

Aquaponics in Hawaii Conference

Are we ready for insecticide-free aquaponic system?

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Why going after non-chemical based IPM for Aquaponic?

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



National Organic Program– 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>)



Options for Non-chemical Based IPM against Insect Pests for Aquaponic

❖ Biological

- * Planting insectary plants to attract natural enemies
- * Setting up wasp nesting block

❖ Physical

- * Using reflective hydroponic raft to repel insects

❖ Resistance

- * Using vermicompost extracts to induced host plant resistance

Natural Enemies of Insect Pests



Lady beetle



Braconid wasp



Trichogramma wasps



Green lacewing



Hover fly



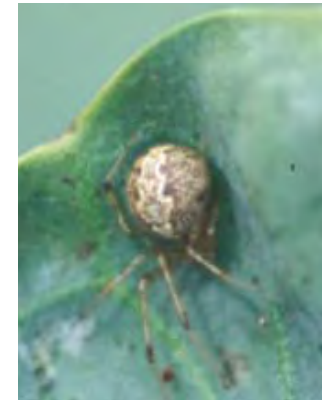
Tachinid fly



Assassin bug



Minute pirate bug



Insectary Plants

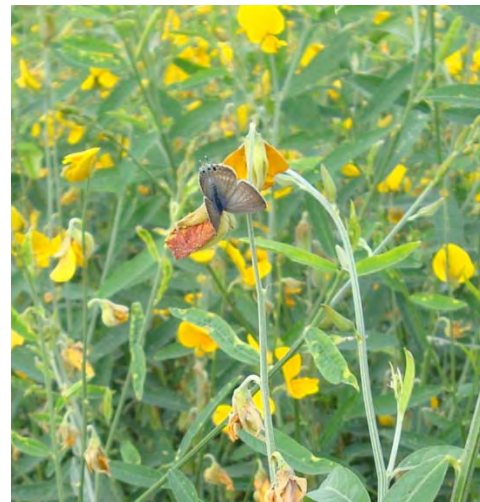
- * Plants that attract insects, either by producing abundant flowers with pollen and nectar for beneficial insects, or by luring insect pests away from the cash crop.



