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Efficacy and effects of trunk injection for delivering imidacloprid and oxytetracycline to HLB-affected sweet orange trees

# Funding

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Development of an automated delivery system for therapeutic materials to treat HLB infected citrus

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United States Department of Agriculture  
National Institute of Food and Agriculture



# Trunk injection

- Targeted delivery of crop protection materials into the stem or trunk of woody species as an alternative to spraying or soil drenching
- Injection occurs into the xylem; materials are then distributed through the plant with the transpiration stream





# Trunk injection

- Precision delivery
- Eliminate spray drift
- Minimize run-off and environmental contamination
- Reduced risk of exposure for farmworkers
- Longer residual activity





# Field trial

- Valencia sweet orange trees (5-year-old) on Kuharske rootstock
- Injections performed in October 2020 and April 2021
  - Oxytetracycline
  - Imidacloprid
  - Water
  - No Injection

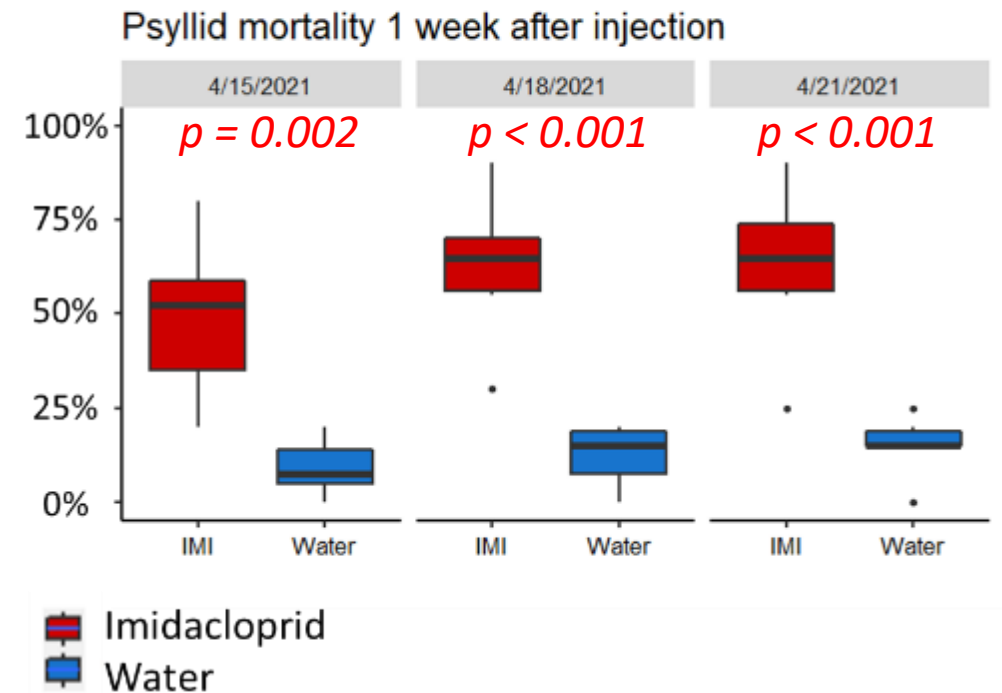
*Injections performed at recommended label rates using Chemjet tree injectors (2 injectors per tree on opposite sides of the trunk)*



