Akamai Cover Cropping Options:

BENEFITS OF WHITE CLOVER IN A LONG-TERM COVER CROP MIX ON SOIL HEALTH AND QUALITIES

Koon-Hui Wang
Justin Mew, Roshan Paudel, Jushua Silva

Department of Plant & Environmental Protection Sciences
University of Hawaii at Manoa

White clover (*Trifolium repens*)

- Legume, fixes N (80-130 lbs N/acre)
- Dense shallow root mass, stolon and rhizome protects soil from erosion and suppresses weeds
- Shade tolerance
- Tolerates traffic
- Creates habitat for above and below ground beneficials e.g. insectary plants

Credit: Alamy

Cover crop Mix with White clover

Cons of White Clover	Solution
• slow growing	Cover crop mix, sod planting
• prefer shade to establish	Companion planting

Cover Crop Mix

- White clover + black oat (*Avena strigose)* + buckwheat (*Fagopyrum Esculentum*)
- Planting cover crop sod can speed up the establishment.

Akamai Cover Crop Mix to Establish White Clover

White clover + black oat + buckwheat

< 1 month

Buckwheat & black oat provides shade for white clover initially.

< 2.5 months

< 4 months

White clover fully established.

8 months

Paper weed mat to protect transplants

< 6 months (black oat die back)

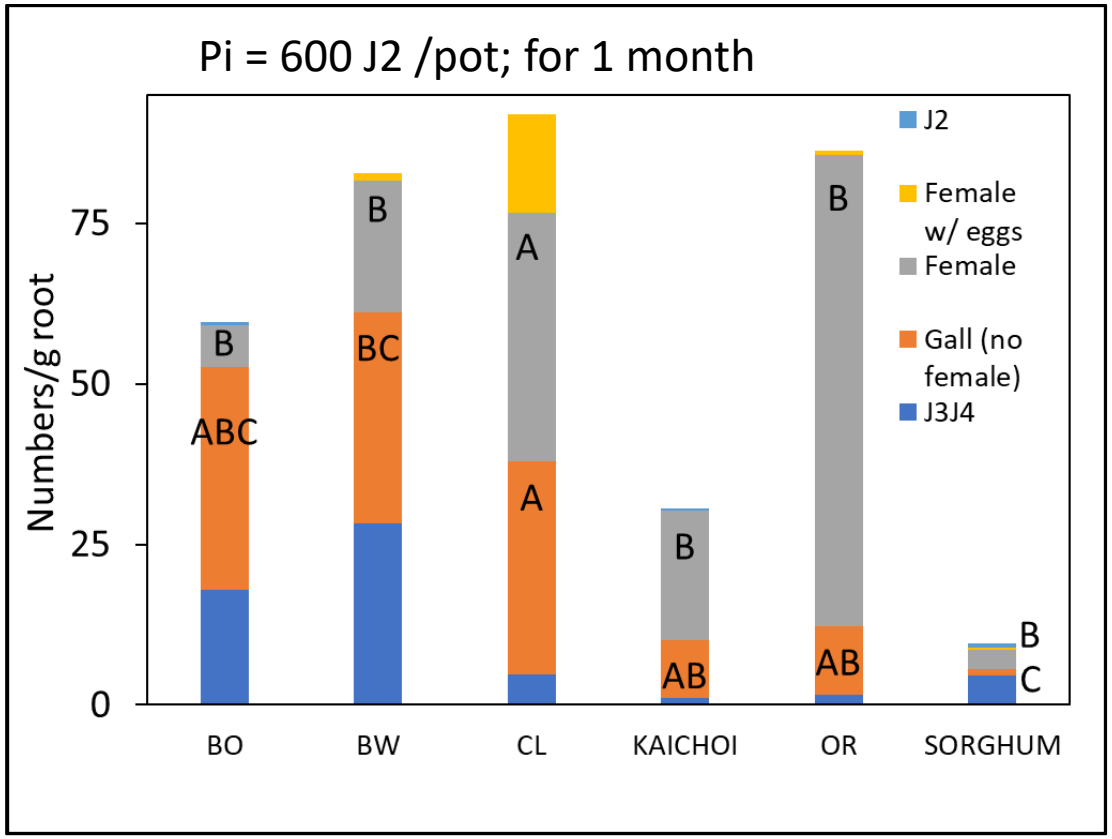
- Initially irrigation is needed, once established, it is a perennial, and minimal irrigation is needed.

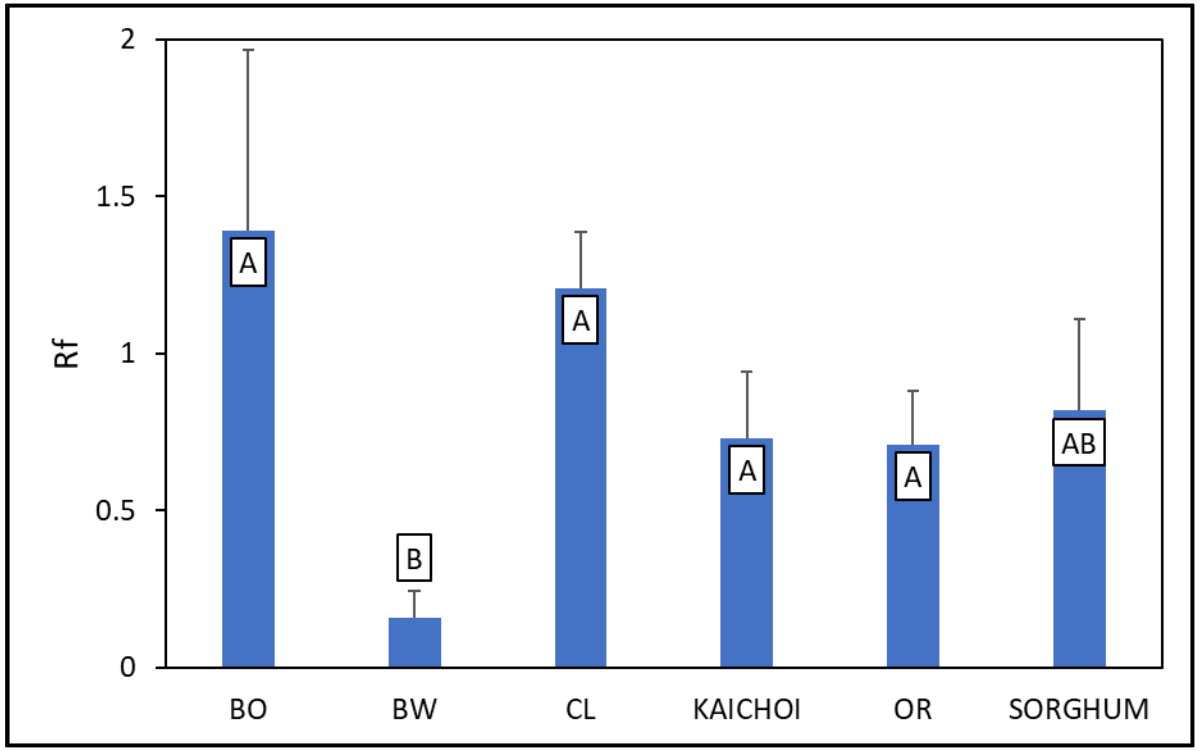
Examine Susceptibility of Cover Crops in the Akamai CC mix to *Meloidogyne incognita*

1. White clover (CL)
2. Buckwheat (BW)
3. Black oat (BO) ‘Soil Savier’
4. Oil radish (OR) ‘Sod Buster’
5. Sorghum (SG) ‘NX-D-61’
6. Mustard green (Kai Choi) ‘Hiroyama’

Examine Cover Crop's Susceptibility to *Meloidogyne incognita*

1. White clover (CL)
2. Buckwheat (BW)
3. Black oat (BO) 'Soil Savier'
4. Oil radish (OR) 'Sod Buster'
5. Sorghum (SG) 'NX-D-61'
6. Mustard green (Kai Choi) 'Hiroyama'





Objectives

The objective of this experiment was to explore the long-term changes in soil health and various soil properties of this cover crop mix.

