College of Tropical Agriculture and Human Resources
University of Hawaii at Manoa

CENTER FOR RURAL AGRICULTURAL TRAINING & ENTREPRENEURSHIP (CRATE) UPDATE

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Archana Pant
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USDA
United States Department of Agriculture
National Institute of Food and Agriculture

PARTNERSHIP

Sustainable Pest Management Lab
University of Hawai'i at Mānoa,
College of Tropical Agriculture and Human Resources

Sustainable and Organic Agriculture Program
College of Tropical Agriculture and Human Resources - University of Hawai'i at Mānoa

Aquaponics
Jari Sugano,
Jensen Uyeda,
Steve Fukuda

LIFE Local & Immigrant Farmer Education
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Aquaponics
Center for Rural Agricultural Training and Entrepreneurship
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University of Hawaii
Aquaponic Group
Clyde Tamaru
(Bradley Fox)

GOFARM HAWAI'I
Steve Chiang

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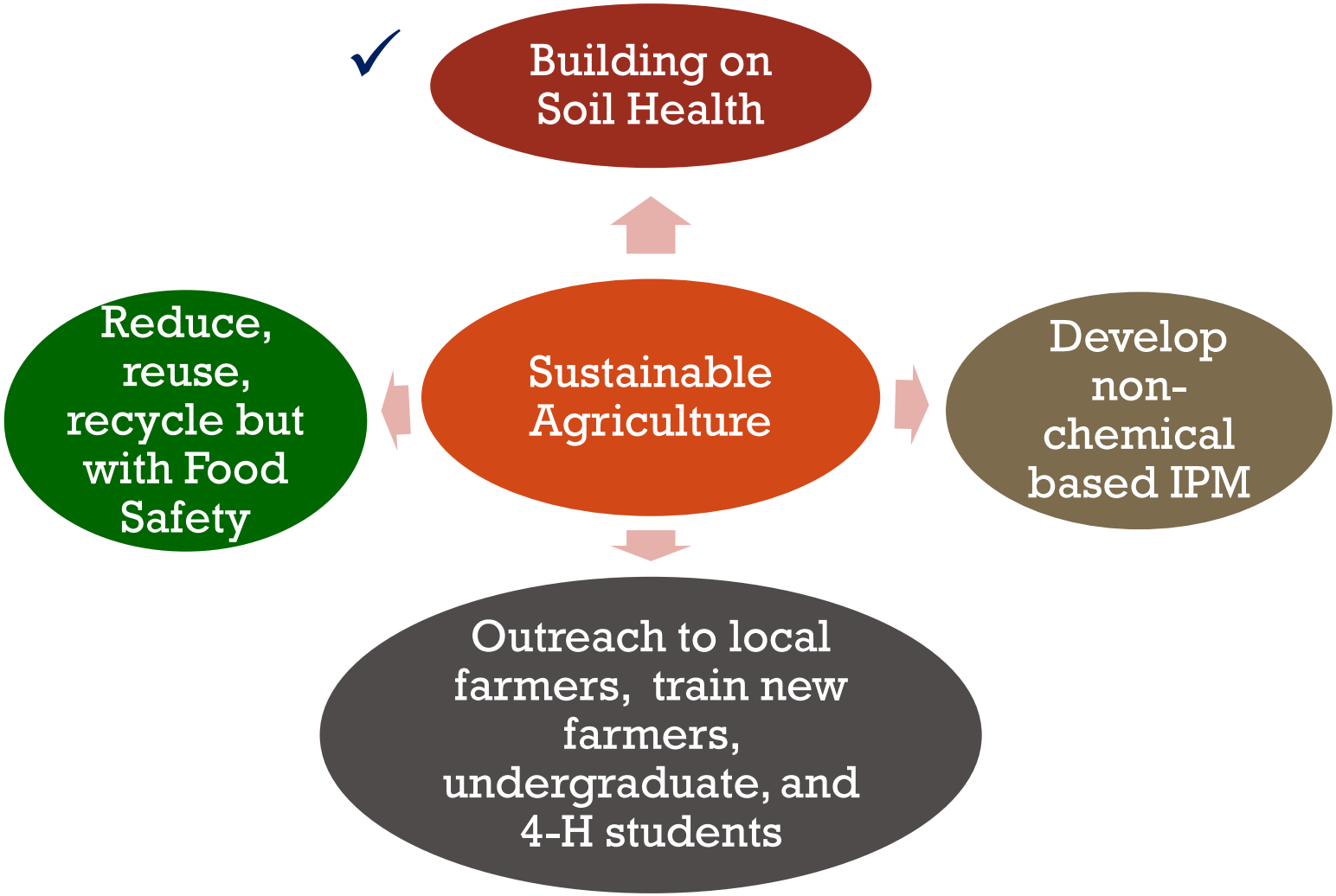
The Founding College of the University of Hawai'i, established 1907

Rose Saito
Hawaii 4-H
A Program of Hawaii Cooperative Extension

CRATE OBJECTIVES

How to make organic farming more profitable and sustainable?



EFFICIENT USE OF ON-FARM RESOURCES

Ray Archuleta: The road to Soil Health-Farming in the 21th century

- Cover crops for soil health improvement
  - Does mix cover cropping resulted in better soil health than single cover cropping?
- Introducing beneficial soil organisms to agricultural soil
  - Can introducing beneficial soil organisms reduce fertilizer use?

A FARMER'S FAVORITE COCKTAIL

MAY NOT BE WHAT YOU THINK.

INNOVATIVE FARMERS ARE BREATHING NEW LIFE INTO THEIR SOIL BY SEEDING A "COCKTAIL MIX" OF 6-12 PLANTS TO GET DIVERSITY ABOVE-GROUND, WHICH CREATES MUCH-NEEDED DIVERSITY BELOW THE GROUND. THROUGH THAT DIVERSITY, FARMERS ARE MIMICKING THE SOIL-BUILDING AND MICROBIAL-FRIENDLY CONDITIONS OF THE DIVERSE NATIVE PRAIRIES.

WANT MORE SOIL SECRETS?