# Efficacy of injection: Imidacloprid

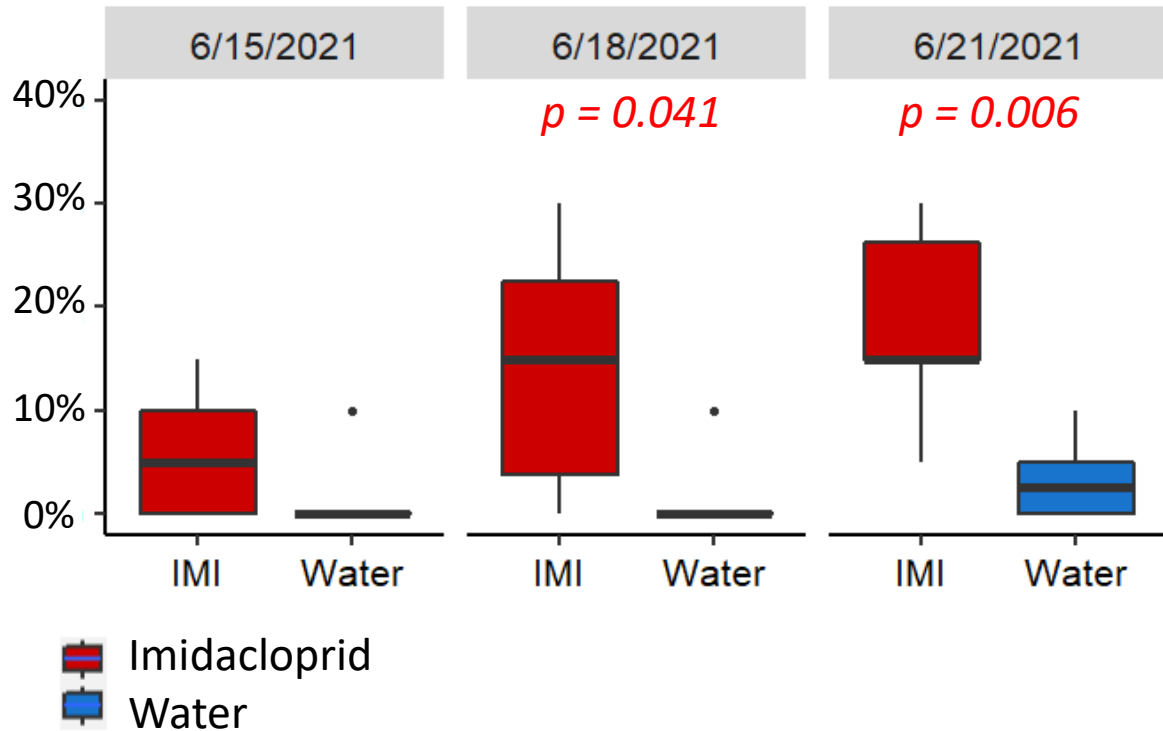


63% adult psyllid mortality **one week** after injection

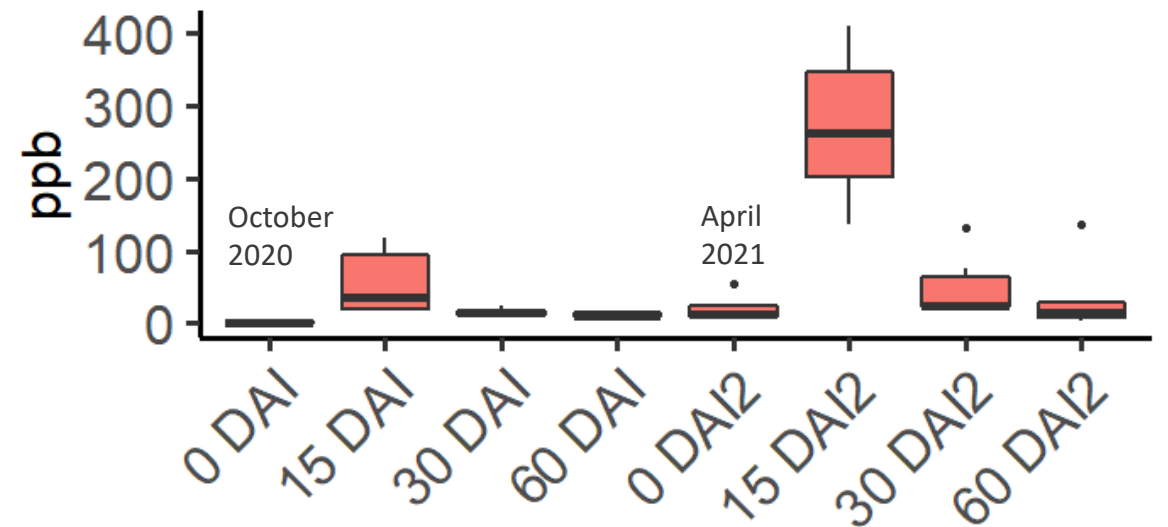


# Efficacy of injection: Imidacloprid

## Psyllid mortality 2 