Materials and Methods

Treatments :

1) long-term cover crop mix (CC)
   - ‘New Zealand’ white clover (55 Kg seeds/ha)
   - buckwheat (66 Kg/ha)
   - ‘Soil Saver’ black oat (77 Kg seeds/ha)
2) no cover crop (Control)

Two Sites

1) Magoon Teaching Plot (2021 Fall; 2022 Spring)
2) Kahumana Organic Avocado Plot (2021 Fall to present)

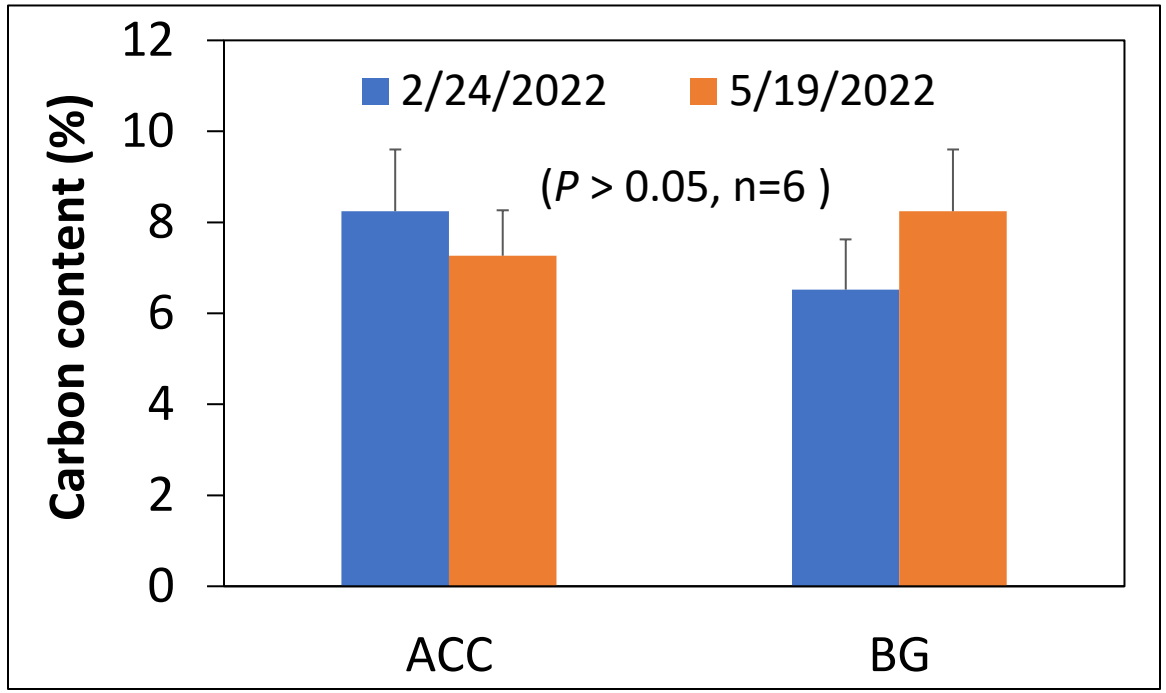
Kahumana Organic Farm

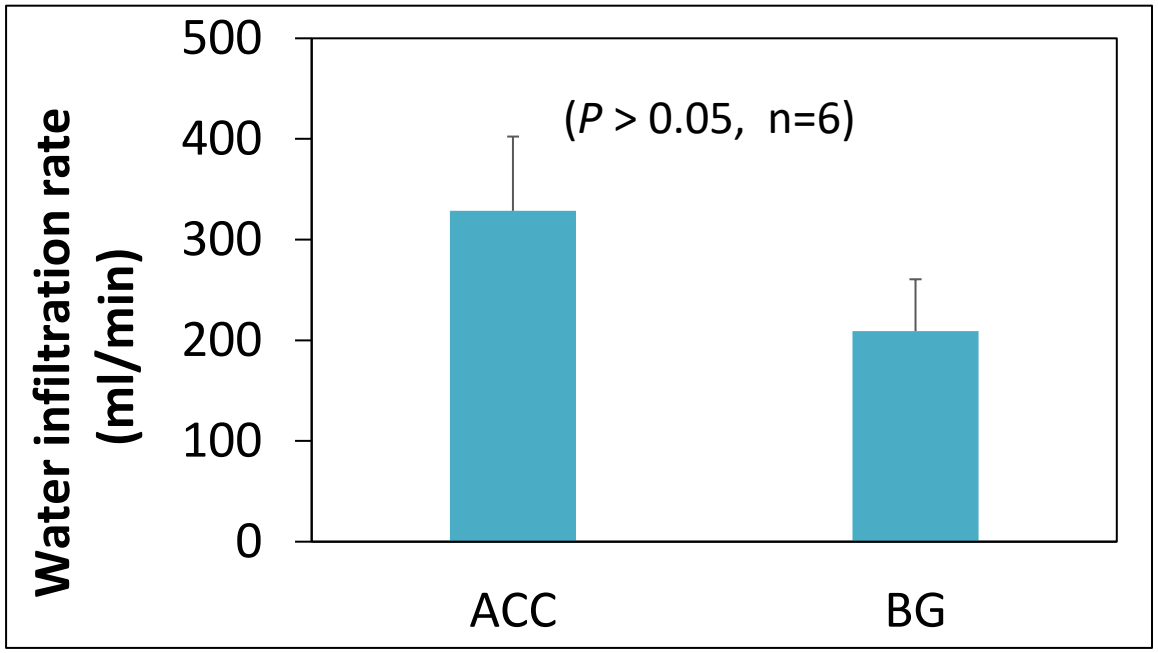
Avocado

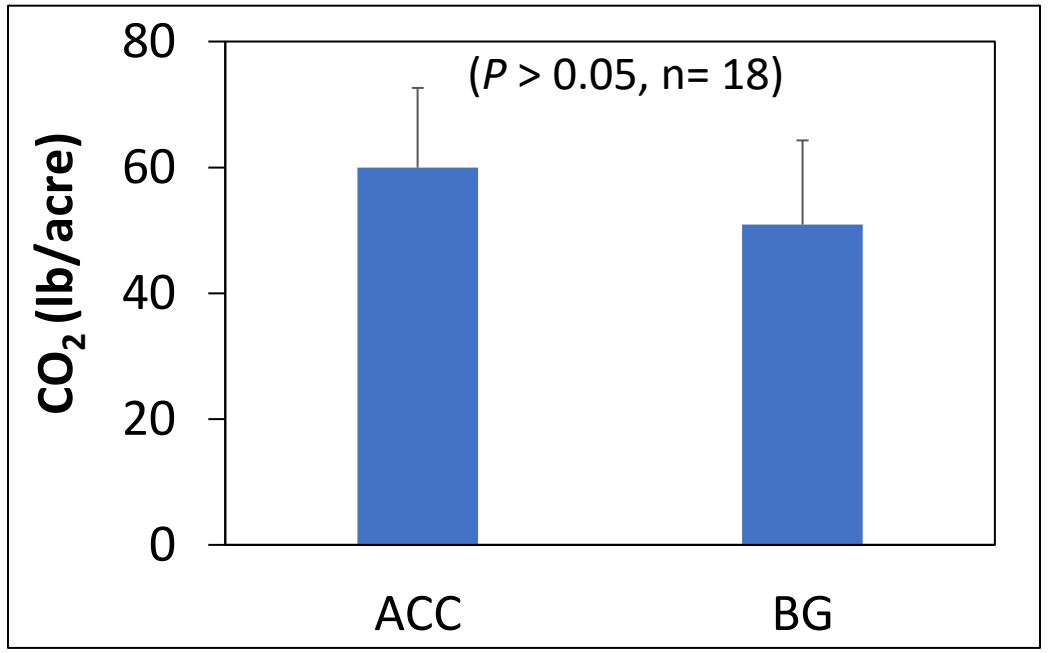
Kahumana

Double ring
Infiltration test