CHECK OUT

WWW.NRCS.USDA.GOV

Winter Cover Crop Trial at Laulamilo Experiment Station, Waimea, HI

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USDA NRCS
United States Department of Agriculture
Natural Resources Conservation Service

Nematodes as Indicators of Soil Health

Bacterivore **Fungivore** **Herbivore** **Omnivore** **Predator**

EI=Enrichment index

CI=Channel index

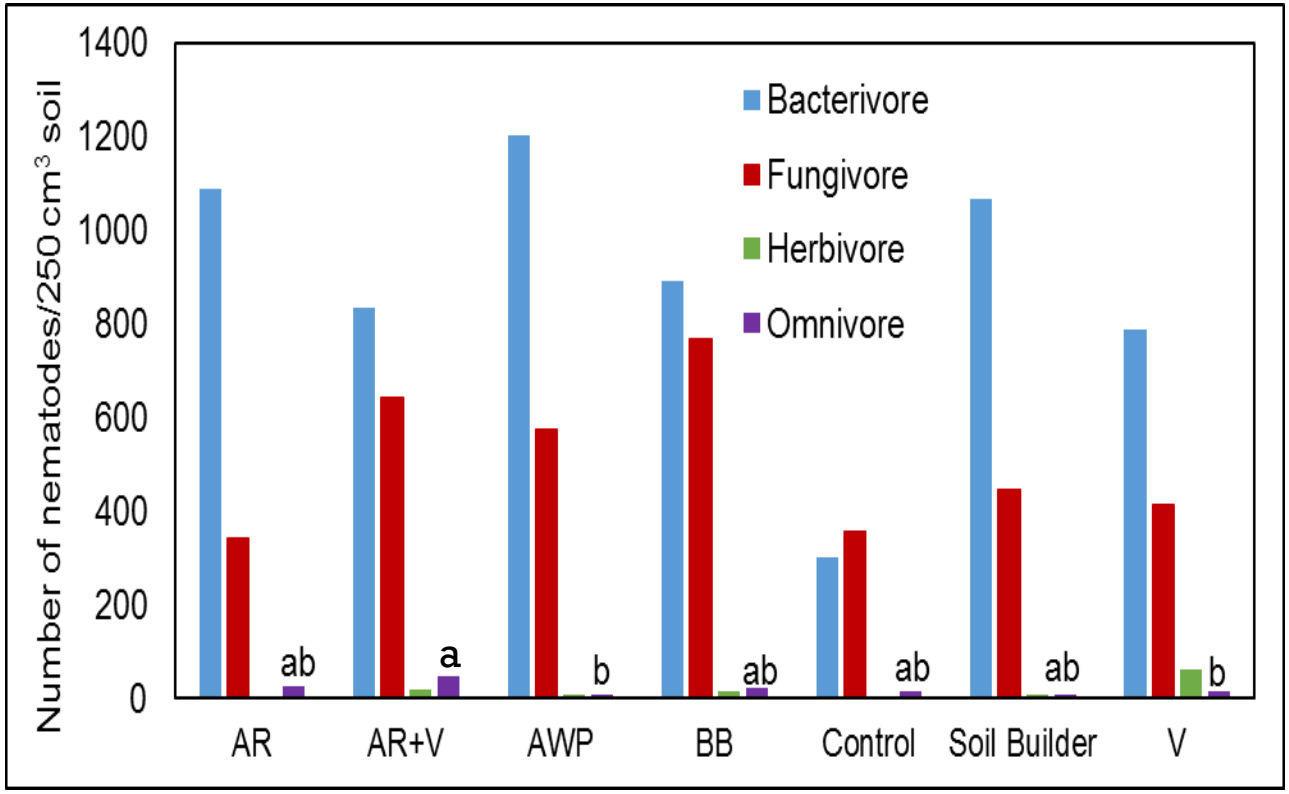
SI=Structure index

+ richness, diversity

Till in organic matters

Reduce tillage

EVALUATING SOIL HEALTH PROVIDED BY WINTER COVER CROP (MIXTURES) FOR HIGHLANDS (LAULAMILO, WAIMEA)



AR = Annual ryegrass
AR+V=AR+hairy vetch
AWP=Austrian winterpea
BB=Bell bean
Control=bare ground
V=Hairy vetch

- Cover cropping improved soil health compared to Control.
- AWP enriched the soil, BB provided a more balance bacteria/fungal decomposition channels, adding AR to V provided a more balance decomposition pathways. Soil builder (7 mix) only performed averagely in Waimea.

Soil Builder = commercial cover crop mix of bell bean (*Vicia faba*), BioMaster peas, Arvika peas (*Pisum sativum*), purple vetch (*Vicia americana*), hairy vetch (*Vicia villosa)*, common vetch and Cayuse oat (*Avena sativa*).

WINTER COVER CROPS FOR HIGH ELEVATION (WAIAMEA, BIG ISLAND)

Bell bean (*Vicia faba*)

hairy vetch (*Vicia villosa)*

Annual rye (*Lolium multiflorum*)- cannot compete with weeds

Austrian winterpea (*Pisum sativum subsp. Arvense)*

Annual rye + hairy vetch

CAN INTRODUCTION OF BENEFICIAL SOIL ORGANISMS REDUCE FERTILIZER USE?

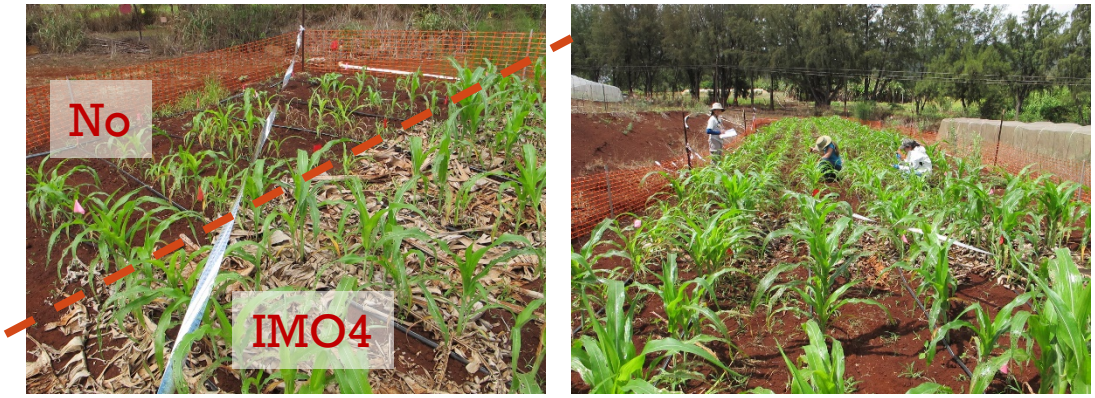
Produce

Jari Sugano,
Jensen Uyeda,
Steve Fukuda

- **Sumagrow** contains various plant-growth promoting rhizobacteria: *Bacillus subtilis, Pseudomonas putida, Rhizobium leguminosarum, Trichoderma virens, T. harzianum, Asobacter vinelandii* + Humic acid.
- Mykos liquid, Mykos Gold: *Rhizophagus irregularis* (formal *Glomus irregularis*)
- Indigenous microorganisms (IMO): Deliberate cultivation of indigenous microorganism collected from natural area (e.g. forest) close to farmland, to restore nutrient cycling organisms into human disturbed agroecosystem. This practice is in conjunction with minimal tillage, mulching with organic surface mulch, and foliar spray with nutrient input extracted from excess farm produce.