months after injection



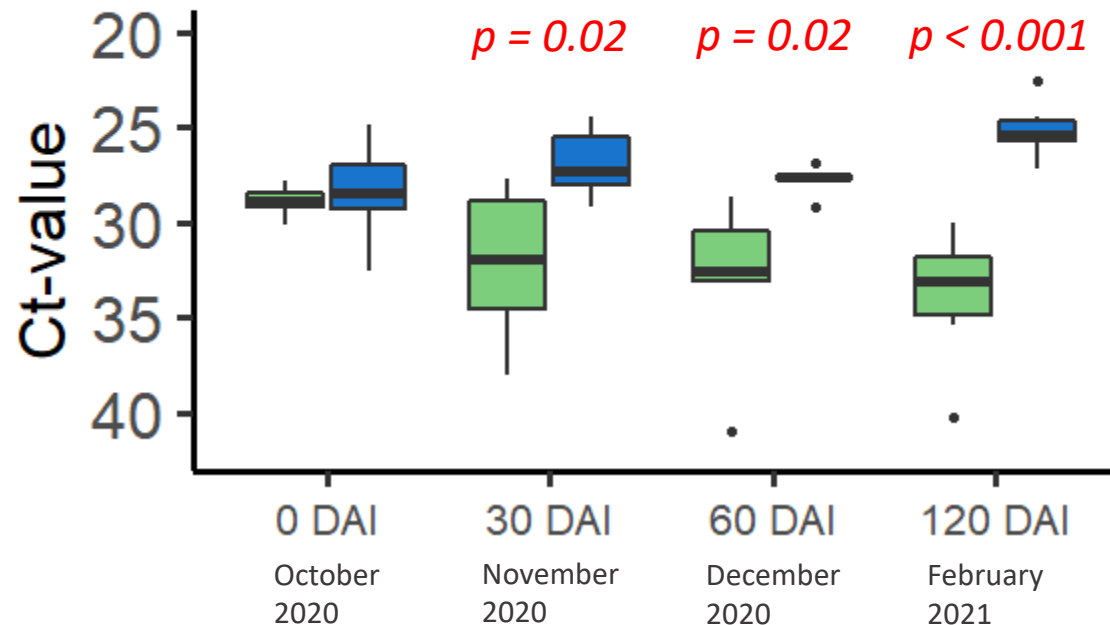
## Leaf imidacloprid concentration



18% adult psyllid mortality **two months** after injection

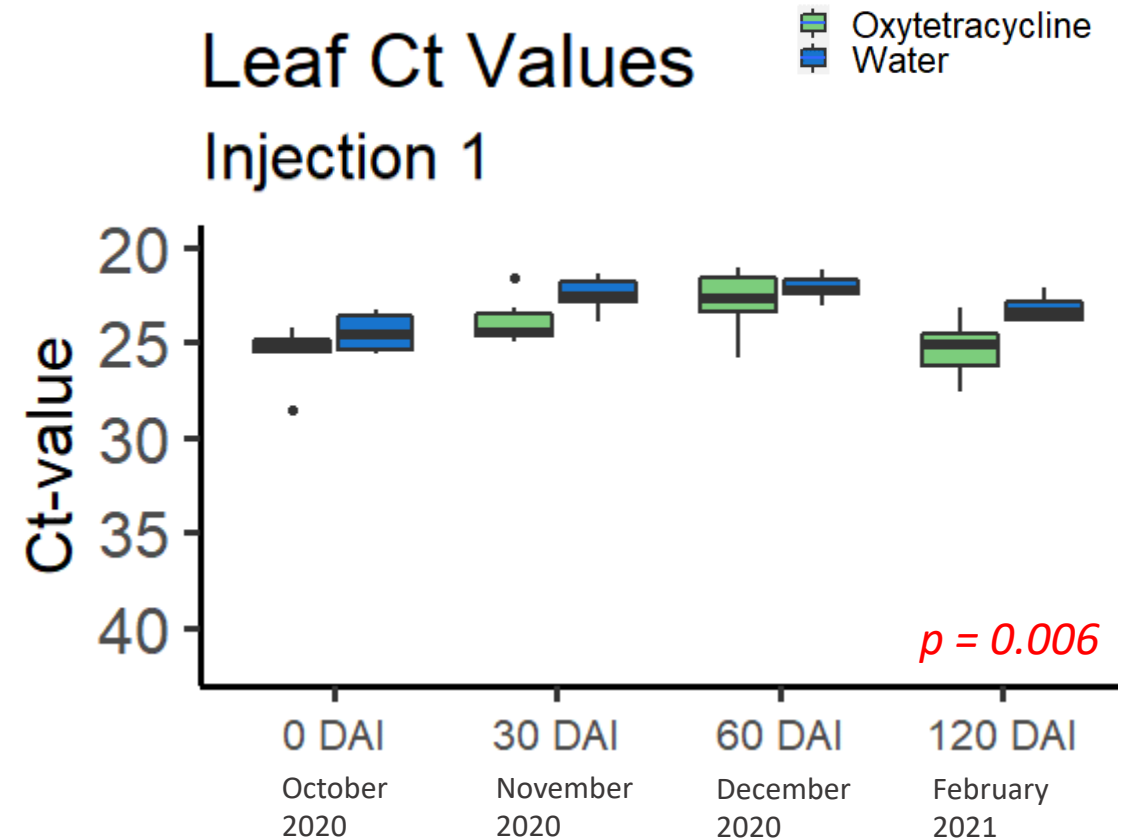
# Efficacy of injection: Oxytetracycline