Hoverflies on buckwheat



Hoverflies on cilantro



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



Case Study 1: Non-Chemical based IPM for Green Onion Pests in Hydroponics



Wasp Nesting Block

Pollinators



Leaf cutter bee



Hylaeus bee



Untreated wood

Predators



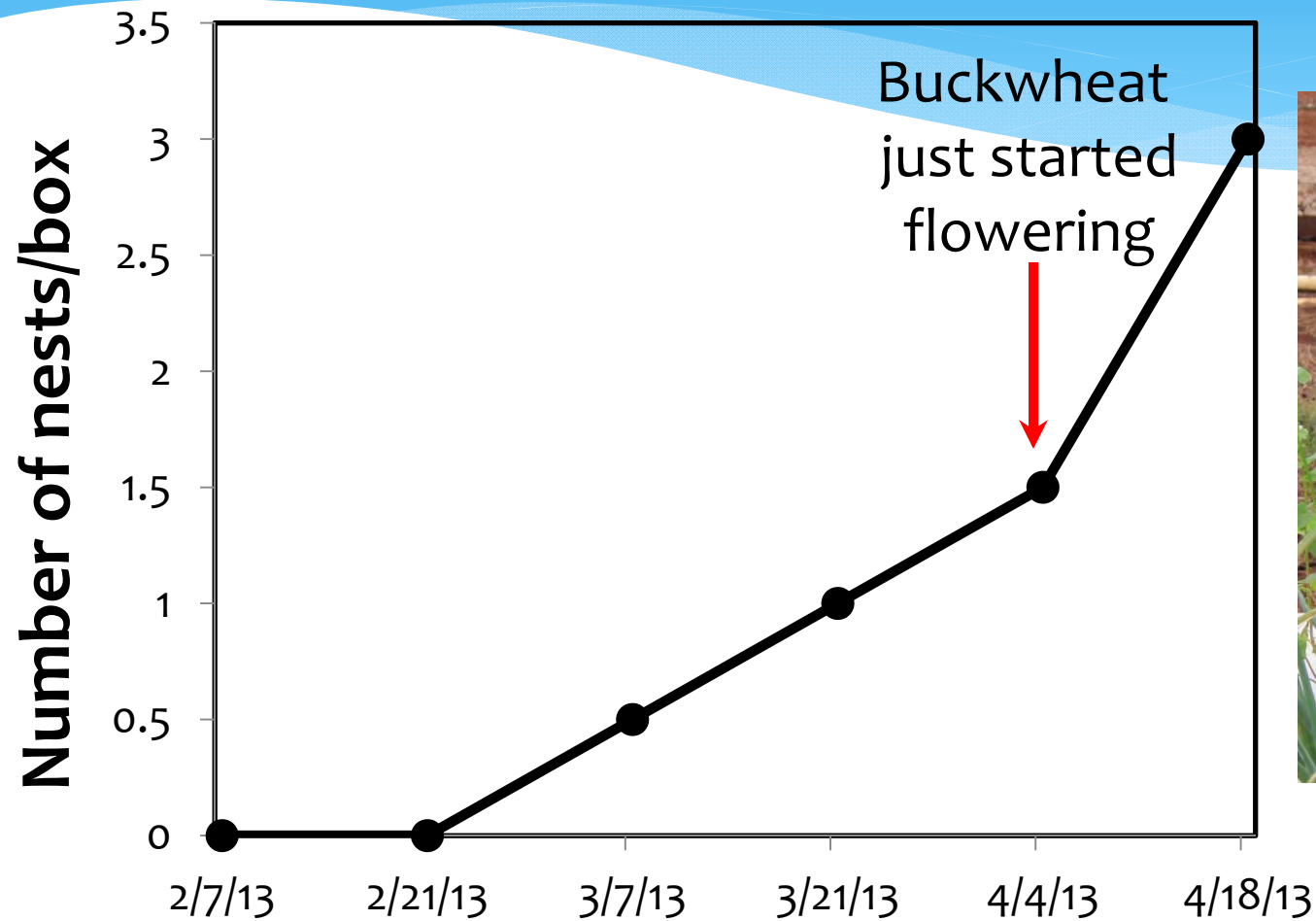
Key-hole Wasp

<http://bugguide.net/node/view/241212>



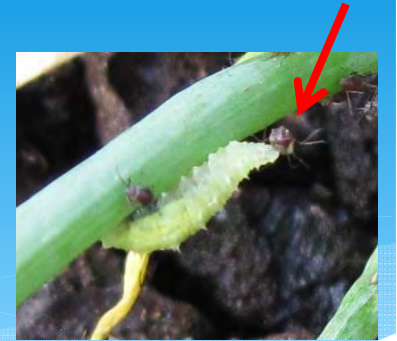
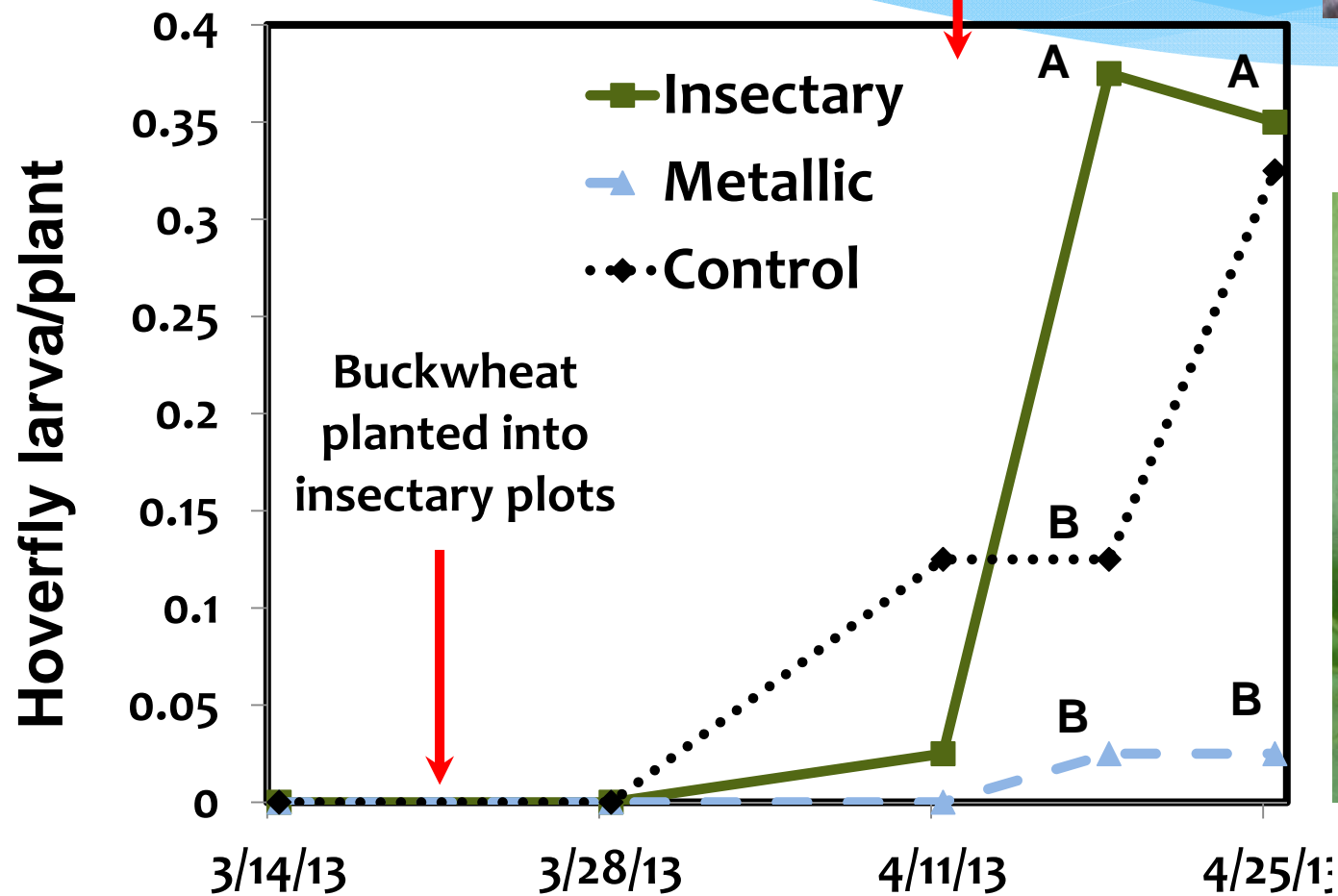
Aphid-collecting Wasp

