

Multi-year comparison of new tools to support establishment of young groves

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Rethinking what citrus insect/mite IPM looks like in a whole-grove context



- Insecticides alone are probably not the answer
- Need to incorporate newer tools to develop management program
- Insect/mite management is PART of a whole-grove management program
 - Need to consider impacts of these tools on:
 - Pathogen management (next talk)
 - Tree growth
 - Irrigation and fertigation needs

Tools under evaluation

- 1. Reflective Metalized Mulch – previous study by Stansly**
- 2. Red-dyed kaolin – previous research on mature trees**
- 3. Individual Protective Covers (IPCs) – at the time of project initiation, widely used but management parameters not developed**
- 4. Standard – Monthly insecticide applications to protect resets**

Metalized Reflective Mulch



- Has the potential to reduce ACP infestation
- Challenges:
 - Cost of material and installation
 - Material damages easily
- Unknowns:
 - Best irrigation practices
 - Best fertilization practices
 - Impacts on other pests/beneficials
 - Impacts on pathogens
 - Impacts on plant growth/development

Red-dyed Kaolin



- Has been shown to reduce psyllid infestation and proportion of plants infected with CLAs
- Challenges:
 - Applications – need good coverage, need equipment to apply (clogs jets)
- Unknowns:
 - Best irrigation practices
 - Best fertilization practices
 - Impacts on other pests/beneficials
 - Impacts on pathogens
 - Impacts on plant growth/development

Individual Protective Covers (IPCs)/ Exclusion Bags



- Has been shown to reduce psyllid infestation and proportion of plants infected with CLas
- Challenges:
 - Applications – need good coverage, need equipment to apply (clogs jets)
- Unknowns:
 - Best irrigation practices
 - Best fertilization practices
 - Impacts on other pests/beneficials
 - Impacts on pathogens
 - Impacts on plant growth/development

General unknowns for these tools

- **Return on investment**
- **Arthropod and pathogen management**
 - **How to scout**
 - **What arthropods and pathogens will become problematic?**
 - **How to prevent and/or treat arthropod or pathogen outbreaks?**
- **What happens after trees are too big for protection by these tools?**
- **Each tool alters the growing environment for plants, so we need to understand those impacts as we move forward**