## Root Ct Values Injection 1



**Root** bacterial levels significantly reduced 30 days after injection (DAI)

## Leaf Ct Values Injection 1

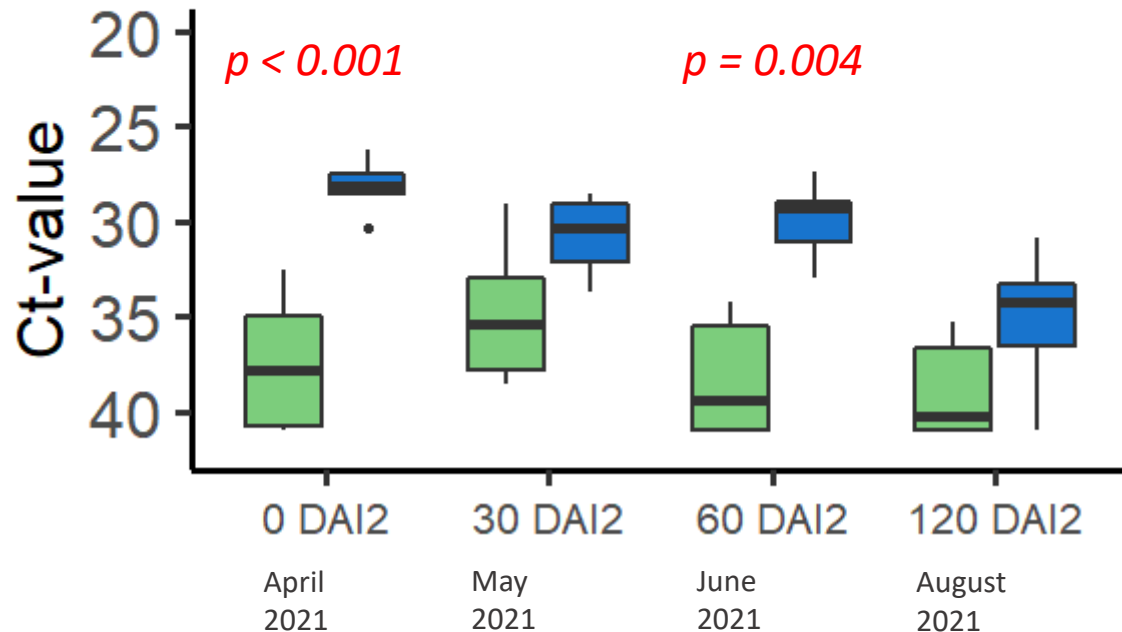


**Leaf** bacterial levels significantly reduced 120 days after injection



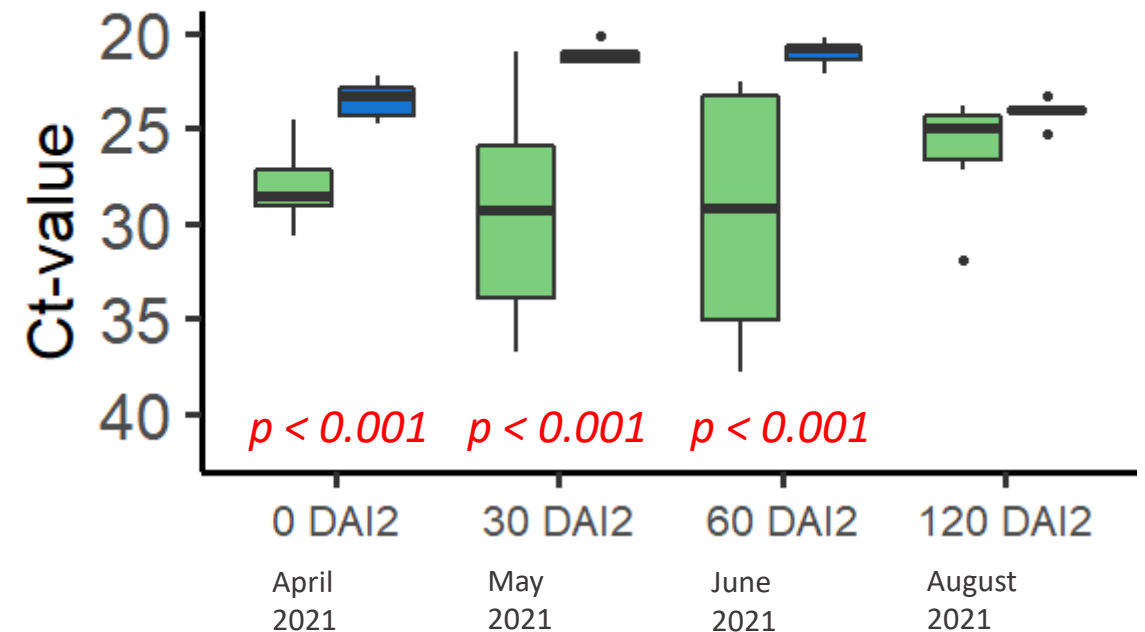
# Efficacy of injection: Oxytetracycline