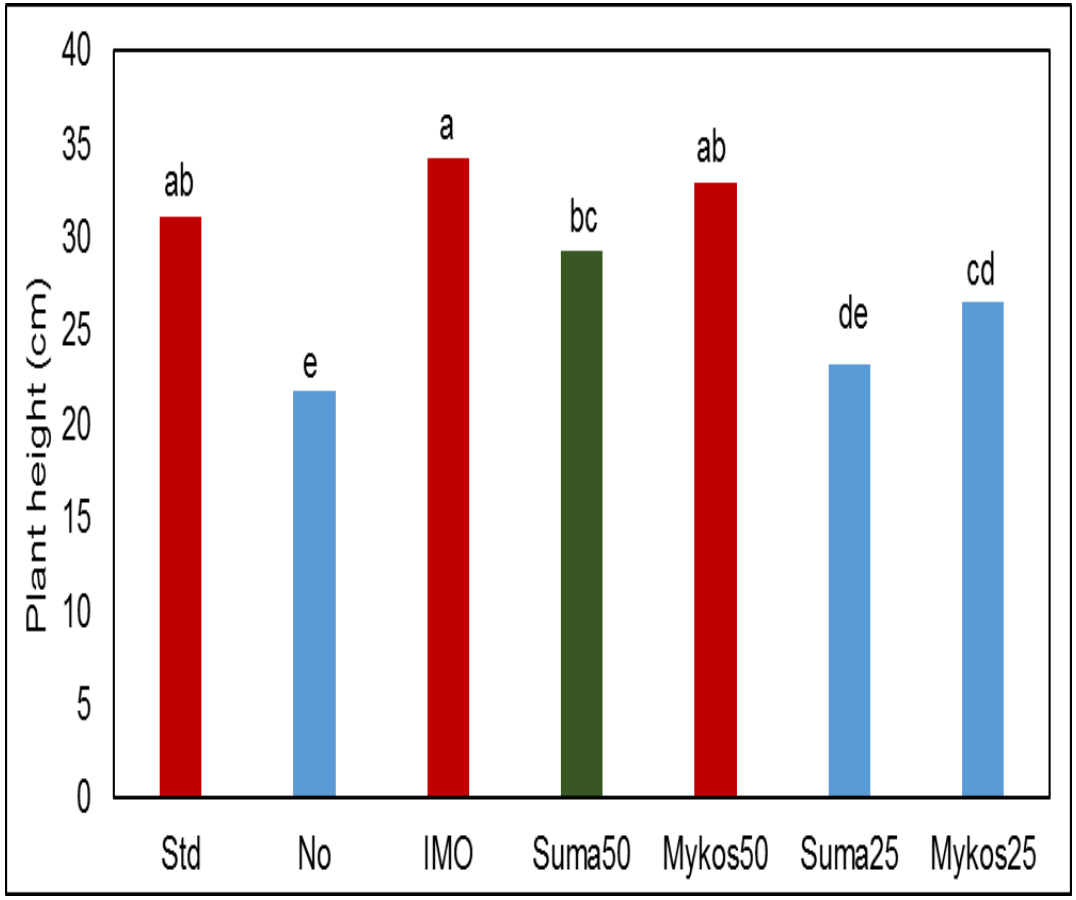
IMO

INTRODUCING SOIL MICROORGANISMS



Results were partly complicated by bird damage.

1. Std = standard fertilizer (200 lb N/acre)
2. No = no fertilizer
3. IMO = Indigenous microorganisms + foliar spray (no additional fertilizer)
4. Suma50 = Sumagrow + 50% of the Std
5. Mykos50 = Mykos liquid + 50% of the Std
6. Suma25 = Sumagrow + 25% of the Std
7. Mykos25 = Mykos liquid + 25% of the Std



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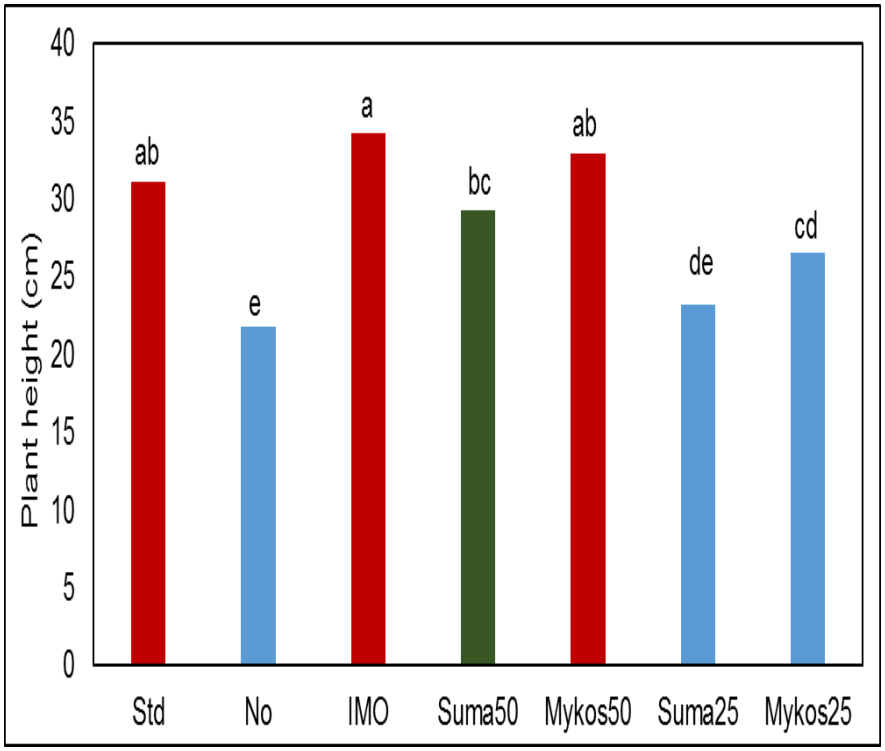
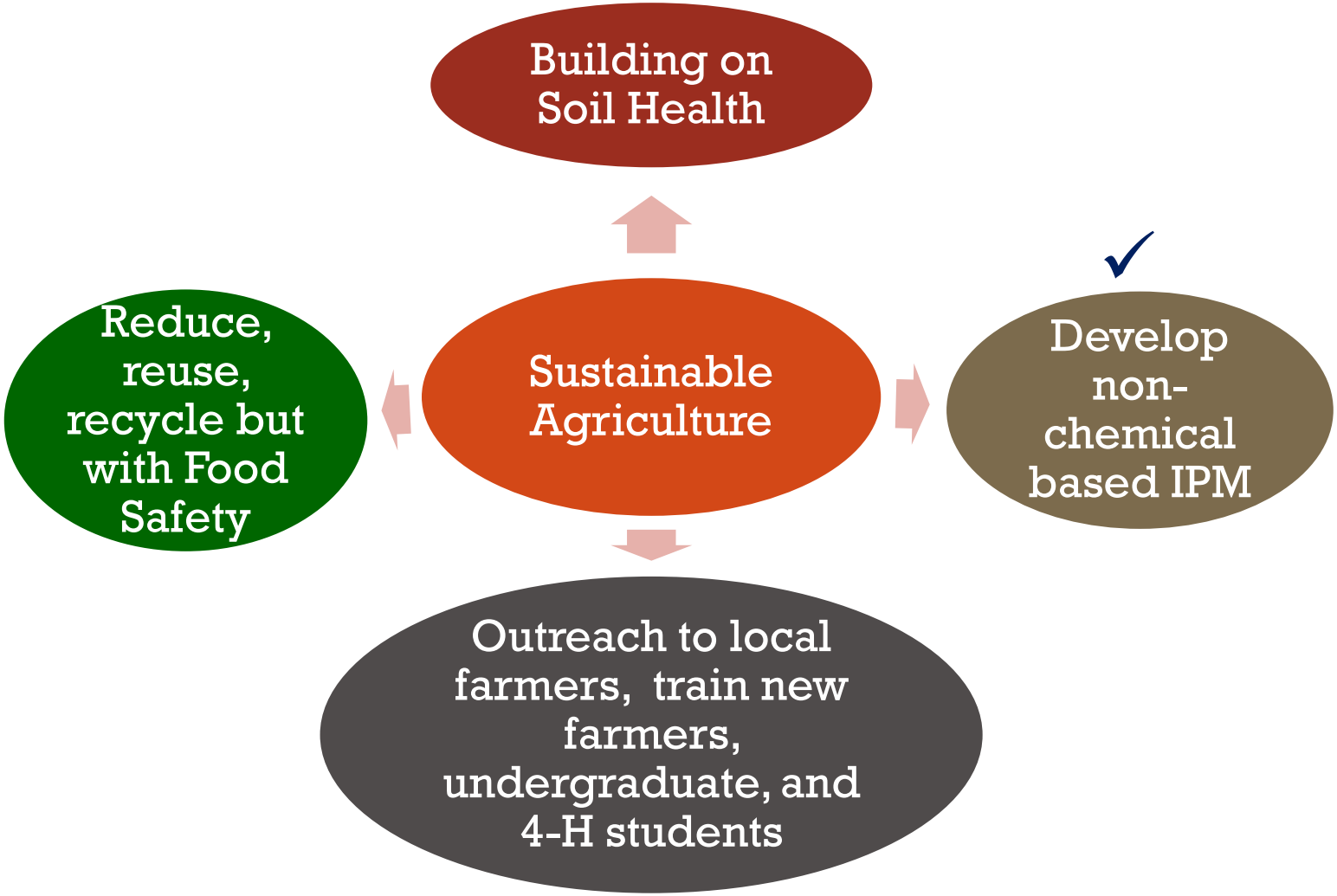