Wasp Nesting Block



Total nesting hole possible = 18

Hoverflies



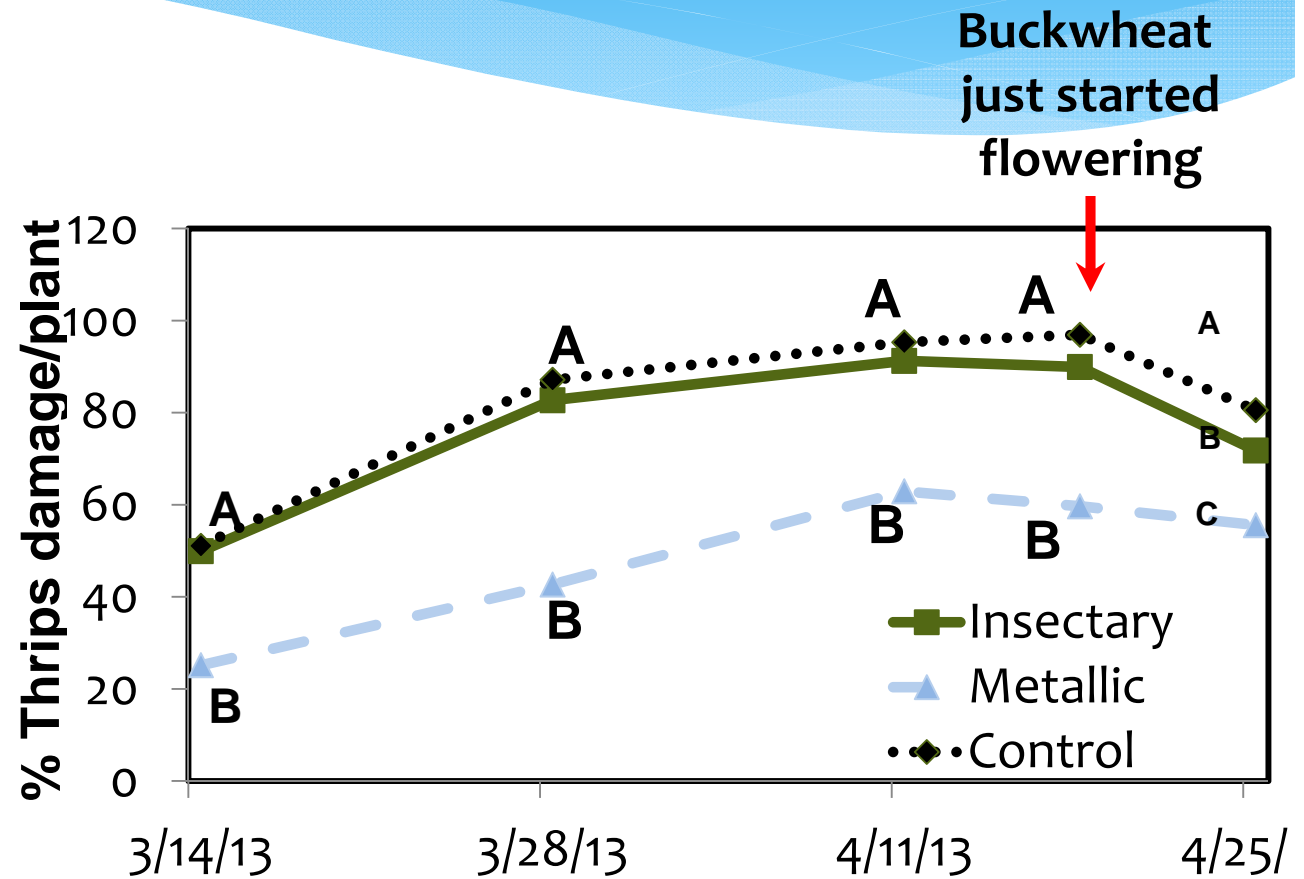
Hoverfly larva eating aphid



Thrips Damage



Light spots are an indication of thrip feeding/damage



Reflective Hydroponic Raft



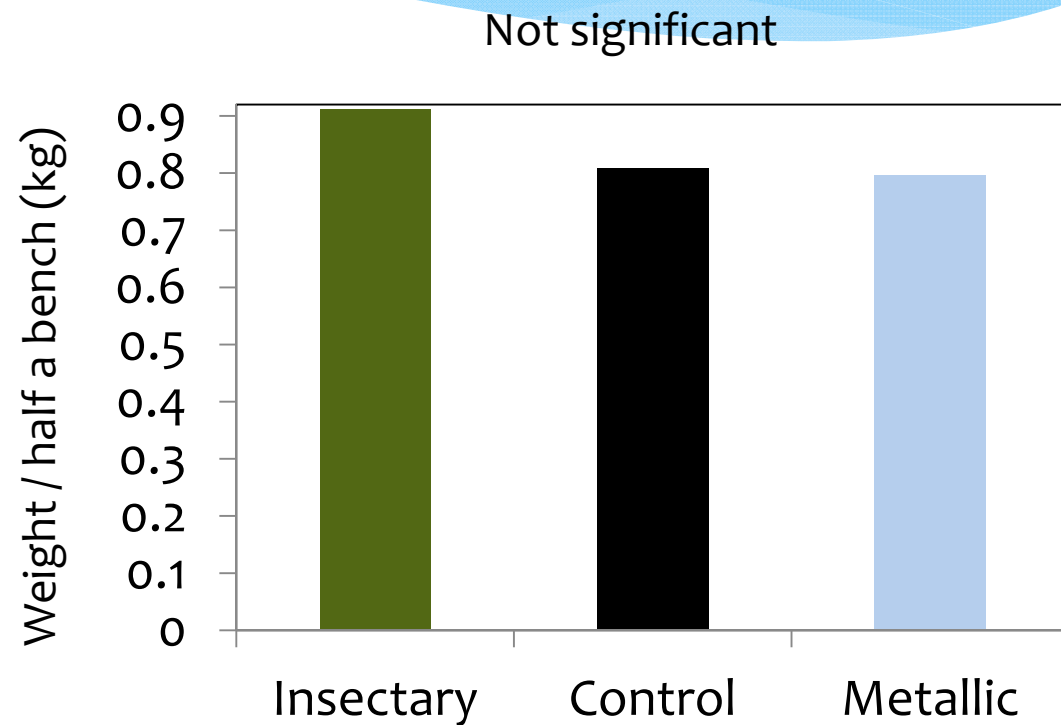
Reflective materials

- * Repel thrips and whiteflies, avoid insect transmitted viruses
- * Repel birds



No need bird netting

Green Onion Biomass



What would Sunn Hemp Border do?



- * 50% of the Lycaenidae eggs were parasitized by Trichogramma wasps (potential biocontrol agent against eggs of most Lepidopteran pests).

Onion Aphids on Aquaponic Cinder Bed is too damaging