## Root Ct Values Injection 2



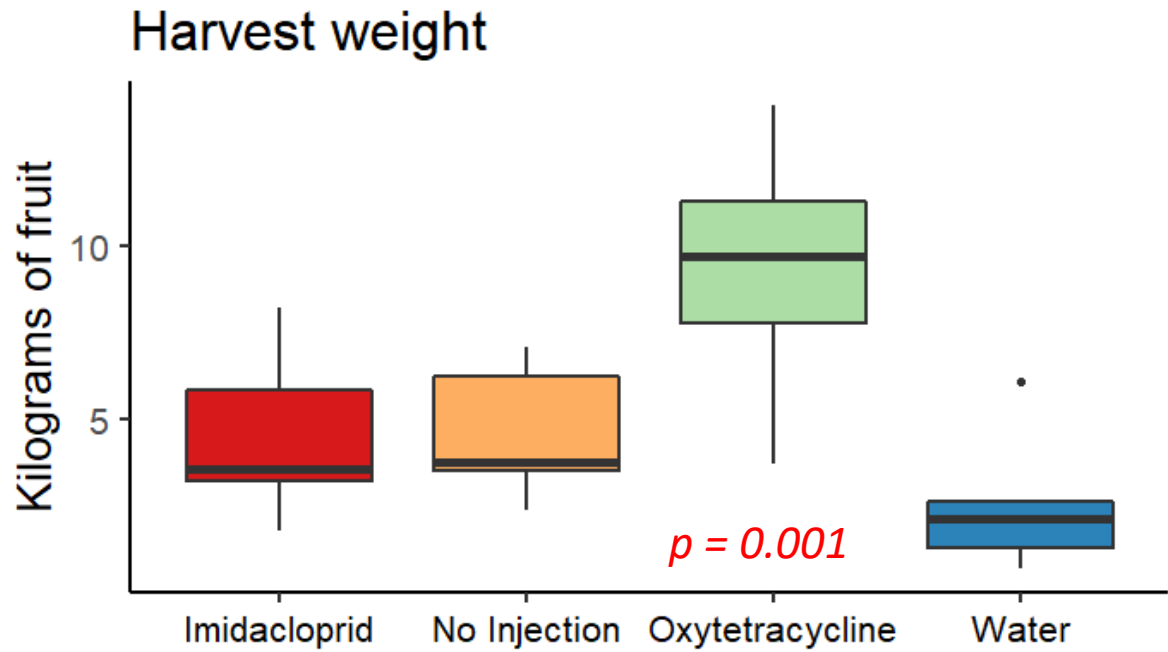
**Root** bacterial levels significantly reduced at 0 and 60 days after injection