6 months after cover cropping







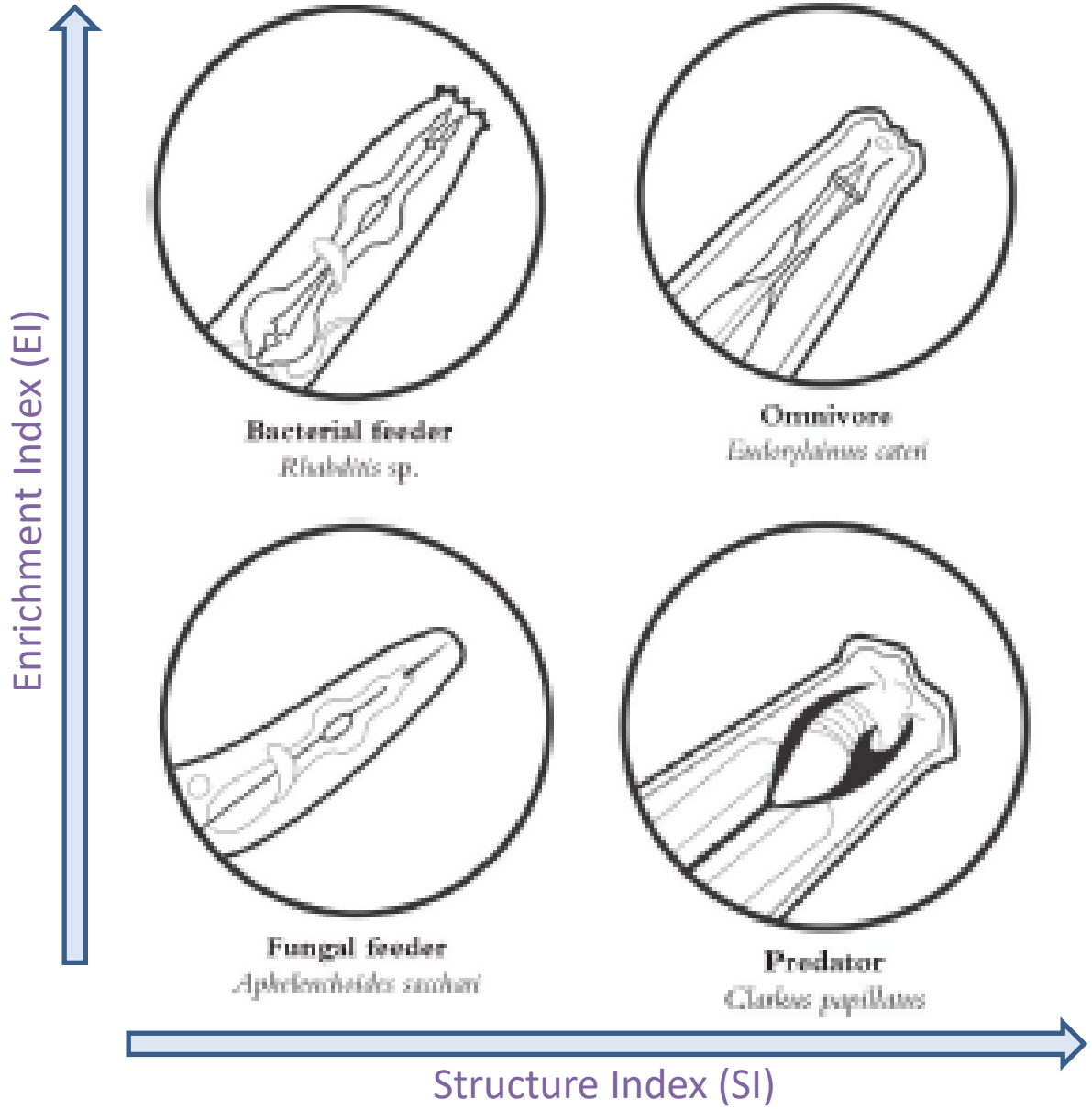
https://cms.ctahr.hawaii.edu/wangkh/Research-and-Extension/Soil-Health-Management

SOIL HEALTH MANAGEMENT

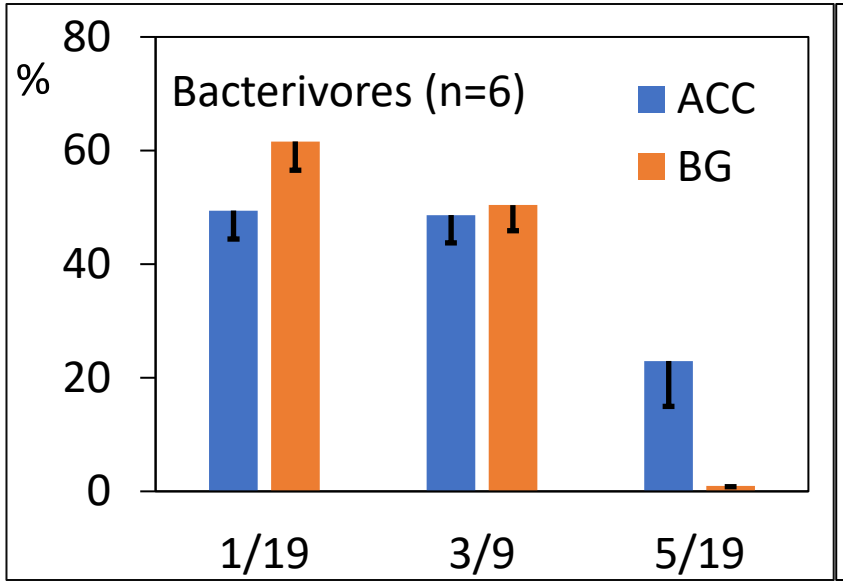
Principles:

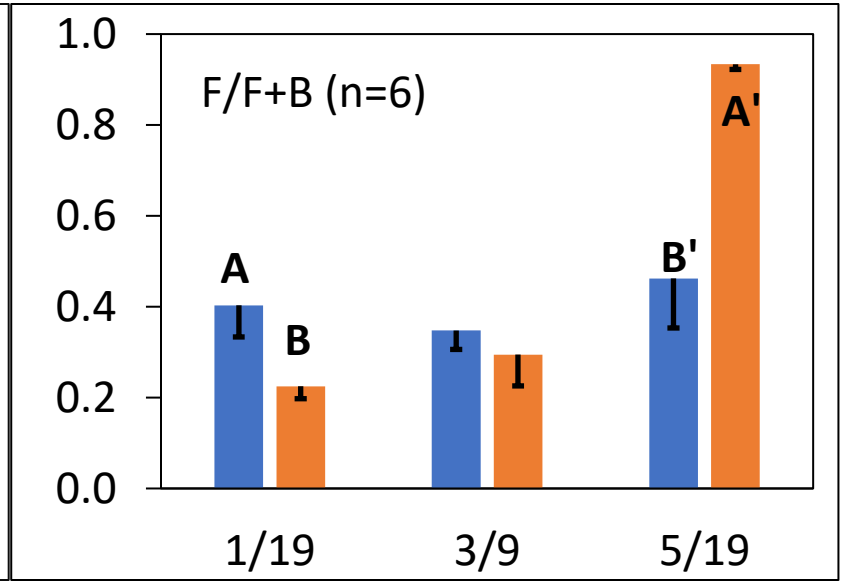
- Improvement of plant health
- Stability to disturbance or stress
- Maintenance of soil nutrient cycling
- High biological diversity
- Suppression of multiple pests and pathogens
- Enhance Soil Physical properties

Nematodes are good soil health indicators:



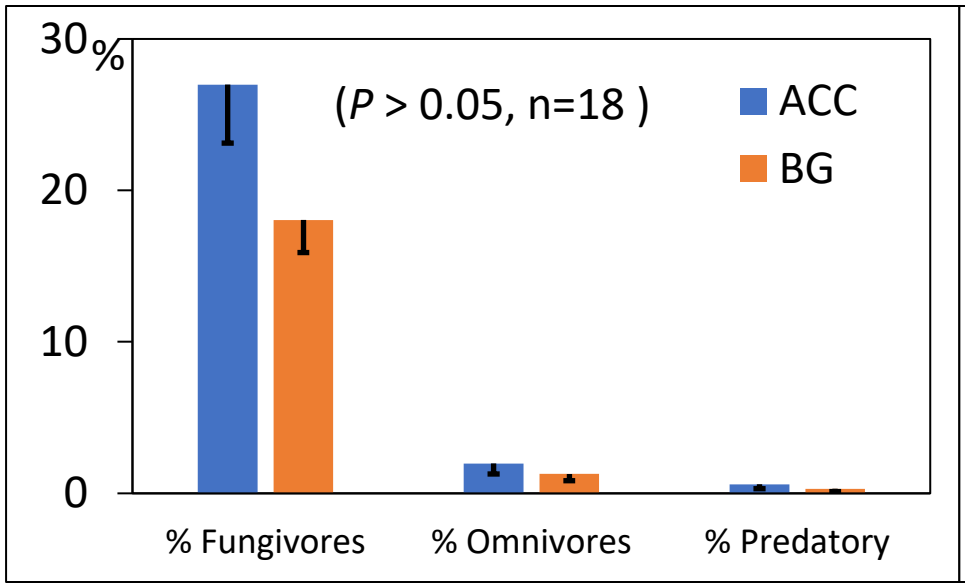
Kahumana

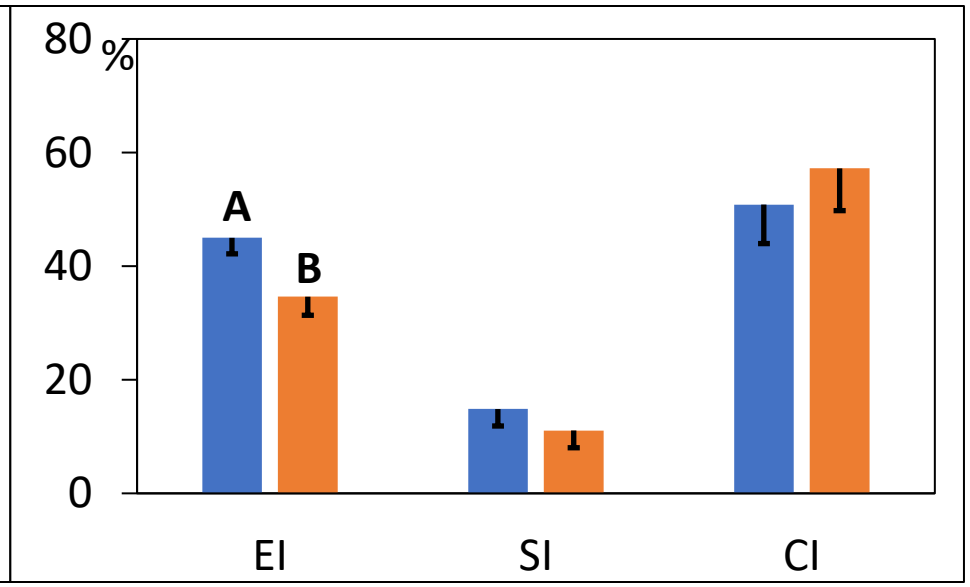




Planting of akamai cover crop shifted soil food web from fungal dominated to nutrient enriched bacterial dominated decomposition pathways.

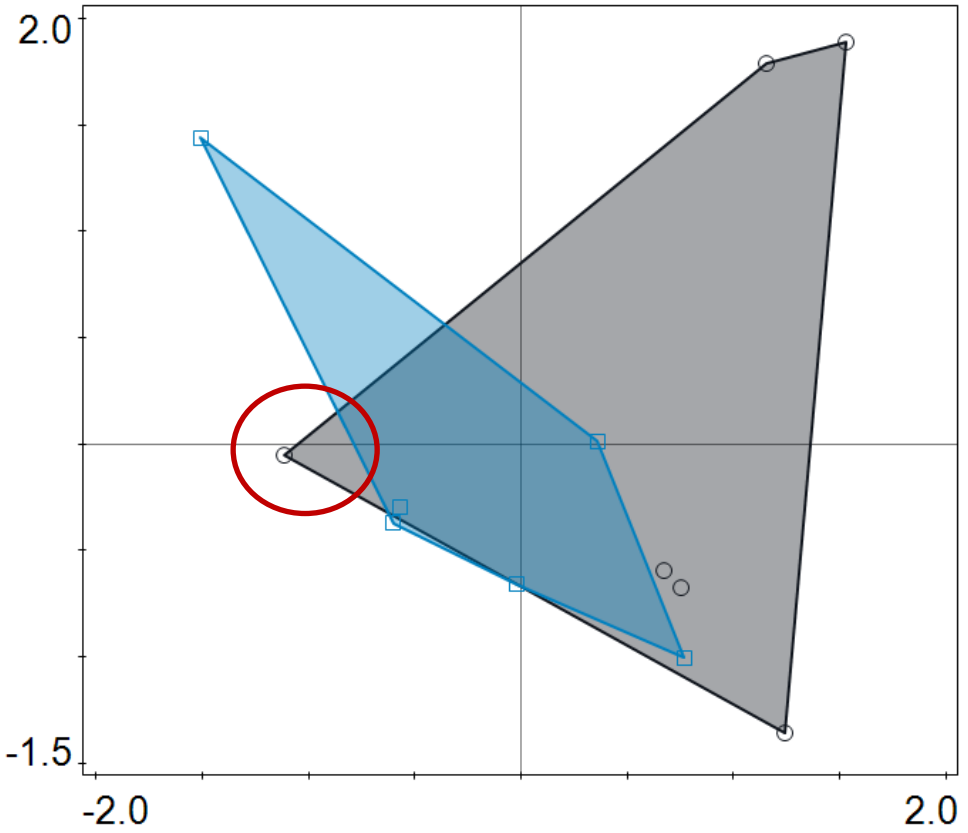
6 months after cover cropping

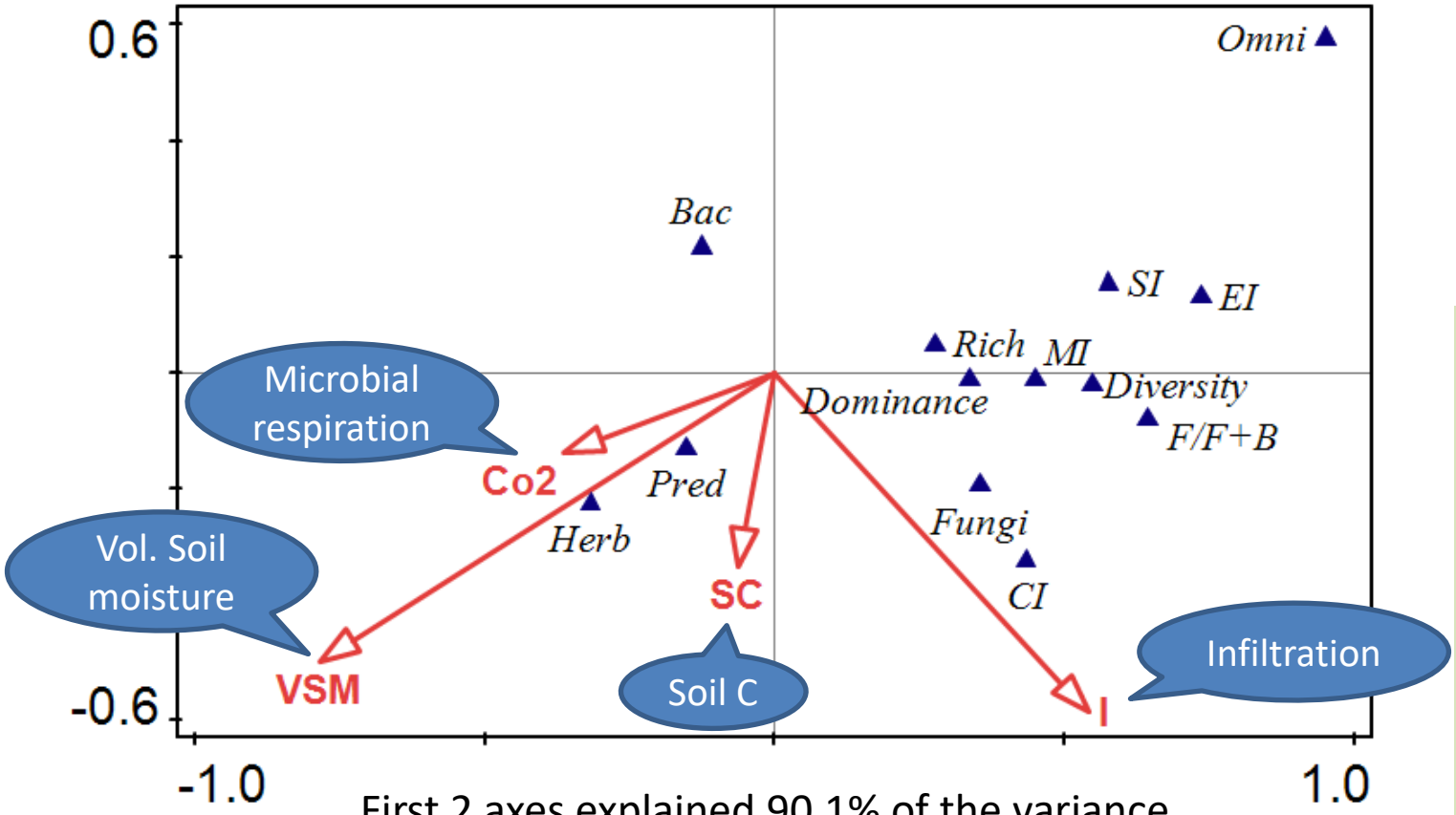




In parts due to irrigation in ACC plots allowed mycorrhizal/ other saprophytic fungi to proliferate initially in ACC. Lead to more nutrient rich conditions later in ACC.