- Introduction of commercial rhizobacteria (Sumagrow) and mycorrhizae (Mykos) could reduced 50% of fertilizer use.
- Introduction of farm prepared IMO produced corn growth similar to the standard fertilizer practice.
- Experiment in progress to measure soil health……

For more information on how IMO4 compost affect soil health, please visit: http://www.ctahr.hawaii.edu/WangKH/KNF.html

CRATE OBJECTIVES



WHY A NEED ON NON-CHEMICAL BASED IPM?

Disadvantages of pesticides (OMRI or not) and monoculture:

- Environmental hazard (bees, aquatic invertebrates)
- Low biodiversity
- Pesticide treadmill
- NOP Sunset list

Several organic insecticides such as sulfur, horticultural oil, insecticidal soap, and even insect pheromone and sticky traps for insect management are on the National Organic Program (NOP) Sunset list due on 27 Jun, 2017.

(http://www.ams.usda.gov/AMSv1.0/getfile?dDocName=STELPRDC5096045)

DEVELOP NON-CHEMICAL BASED PEST MANAGEMENT STRATEGIES

- Attracting natural enemies of arthropod pests through the planting of insectary borders
- Induce host plant resistance through vermicompost tea drenching
- Recycle spent oyster mushroom compost for nematode management (Shelby Ching's Booth)
- Soil solarization for weed management

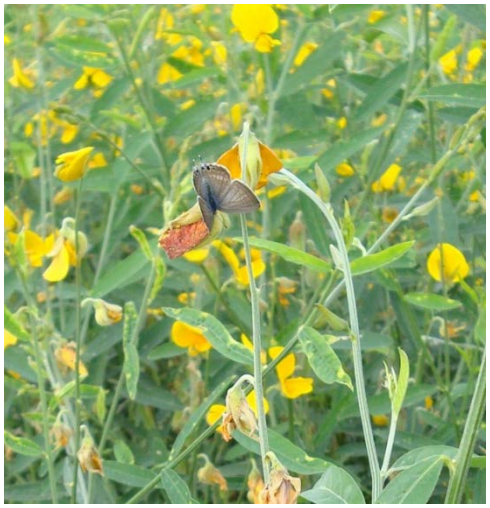
C.R.A.T.E.

INSECTARY PLANTS

- Plants that attract insects, either by producing abundant flowers with pollen and nectar for beneficial insects, or by luring insect pests away from the cash crop.

Hoverflies on buckwheat

Hoverflies on cilantro



Sunn hemp flowers attract Lycaenidae butterflies that drawn *Trichogramma* wasps to lay eggs on the Lepidopteran eggs.