Comparison planting

Planted Spring 2020

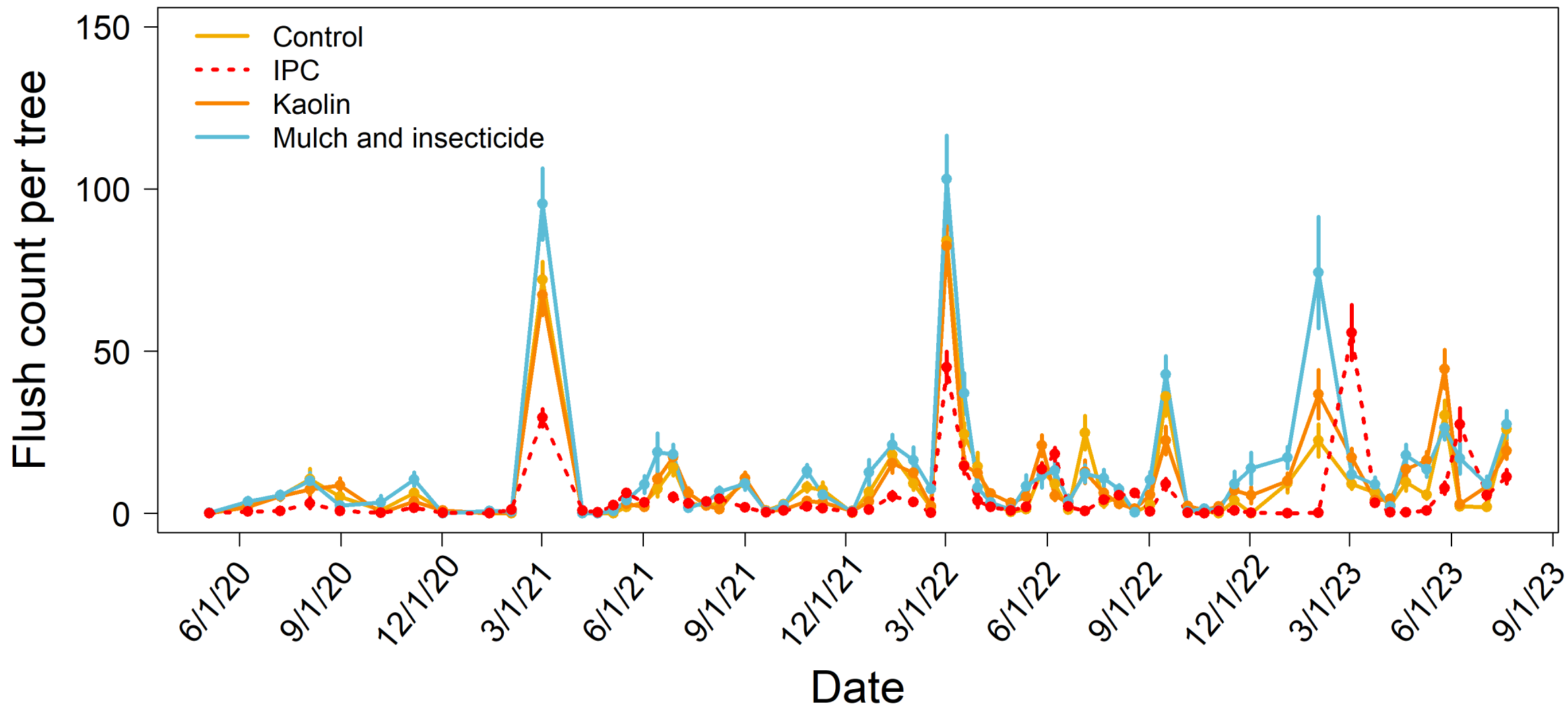
Data presented through Sept 2023



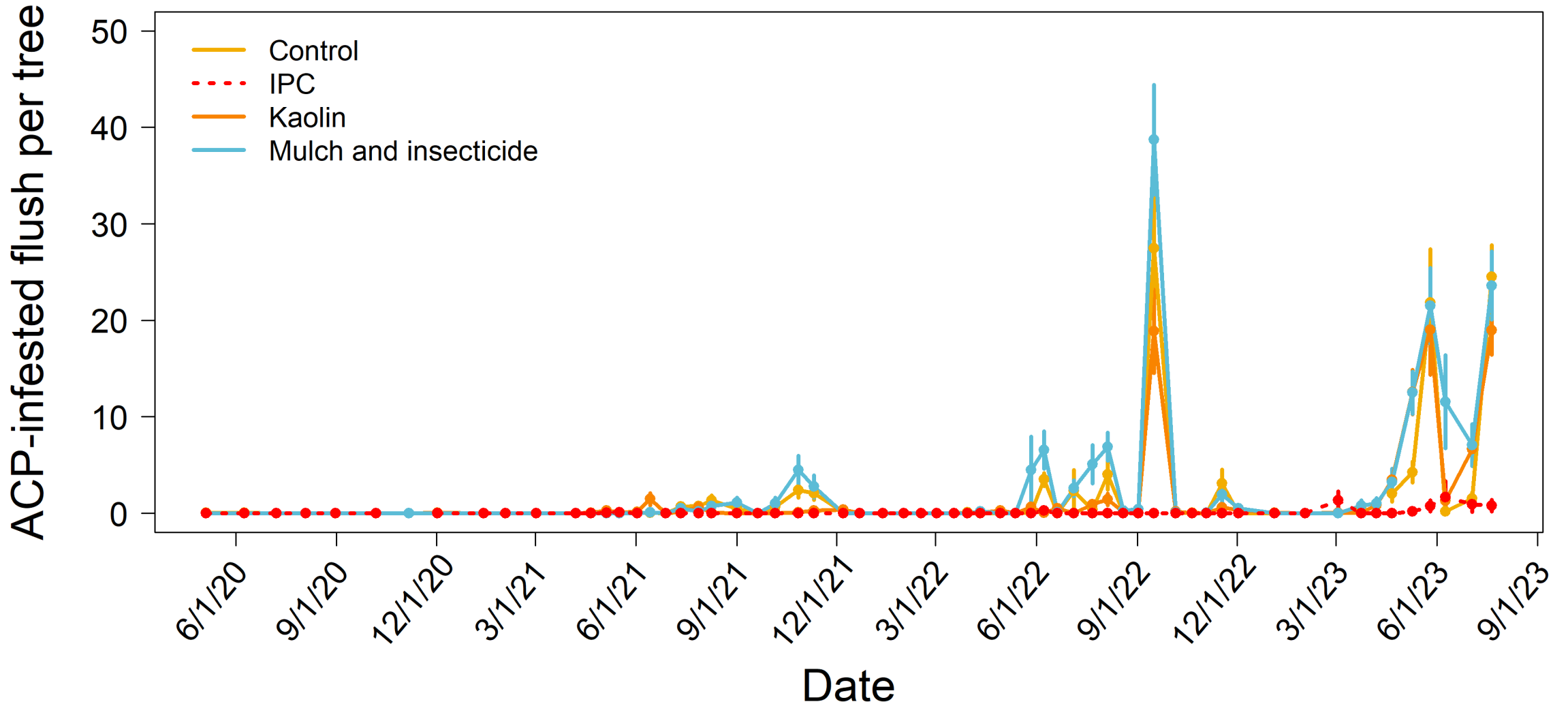
Insect and mite scouting

- **Every 2 weeks (1× per month in winter)**
- **Counted:**
 - **Number of flush/tree**
 - **Number of ACP eggs and nymphs on flush**
 - **CLM infestation on flush**
 - **Mites: rust, spider**
 - **NOTE: project was initiated prior to finding lebbeck mealybug, this pest was not in the project plan**
- **Management actions taken as needed**