6 months after cover cropping





First 2 axes explained 90.1% of the variance.

Summary:

- VSM and soil C positively related to soil microbial respiration.
- Infiltration rate was more related to abundance of fungivores/fungal decom-position.
  - However, soil health and quality conditions are still overlapping b/t ACC and BG.

Objectives

The objective of this experiment was to explore the long-term changes in soil health and various soil properties of this cover crop mix.

Materials and Methods

Treatments :

1) long-term cover crop mix (CC)
   - ‘New Zealand’ white clover (55 Kg seeds/ha)
   - buckwheat (66 Kg/ha)
   - ‘Soil Saver’ black oat (77 Kg seeds/ha)
2) no cover crop control (Control)

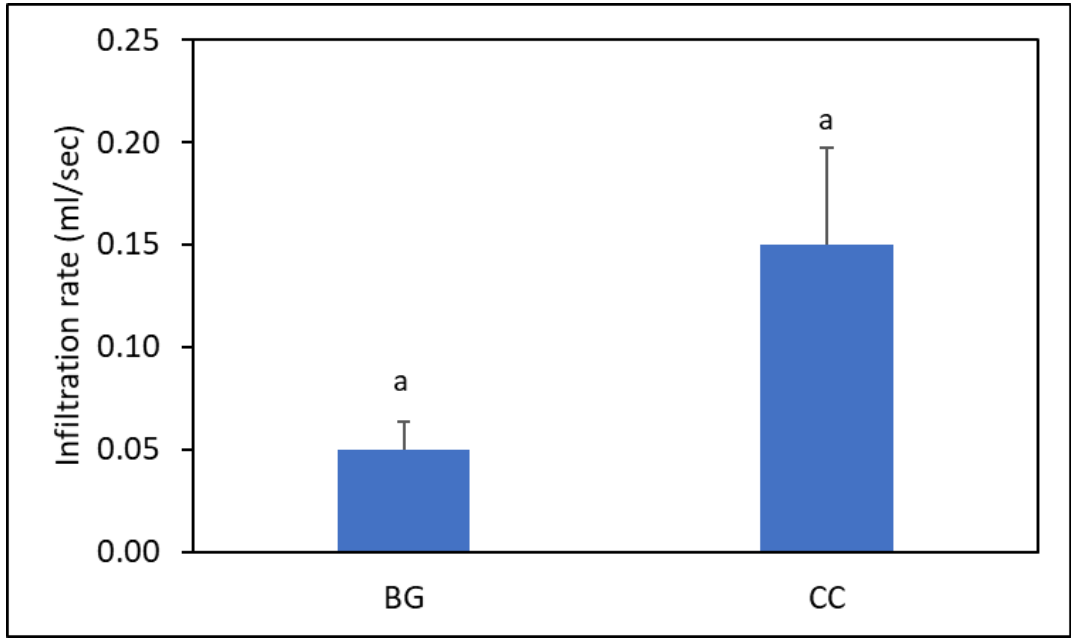
Two Sites

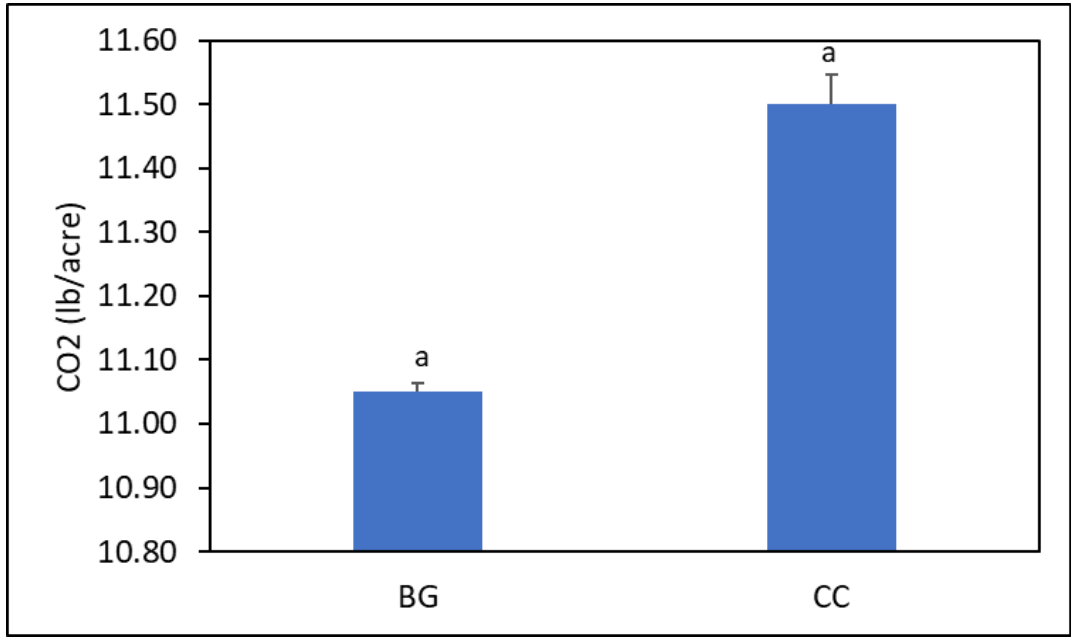
✓ 1) Magoon Teaching Plot (2021 Fall; 2022 Spring)
2) Kahumana Organic Avocado Plot (2021 Fall to present)

Magoon

(Trial I Sep - Dec 2021)

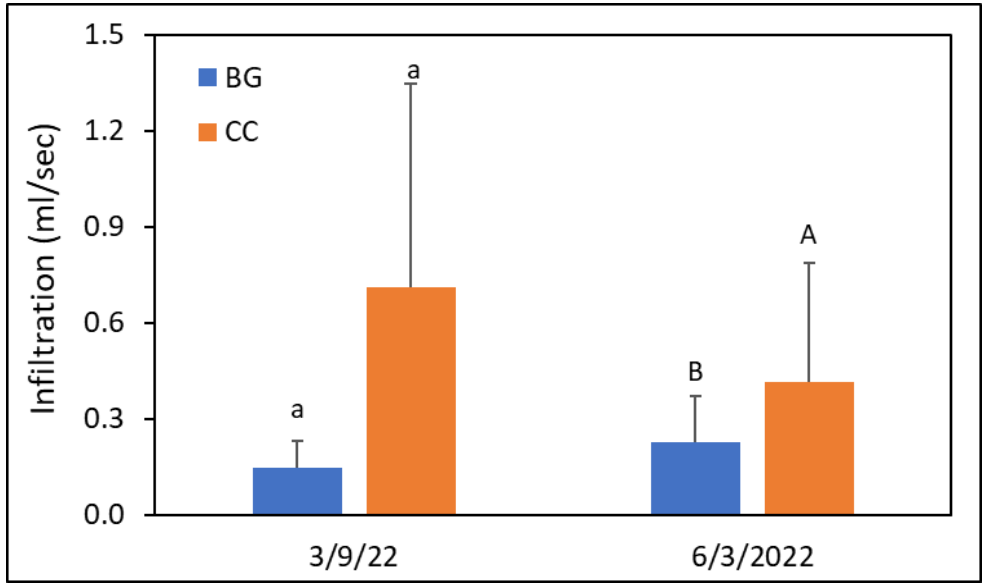
Cover crop terminated as surface mulch 2 months after planting