WASP NESTING BLOCK

Pollinators

Leaf cutter bee

Hylaeus bee

Untreated wood

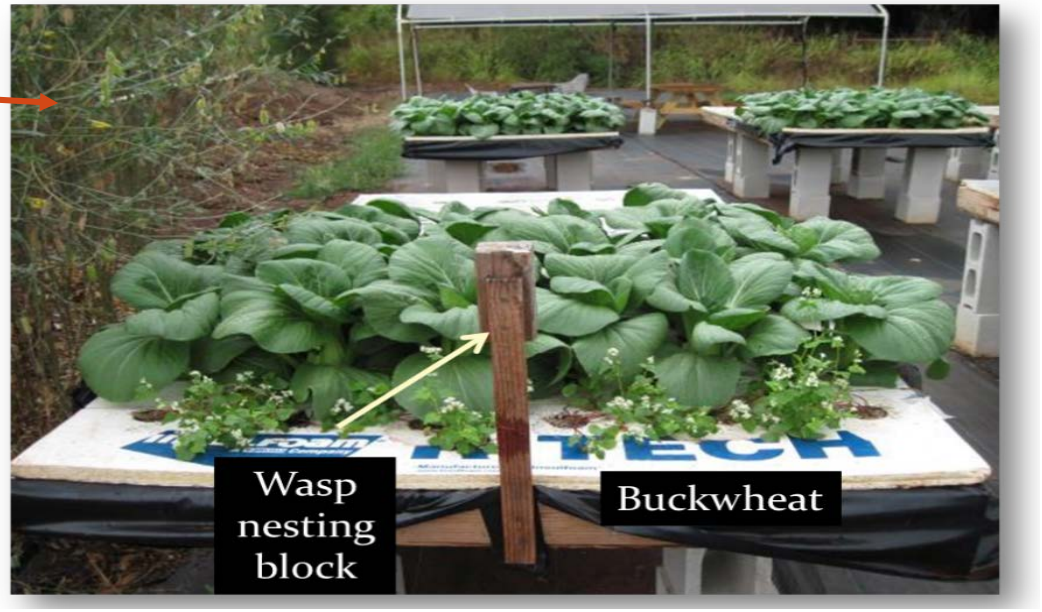
Predators

Key-hole Wasp

Aphid-collecting Wasp

INTEGRATING INSECTARY PLANTS WITH WASPS NESTING BLOCK

Sunn hemp border



aphids

Diamond back moth (DBM) larvae

Hoverfly larva eating aphid

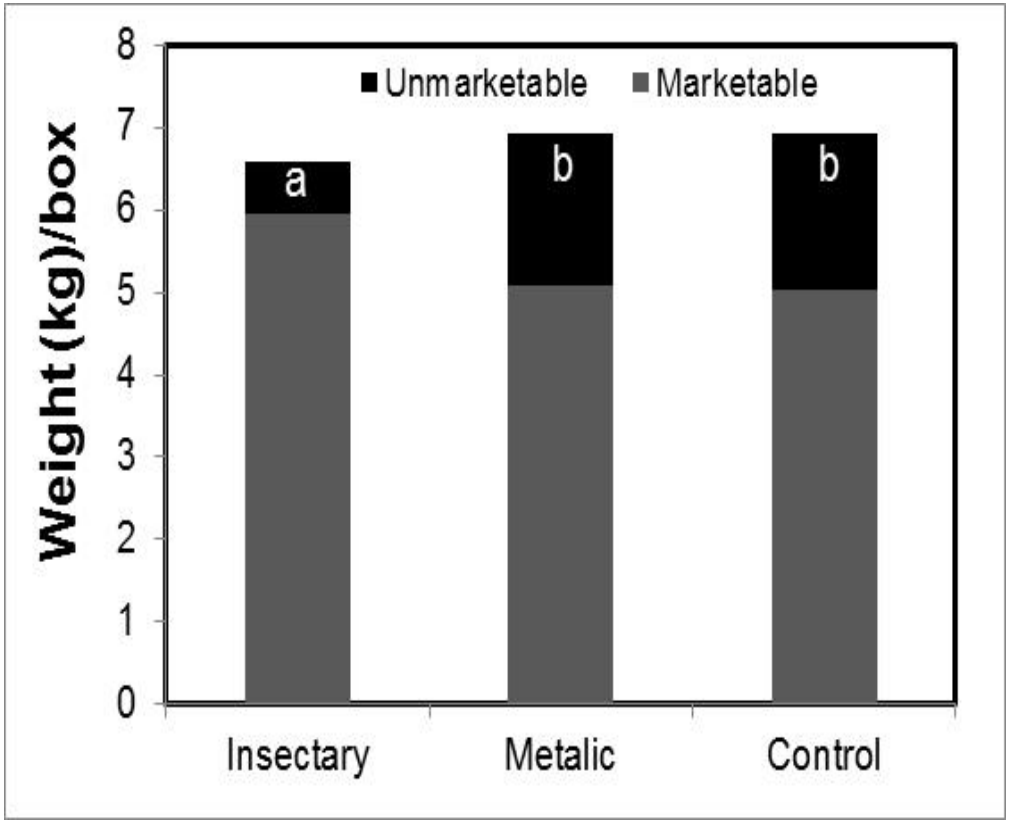
This insectary setting reduced aphids and DBM, and resulted in significant pak choi yield than the control treatment.

- http://www.ctahr.hawaii.edu/WangKH/sustainable-pest.html

SUMMARY

Insectary box:

- yielded similar to other treatments despite loosing one row of crop for buckwheat plants.
- had less unmarketable pak choi than the other treatments.



Jane Tavares, 2013

Integrating Insectary border with no-till sunn hemp cover cropping

Sunn hemp (SH) for 9 weeks, no till with flail mower

Cowpea & buckwheat border

No-till SH mulch

Case Study 3: Terrestrial Green Onion

2) Solarization (Sol)

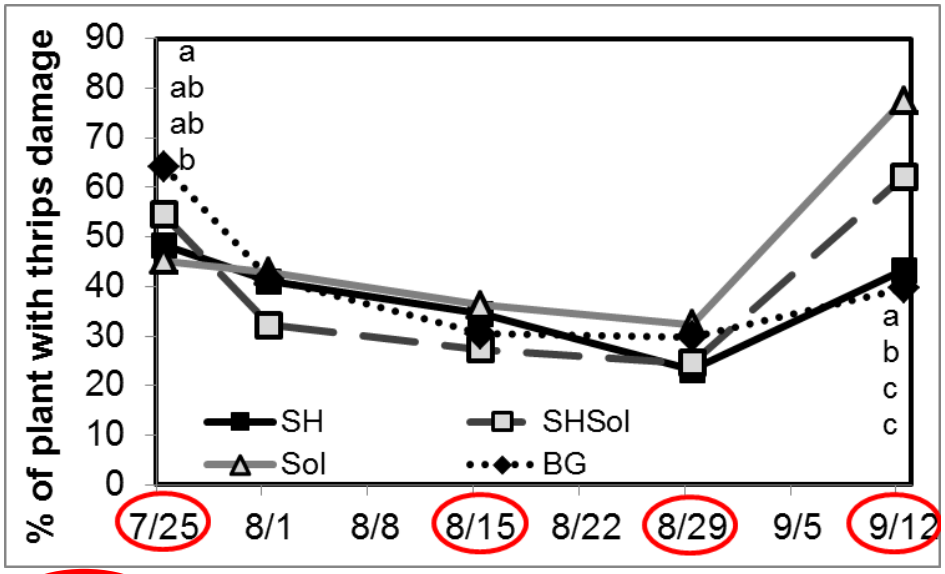
Till & Solarized for 11 weeks (1 µm thick, UV protected clear plastic)

3) SH + Solarization (SHSol)