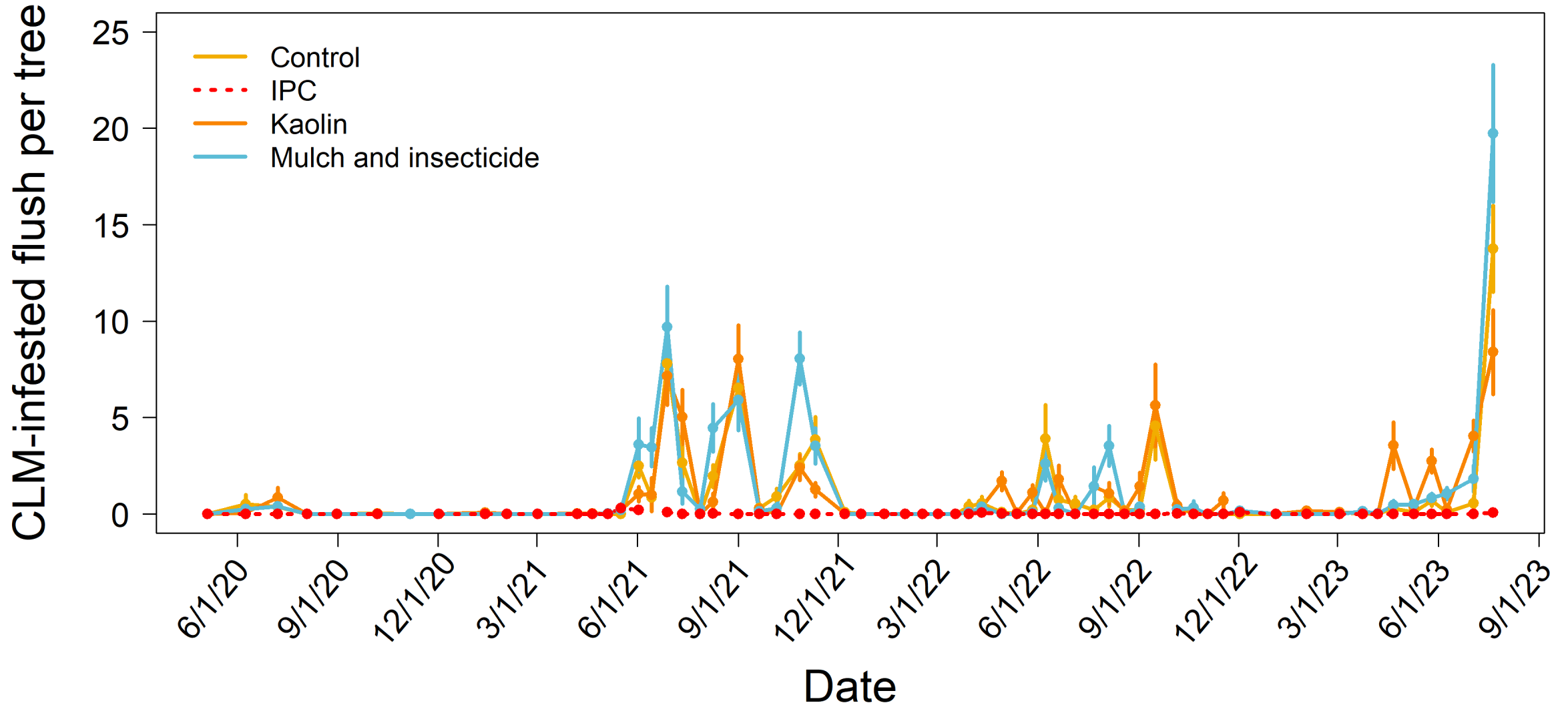
Impacts of treatments on flush counts



Impacts of treatments on ACP infestation



Impacts of treatments on CLM infestation

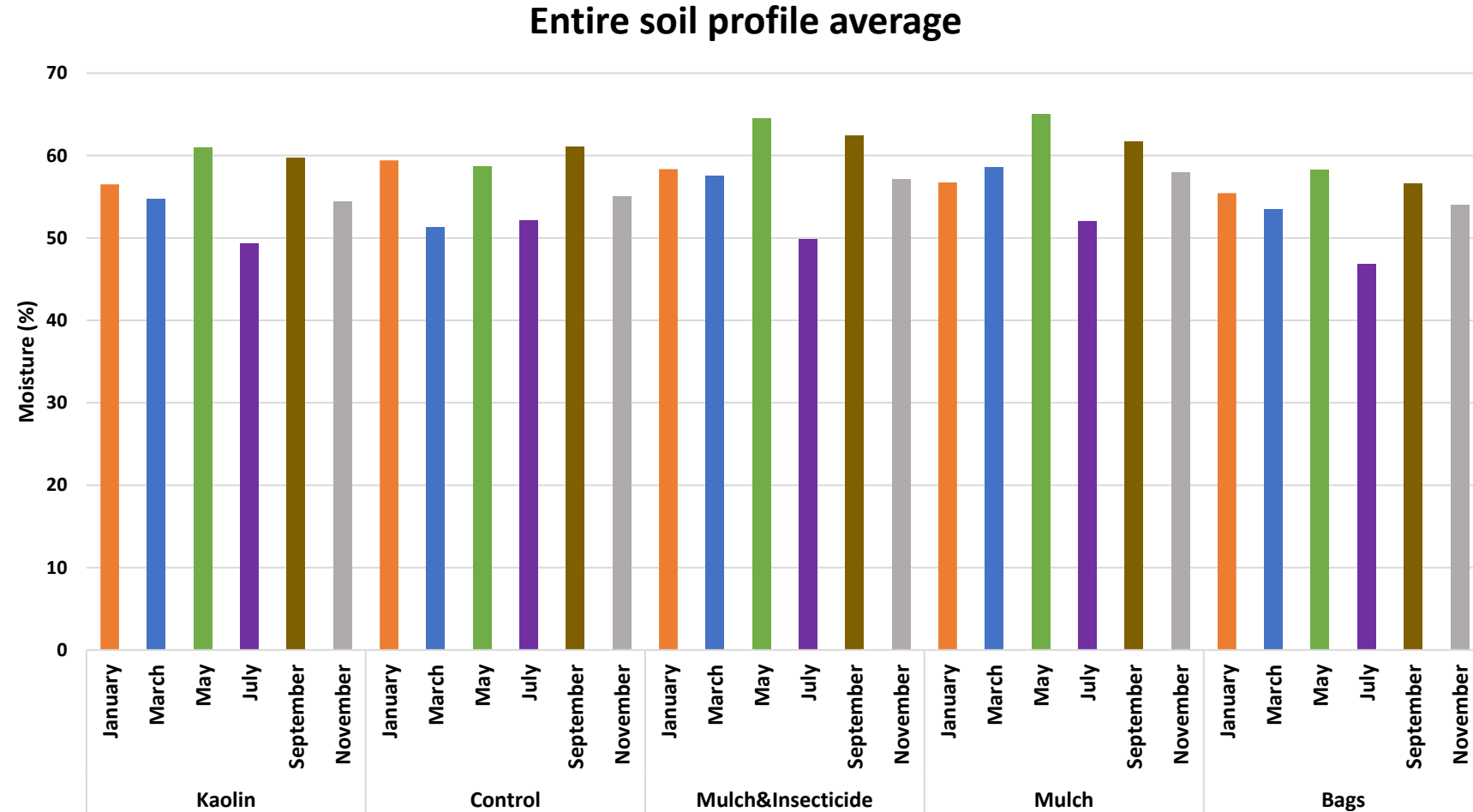


Insect and mite outcomes

- **Asian citrus psyllid**
 - **IPCs were the most effective tool for minimizing ACP infestation**
- **Citrus leafminer**
 - **IPCs were the most effective tool for minimizing CLM infestation**
- **Scales and mealybugs**
 - **Not quantified, but generally more problematic in IPCs. Targeted insecticide applications had to be performed to reduce populations.**
- **Mites**
 - **Variable across treatment and time, like not heavily impacted by treatment**