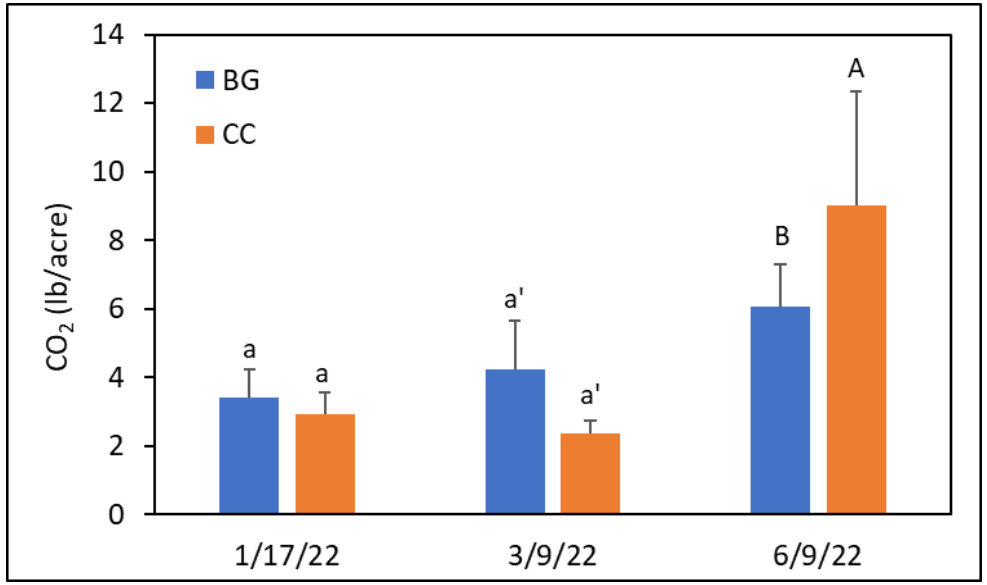




Magoon
(Trial II: Jan-June 2022)

Cover crop maintained as living mulch



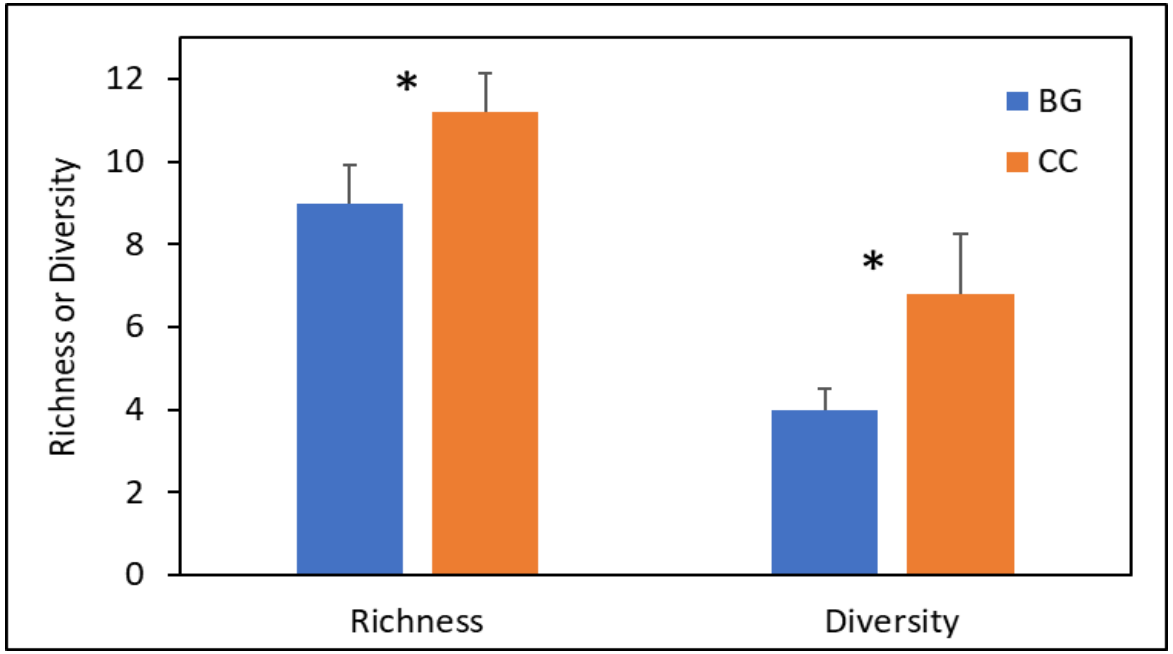


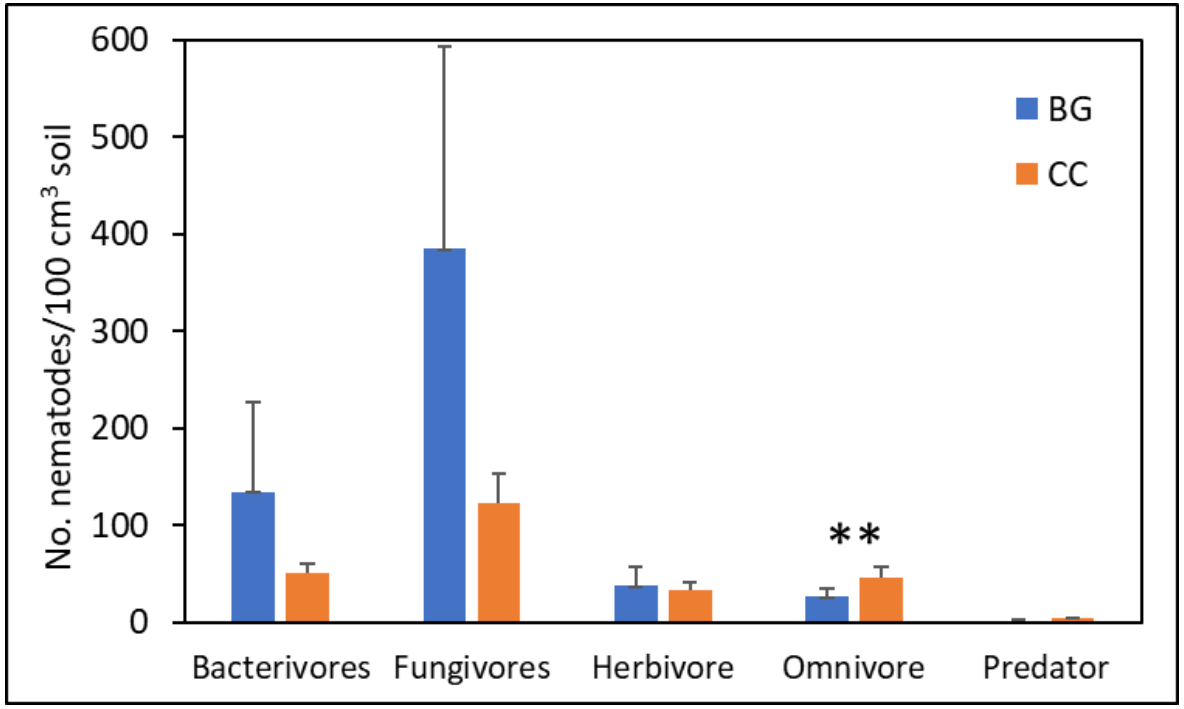
Living roots supported better soil properties

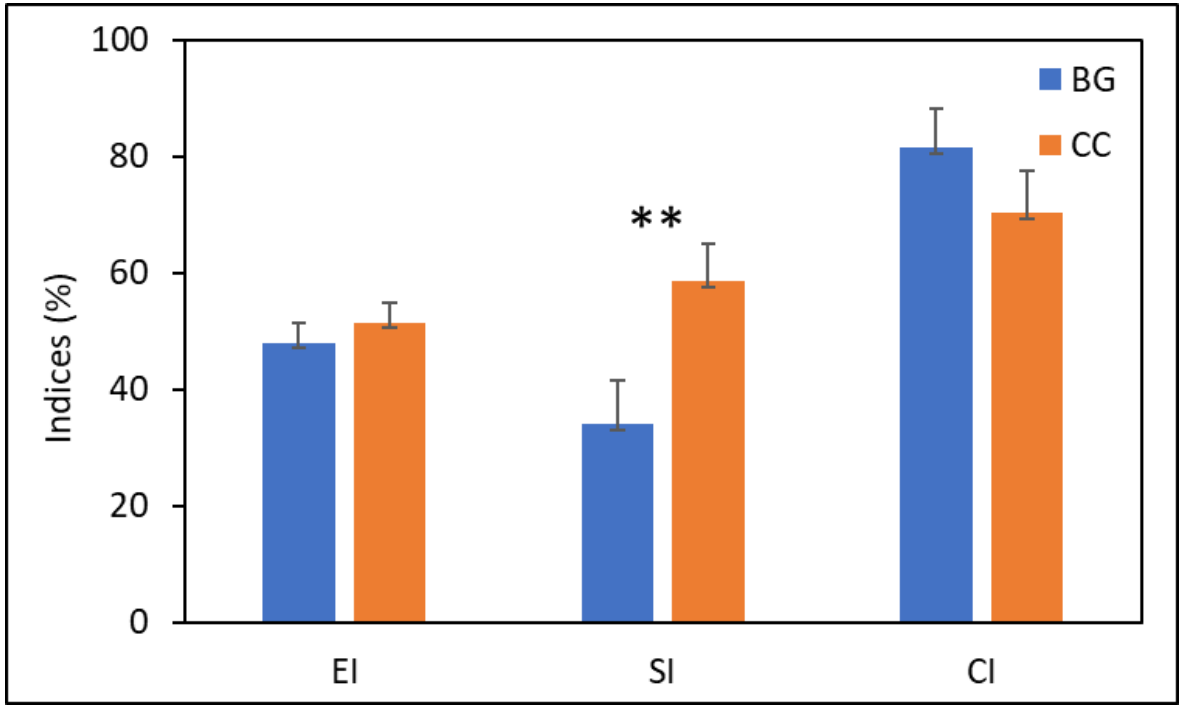
Soil Health Condition under Akamai Cover Crop Mix