## Leaf Ct Values Injection 2



**Leaf** bacterial levels were significantly different until 120 days after injection

# Harvest: 5 months after injection one





Water control

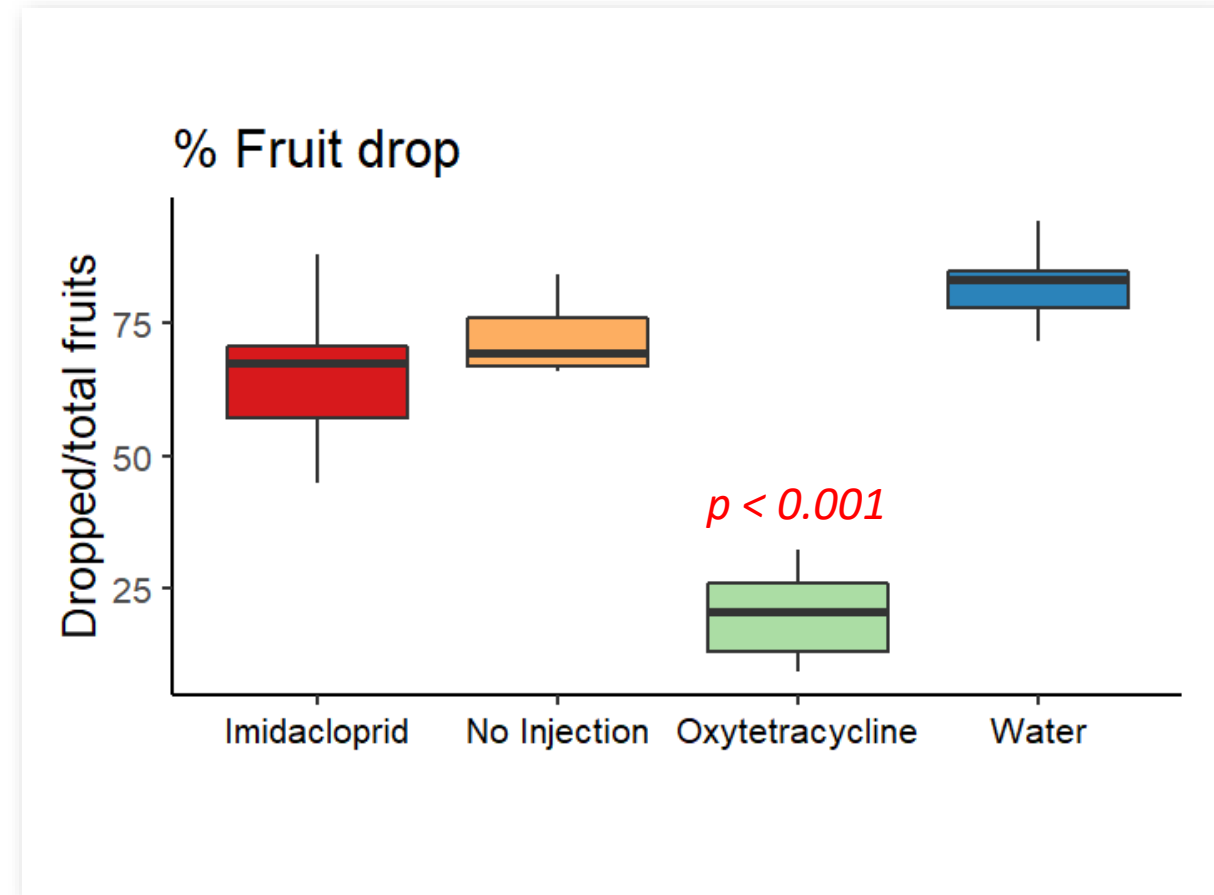
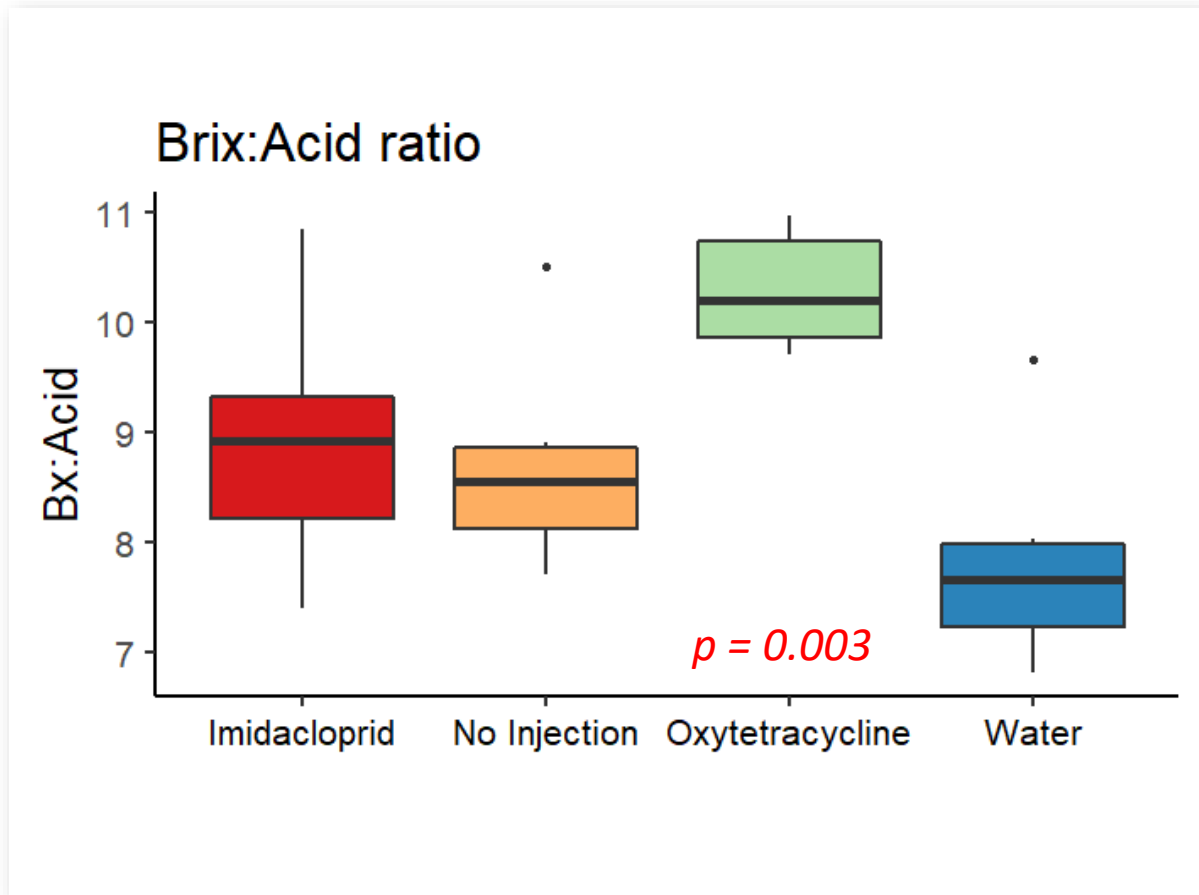