March 7, 2013

Green Onions
Completely killed by
onion aphids

Green onion planted: January 31, 2013

Summary

- * Planting insectary plants can enhance natural enemies of insect pests (hoverflies), but only after they are in full bloom. Thus, critical to synchronize flowering time with crop production.
- * Wasp nesting block provide another means to enhance natural enemies of insect pests.
- * Reflective hydroponic raft could repel thrips and whiteflies.
- * Non-chemical based insect pests management strategies are more manageable in hydroponic raft system then on cinder beds.

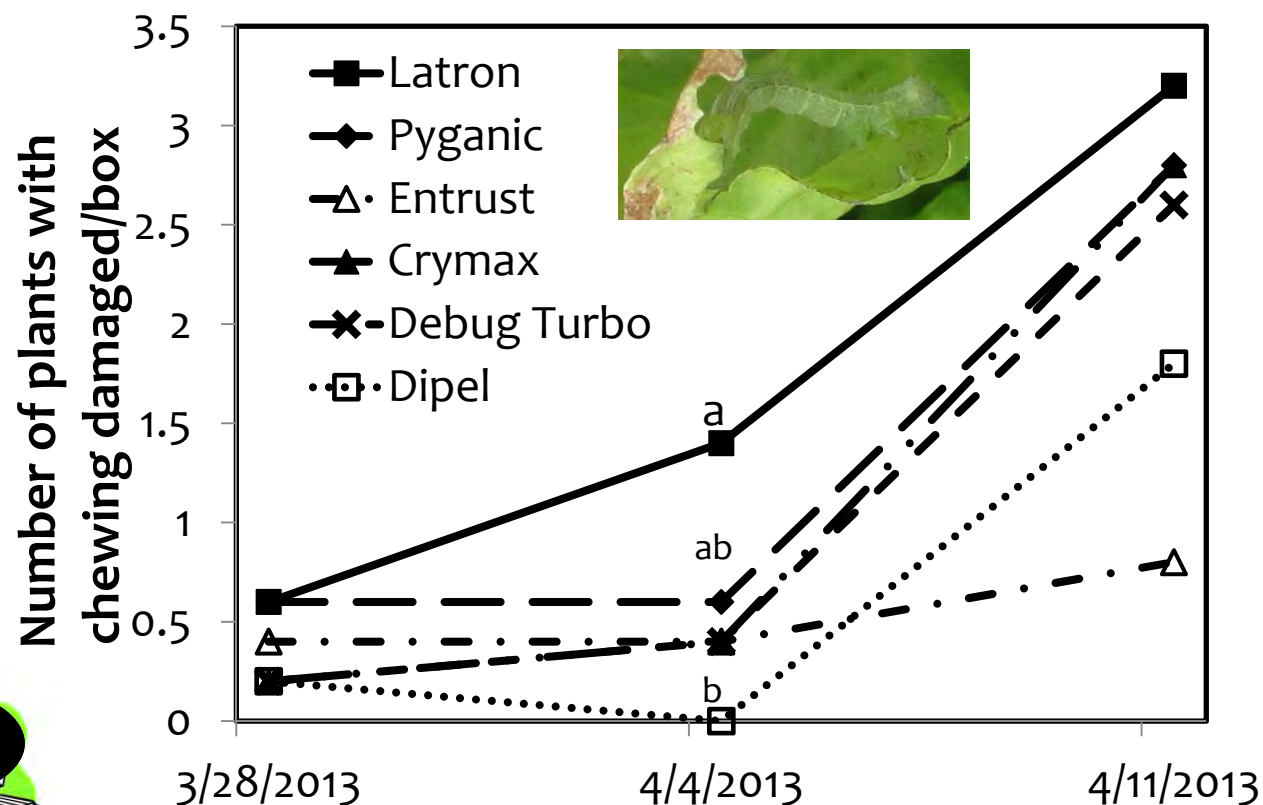
OMRI Insecticide Trials on Manoa Lettuce