(2 cycles: Sep 2021- March 2022)

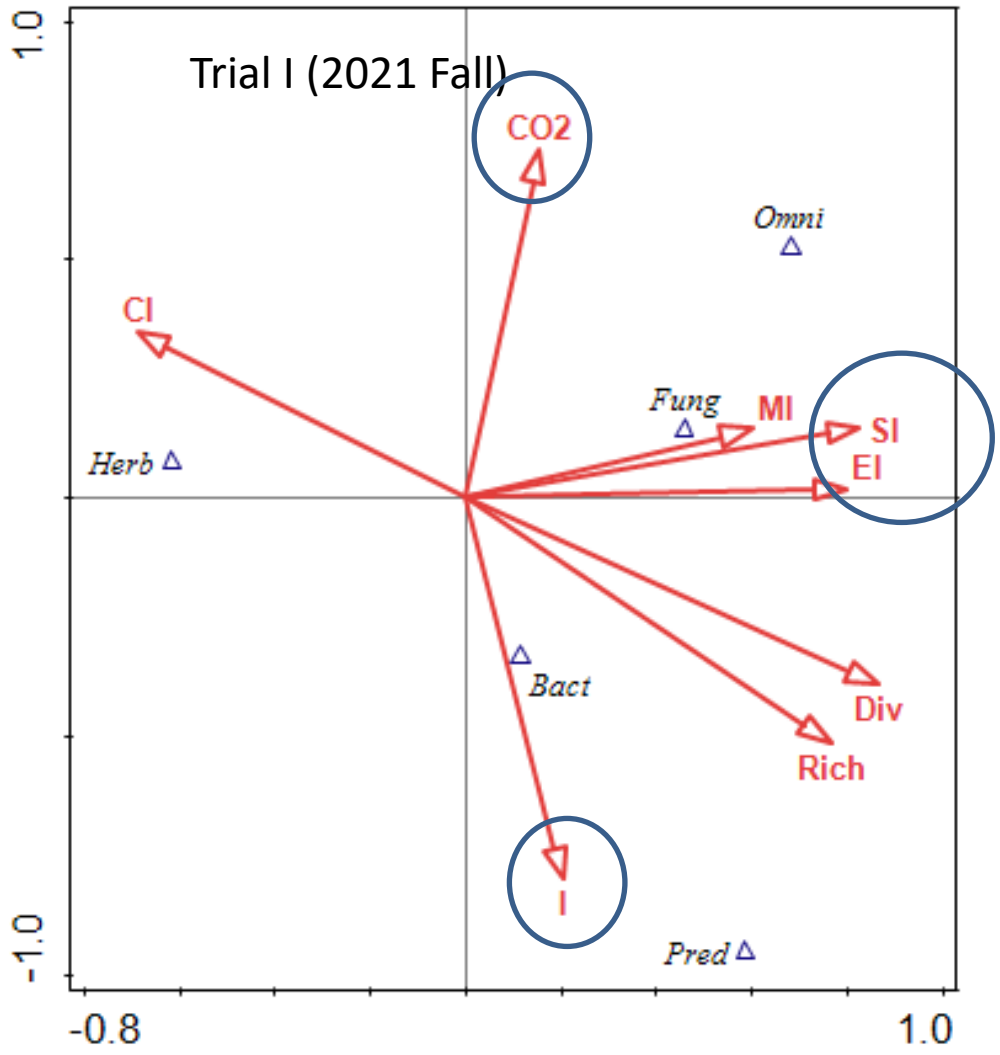
Akamai CC living mulch increased omnivores, richness and diversity, and improved soil food web structure





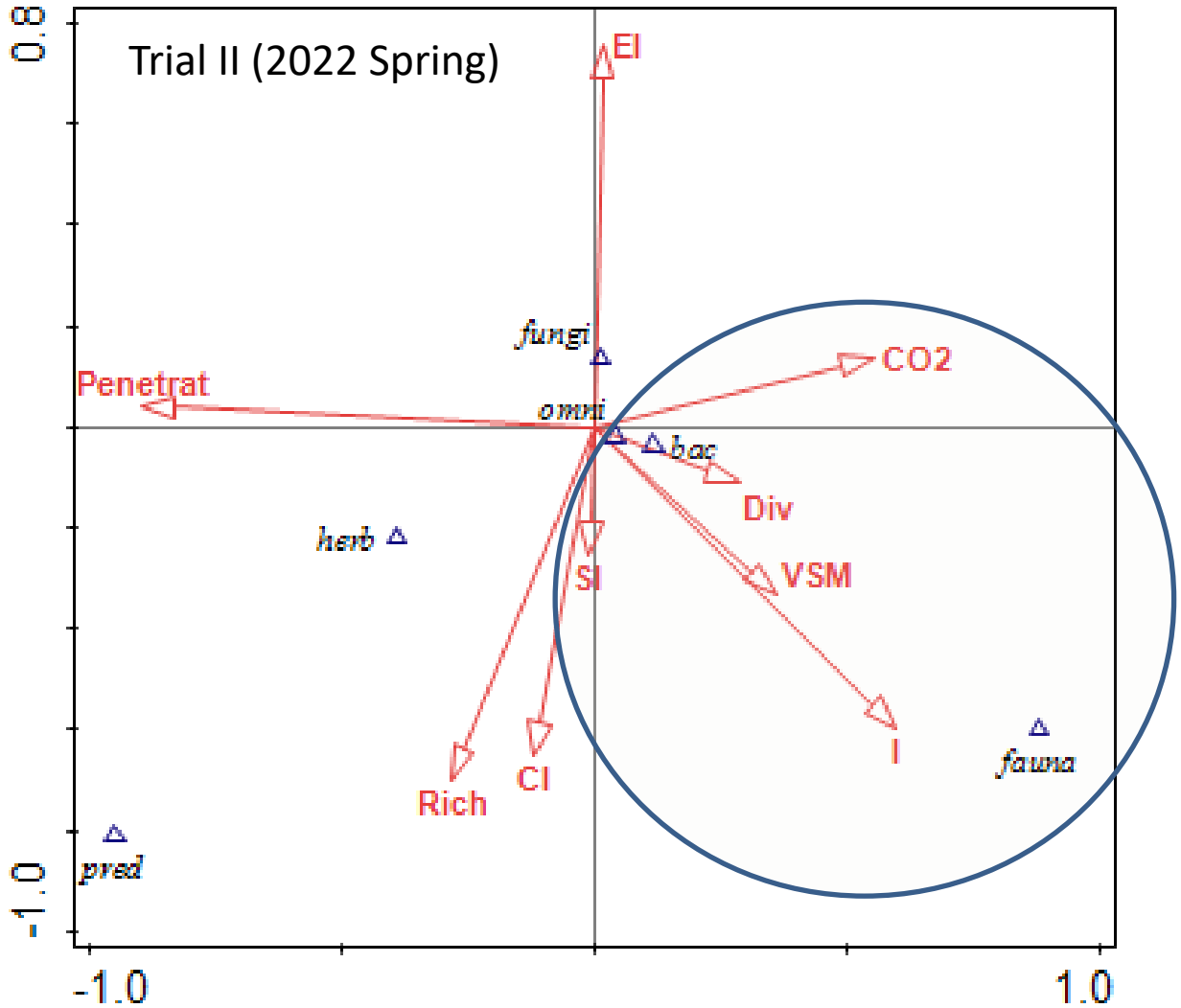


Trial I: Improvement in soil health indices did not relate to soil microbial respiration and infiltration rates.