Oxytetracycline





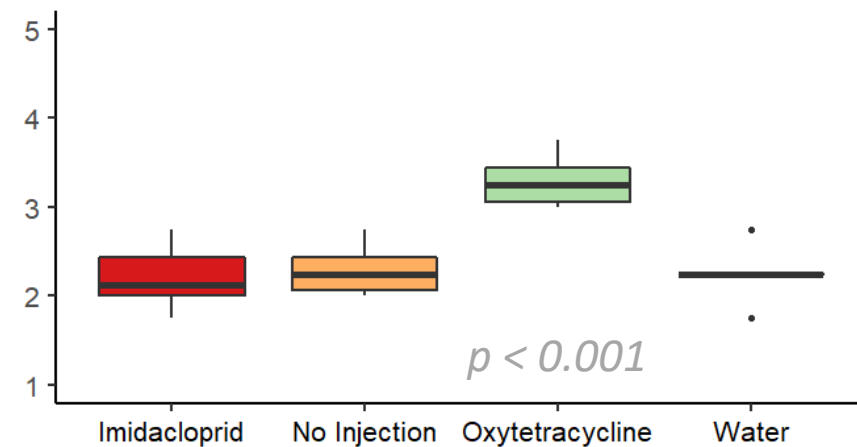
# Harvest: 5 months after injection one



# Efficacy: 6 months after injection one



April visual ratings: Canopy density

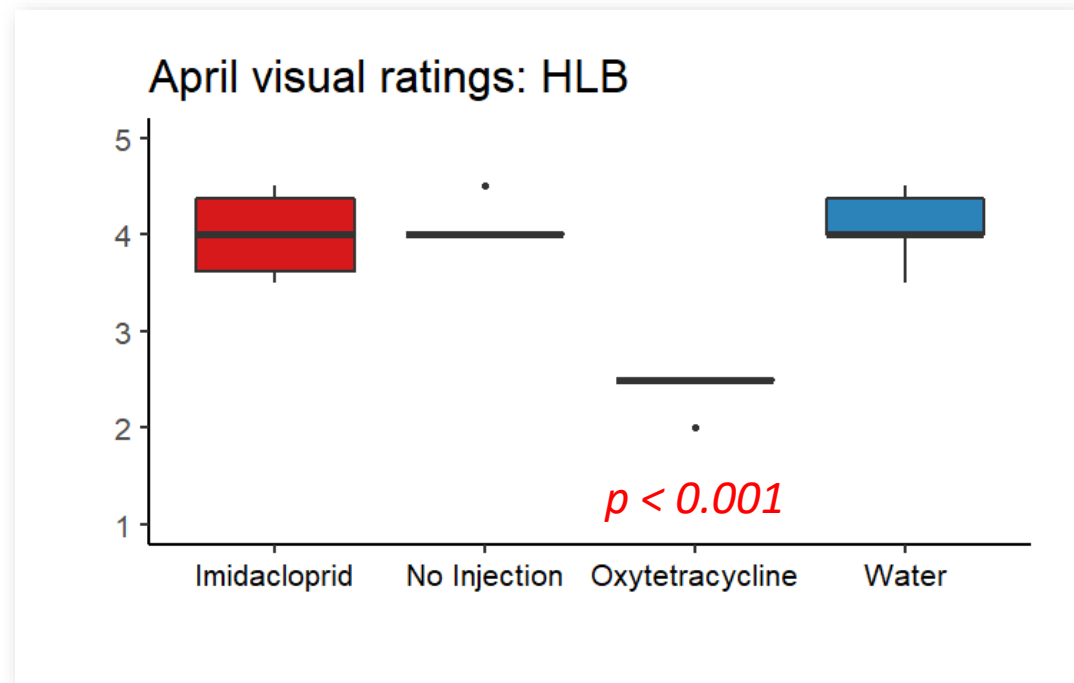


1 = Very *sparse* canopy

5 = Very **dense** canopy



# Efficacy: 6 months after injection one



% of branches with HLB symptoms:

1 = 0%    2 = 1-25%    3 = 25-50%    4 = 50-75%    5 = 75-100%





Efficacy: 1 year after injection one





## Trunk injection: Risks

- Wounding and internal injury associated with drilled injection ports
- Phytotoxicity associated with therapeutics

Water control

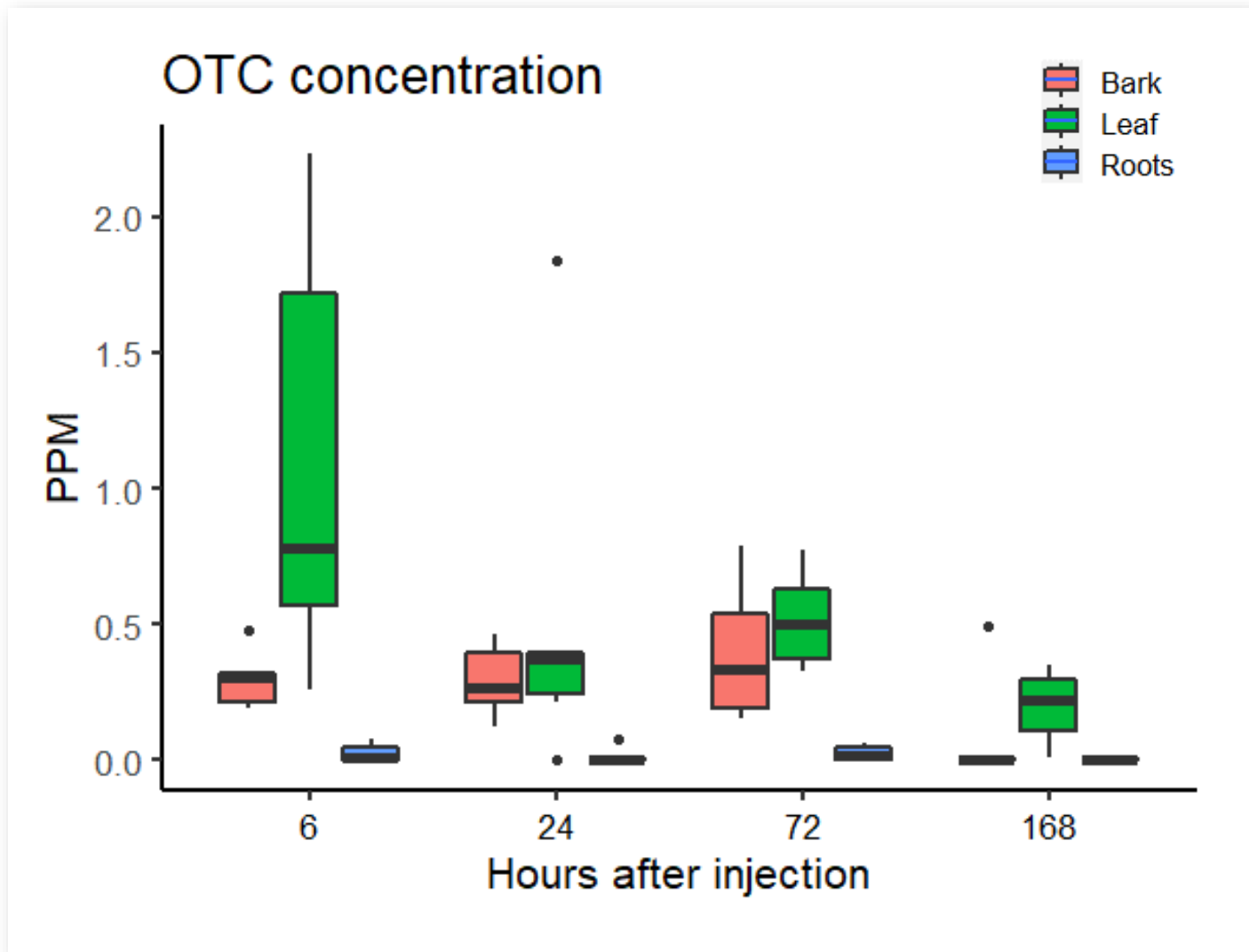


Oxytetracycline





# Trunk injection: Risks



- Compound residue

# Summary

- Trunk injection can effectively and systemically deliver crop protection materials to target pests and diseases of citrus
- The efficacy of imidacloprid injection diminished within 2 months
- Oxytetracycline injection reduced bacterial levels in HLB-affected trees
- The long-term effects of trunk injection on tree health still need to be determined



