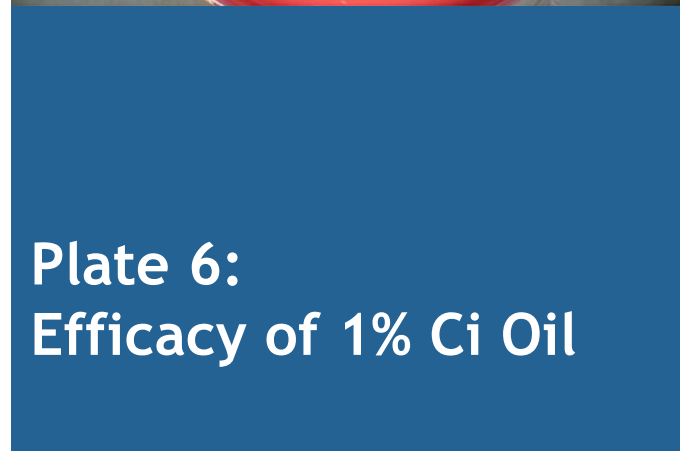
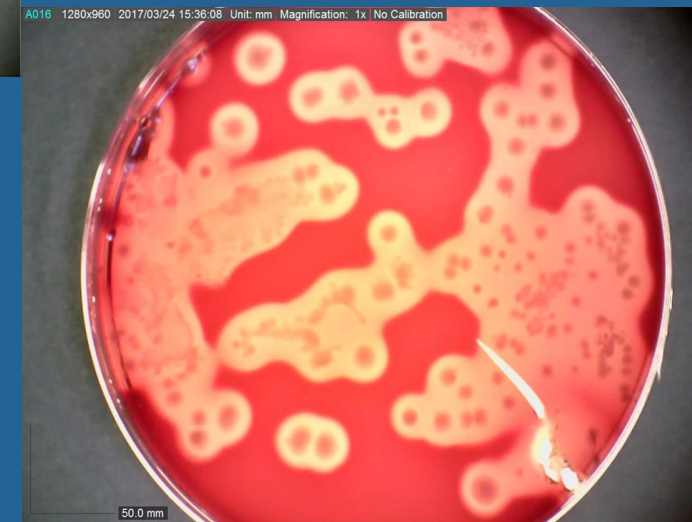


Plate 6:
Efficacy of 1% Ci Oil



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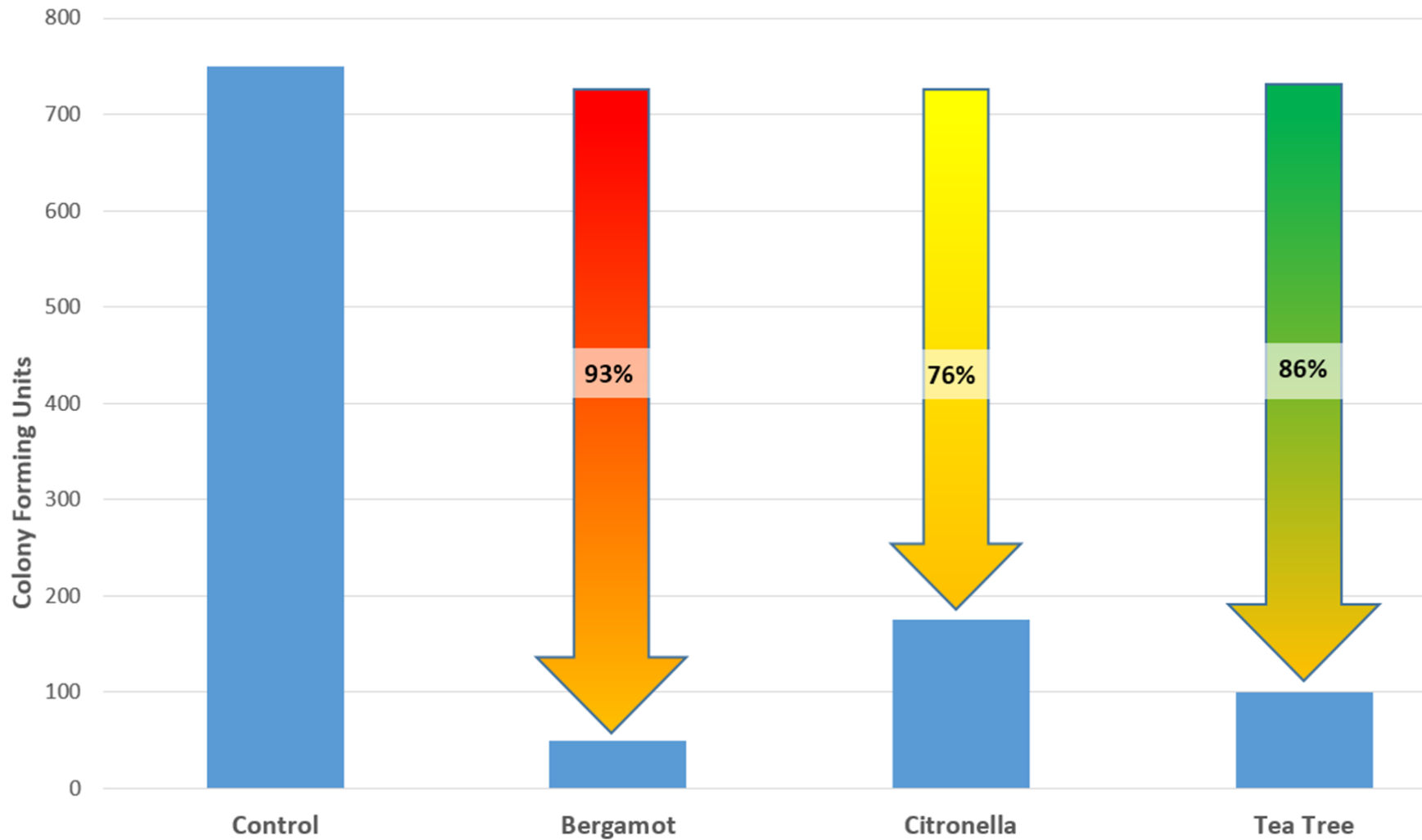


Figure 1 Percentage inhibition of *F. necrophorum* by EO treatments at 1% concentration

- Tea tree and Citronella oils similar chemical composition containing terpene hydrocarbons
- Mode of action is to disrupt cellular membrane permeability on both gram-positive and gram-negative bacteria
- Bergamot different structure with unique polyphenol content influencing lipid and sugar metabolism at a molecular level



Plate 7: Tea tree, Citronella & Bergamot

- All three essential oils Bergamot, Citronella and Tea tree were considered to be effective at significantly reducing colony forming units of *Fusobacterium necrophorum* cultured *in vitro*
- Bergamot seemed to have highest level of efficacy even when applied at 0.1% concentration reduced *F. necrophorum* to 90 CFU ($P < 0.0001$)
- Essential oils have potential to reduce use of antibiotics and antimicrobials or to replace their use in Ovine organic or milk producing systems to combat footrot

**Thank you to
Dr Alan Birtle
Head Technician at Myerscough University
Centre Laboratories for his assistance in this
research project**

**Andrea Smith BSc (Hons) Agriculture &
dedicated sheep farmer for her innovative
choice of honours research project**



**University Centre
Myerscough**