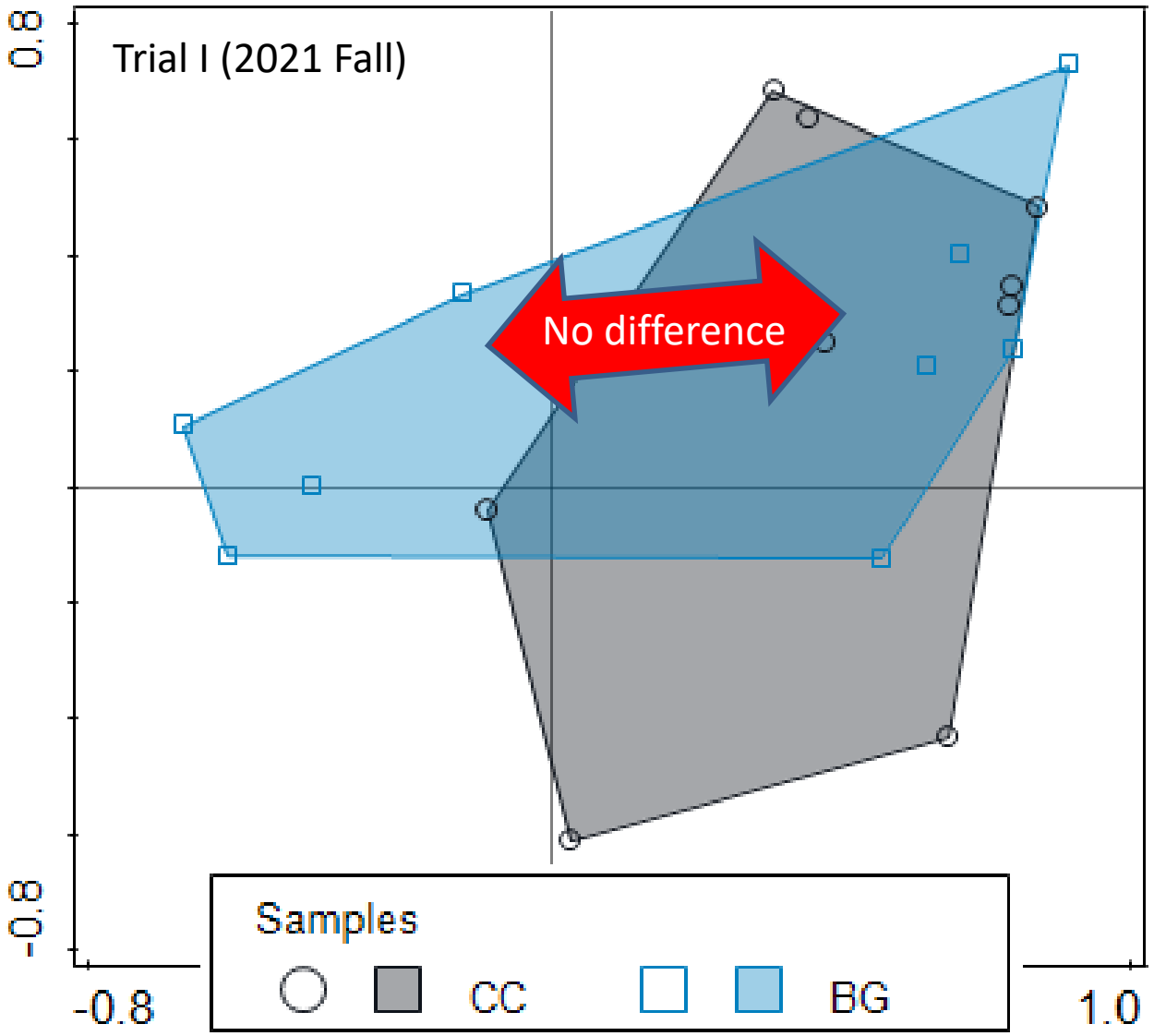
First 2 canonical axes explained 90.24% of the variance.

Trial II: Increase in SI and abundance of other soil fauna (not nematodes) were positively related to infiltration (I) and soil moisture (VSM). Soil microbial respiration (CO2) was more related to abundance of bacterivorous nematodes and diversity).

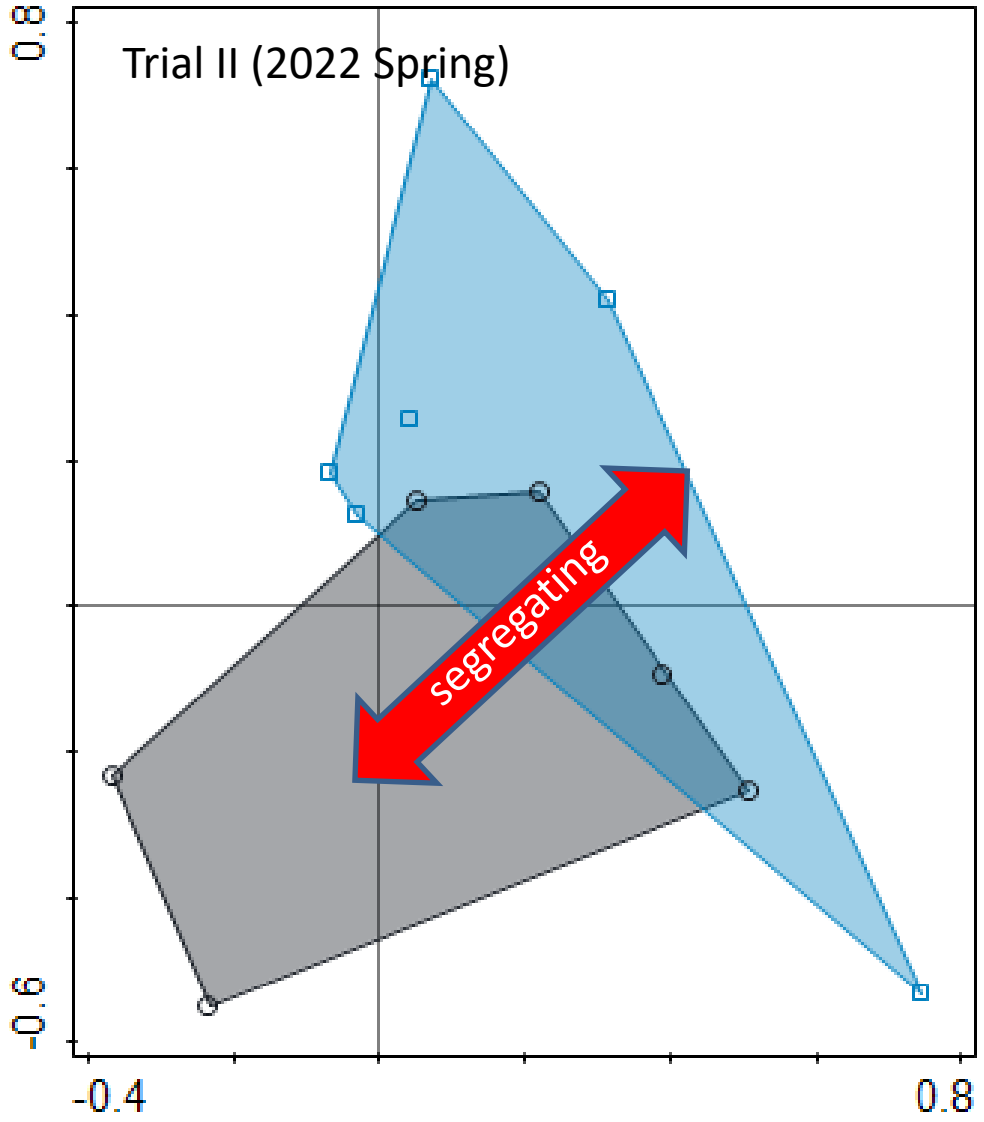


First 2 canonical axes explained 77.94% of the variance.

Short-term Cover Cropping



Long-term Living Mulch



Acknowledgement

Donna Meyer
Lauren Braley
Quynn Cytryn
Kira Tobita
Kahumana Farm

Magoon Teaching Plot where students transplanted into a solid stand of white clover following Akamai Cover Crop Mix planting strategy.

This project is supported by NRCS CIG Hawaii NR1992510002G001 and NR2192510002G002, NIFA OREI (HAW09705-G) CTAHR Hatch, Multistate (NE2140), Plan of Work (HAW9048-H, 9034-R and POW 16-964), and WSARE graduate student grant GW20-212.


Any Questions?