- Entrust (a.i. spinosad) and Dipel (a.i. Bt) are most effective.
- Both are sensitive to pest resistance.



Cabbage Looper/Imported Cabbage Worm



Future Research

Induced Host Plant Resistance with Vermicompost Extract



Reduce aphids on tomatoes

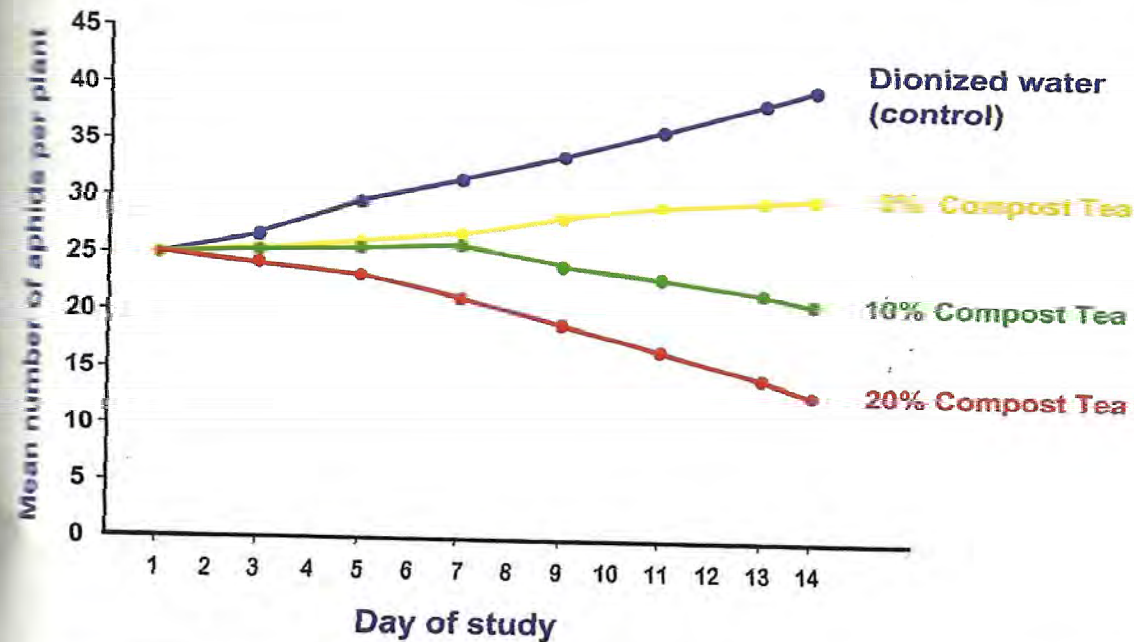
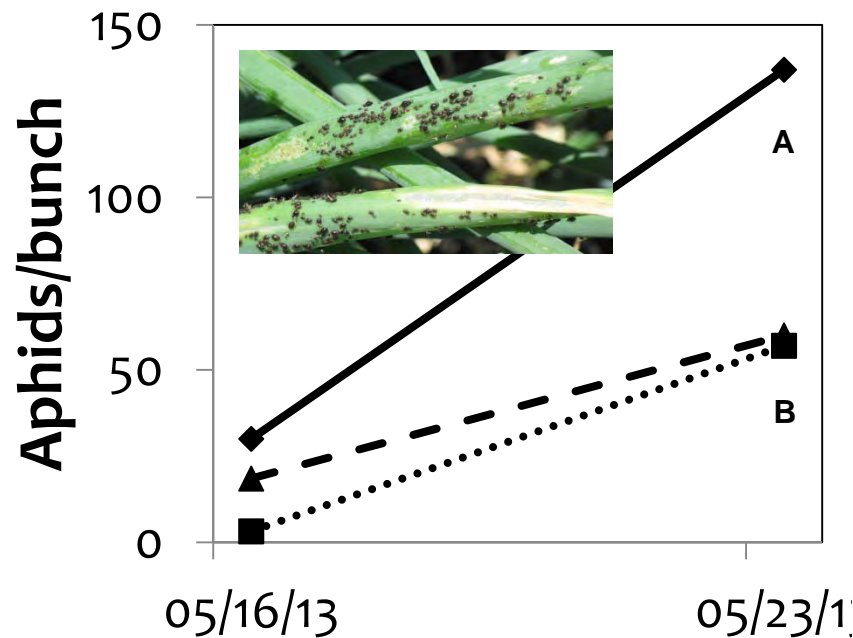