Solarization for 1 month + SH grown for 7 wks
No-till with flail mower

Green onion planted into cut solarization mulch

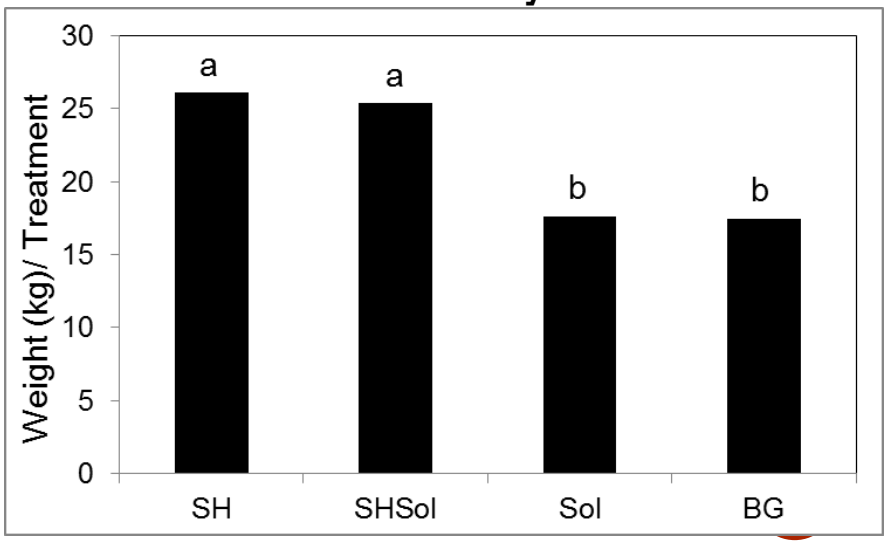
INSECTARY SETTINGS REDUCE THRIPS DAMAGE AND INCREASE CROP YIELD



= insecticide treatment in the BG

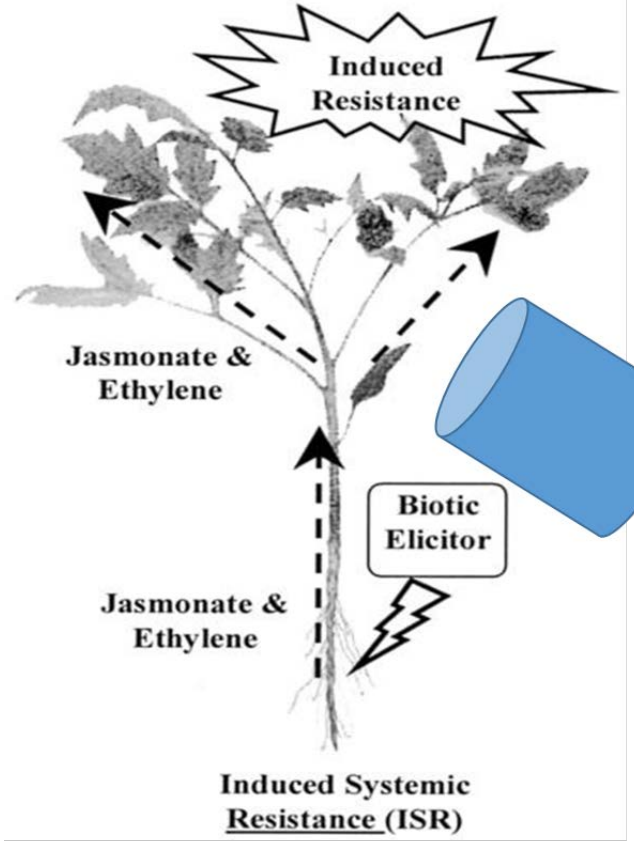
SH = Sunn hemp no-till+insectary border
Sol = Soil solarization
SHSol = Sunn hemp tilled + solarization
BG = Bare ground

Green onion yield



INDUCE HOST PLANT RESISTANCE THROUGH VERMICOMPOST TEA DRENCHING

ISR = Induced plant systemic immunity against broad spectrum of pests and pathogens by beneficial soil-borne microorganisms.



Rhizobacteria

CURING AGE OF VERMICOMPOST TEA AFFECT THE ISR CAPABILITY

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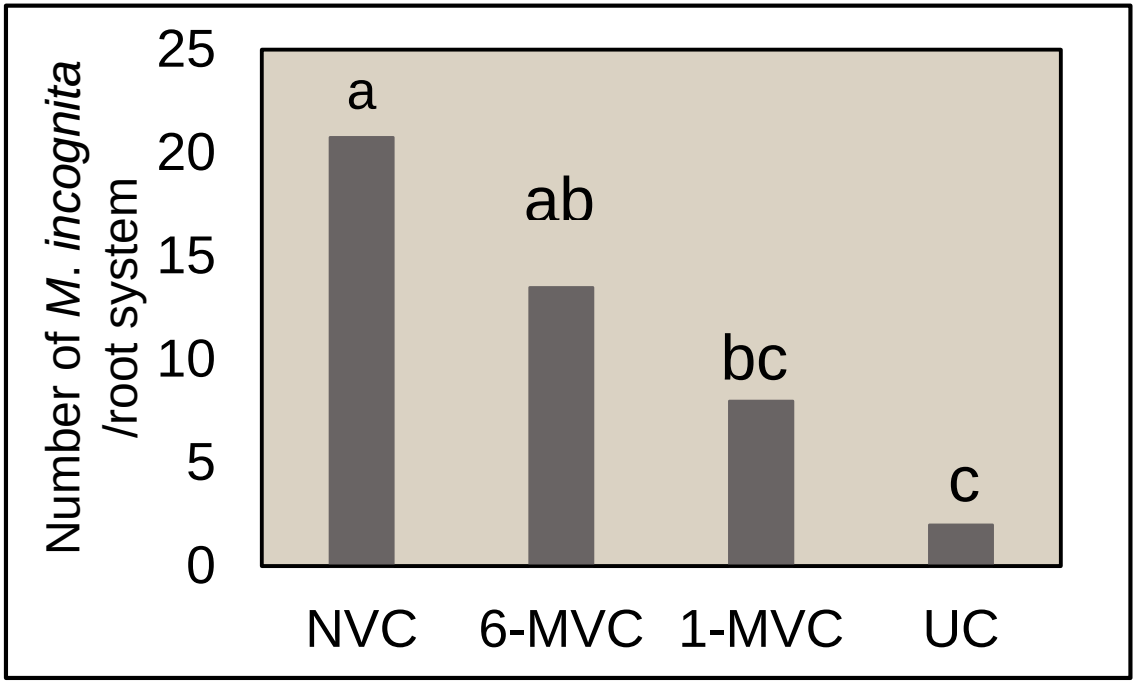
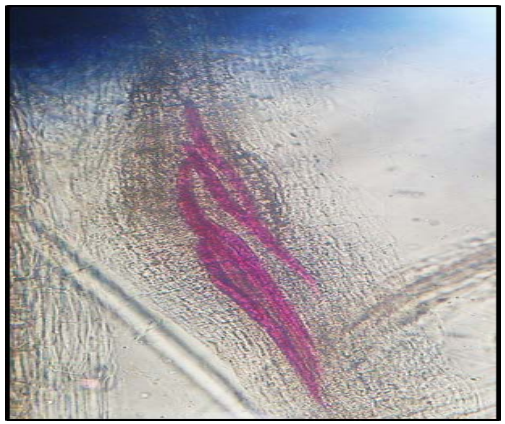


NVC: No vermicompost
6-MVC: VCT from 6 month cured verrmicompost
1-MVC: VCT from 1 month cured vermicompost
UC: VCT from uncured vermicompost