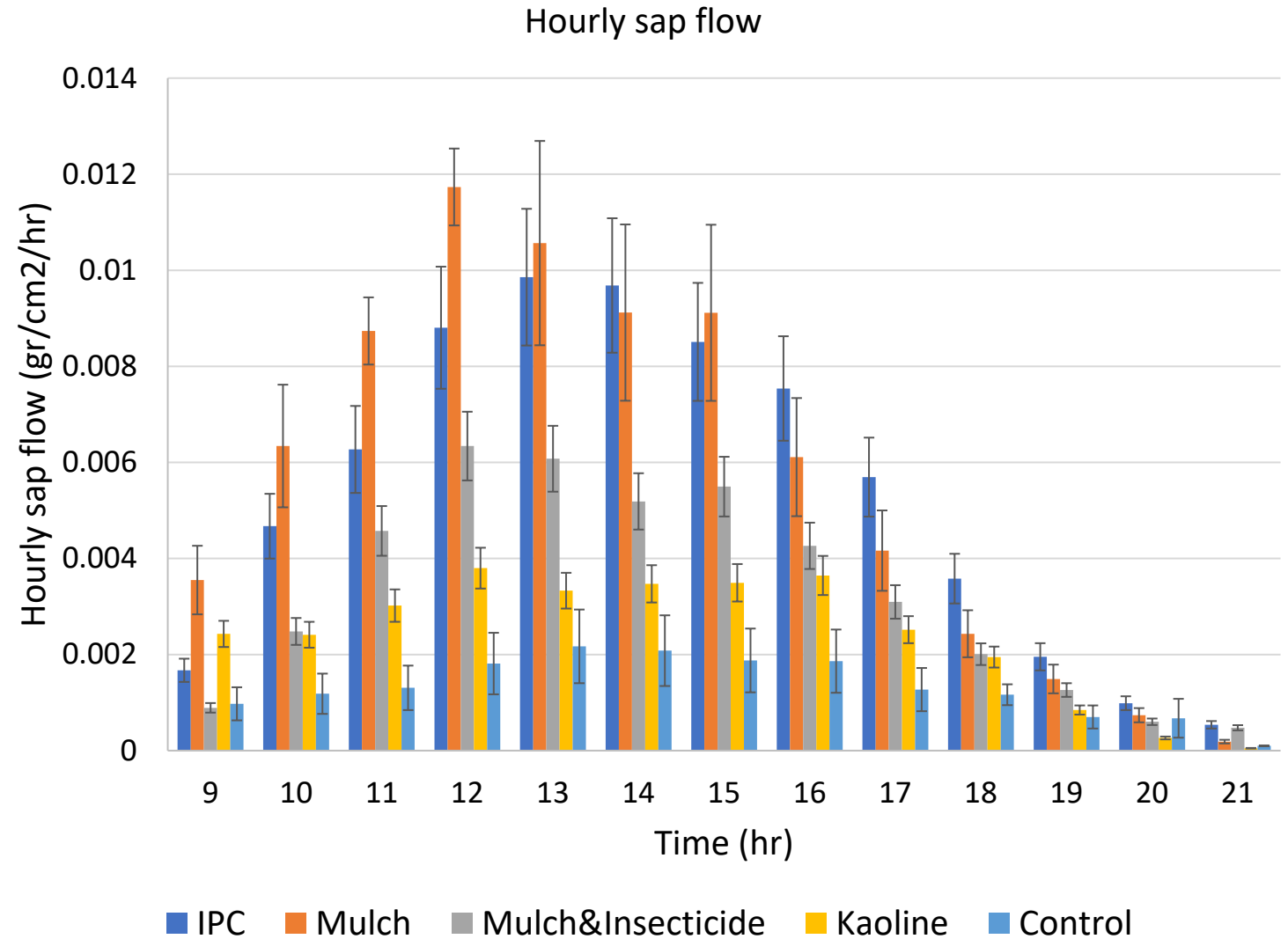
Soil moisture content

- Soil moisture monitored using soil moisture sensors
- No significant differences throughout year



Sap flow

- Water use is optimized by use of reflective mulch, with IPCs being second most efficient

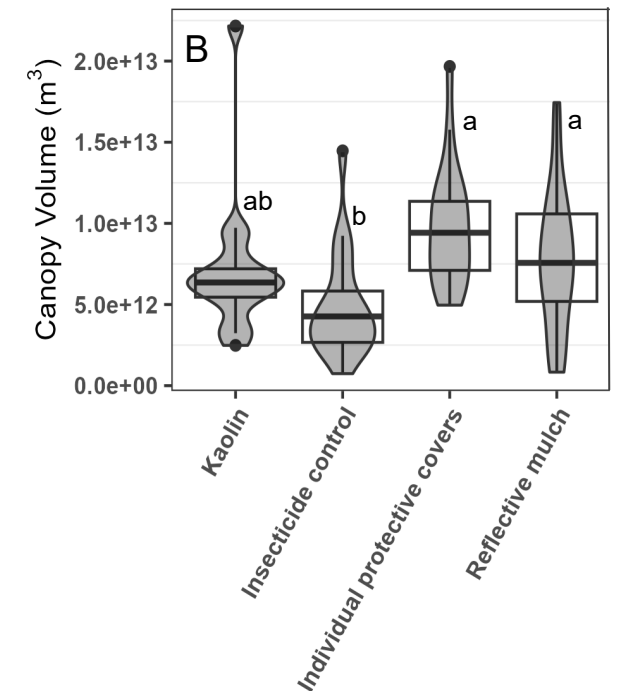


Canopy development



Canopy development (as of January 2023)

- IPCs have the most robust canopy
 - Equal canopy volume despite constriction
 - Greater trunk girth
- Followed in order by:
 - Reflective mulch
 - Red-dyed kaolin
 - Control
- IPCs and reflective mulch treatments have nearly 2× the canopy volume of control
- Trunk girth and canopy volume are now aligned, previously trunk girth was not in agreement with canopy data



Overall findings and future research

- Based on almost 3 years of study, IPCs outperform reflective mulch, red-dyed kaolin, and monthly insecticide applications for ACP and CLM control and for overall tree development
- Trees under IPCs did not flower as robustly as trees in other treatment (data not shown), which will lead to reduced fruit set
- Future research should focus on
 - Improving pest management under IPCs
 - Determining optimal timing for IPC removal relative to tree development
 - Management for susceptible trees once IPCs are removed

NOTE: these ideas were suggested in a preproposal to ECDRE this year

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