Figure 4.3. Effects of a range of aqueous vermicompost extracts or deionized water (control) on green peach aphid (*Myzus persicae*) numbers on tomatoes. All needed nutrients were supplied. Differences between means were significant at day 14 ($P \leq 0.05$).

(Radovich and Arancon, 2011)

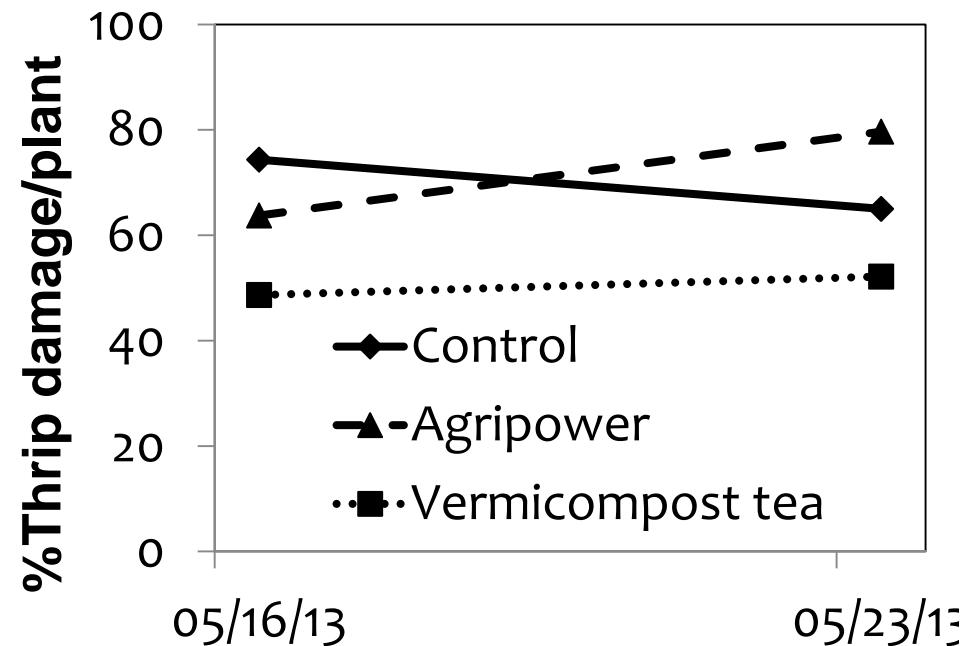
Preliminary results on Induced Host Plant Resistance against Onion Aphids



Vermicompost soak overnight at 1:5 (v/v)
Then drenched into onion seedling pot at
1:10 concentration.



1:180





Future Research

Integrating Reduced Risk Pesticides with Non-chemical Approaches



Note:

- Pests are easier to control in hydroponic raft system than in cinder bed.
- Pesticide use is also safer in raft system than in cinder bed.

	Allow on surface water	Not allow on surface water
	Ecotek (Rosemary oil)	Sucrashield (sugar based)
or 	Dipel, XenTari (<i>Bacillus thuringiensis</i>)	Oroboost (surfactant, citrus oil solution)
	Mycotol (<i>Beauveria bassiana</i>)	Grandevo (<i>Chromobacterium subtsugae</i>)

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