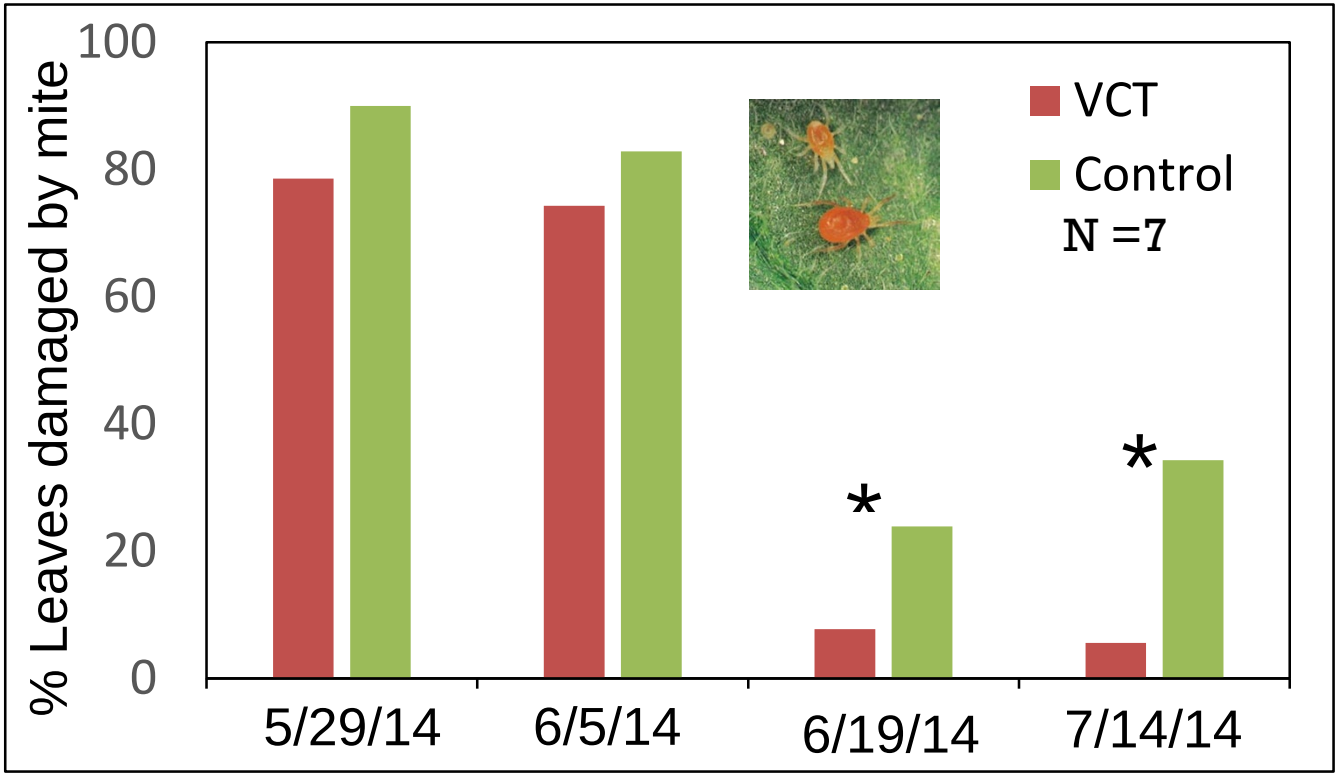
- Uncured and 1-month cured VCT suppressed root penetration of *M. incognita* ($P < 0.05$) compared to the NVC control on tomato.



Stained nematodes in root

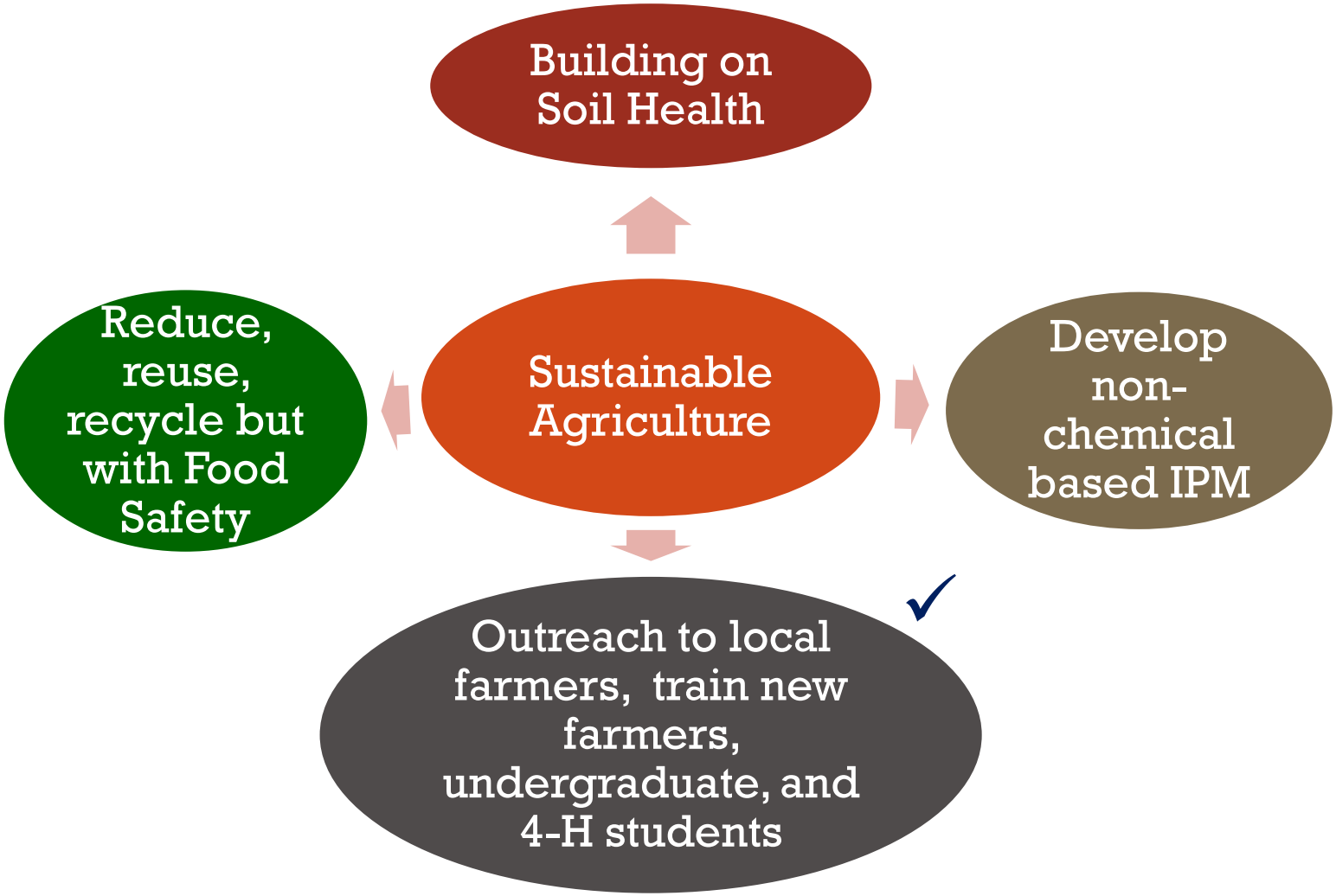
(Shova Mishra, 2014)

VERMICOMPOST TEA TREATMENT INDUCE TEA RESISTANCE TO SPIDER MITE DAMAGE



Tea damaged by spider mites

CRATE OBJECTIVES



OUT-DOOR CRATE CLASS ROOMS

CRATE CLASS ROOM

FACILITATE CTAHR COOPERATIVE EXTENSION SERVICE TO HOST MANY OUTREACH ACTIVITIES

Average 4 community visits to Poamoho Station per month (July –Aug 2014)

OUT-DOOR CRATE CLASS ROOMS ENHANCE CTAHR UNDERGRADUATE TEACHING PROGRAM

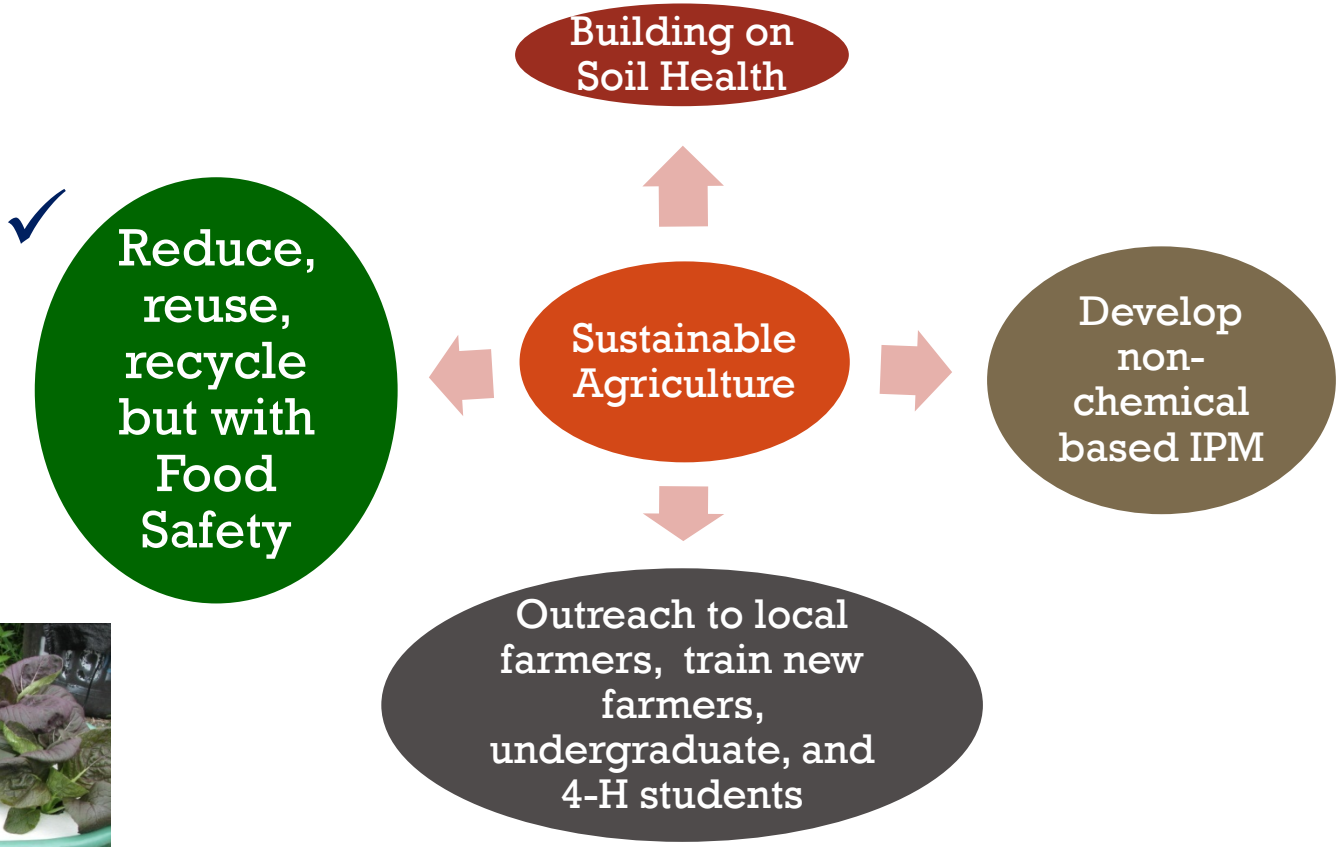
CRATE CLASS ROOMS ALSO TARGET ON TRAINING NEW FARMERS IN HAWAII

GoFarm Hawaii AgXposure

GOFARM HAWAI'I

HOW TO DO ORGANIC FARMING PROFITABILY?

Clyde S. Tamaru



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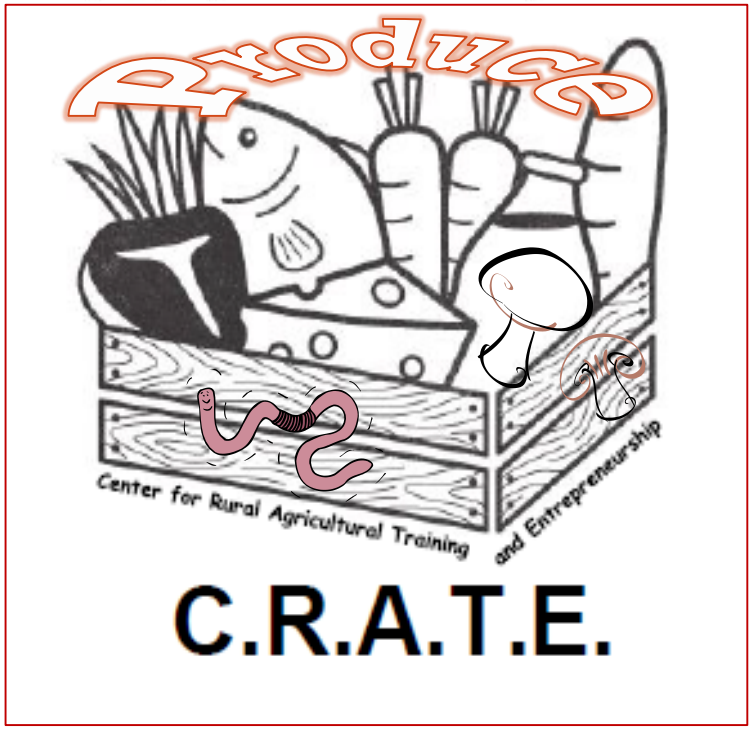

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