Sustainable Pest Management Strategies Using Insectary Settings for Insect Pest Management and Solarization Mulch for Weed Control

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Sustainable Agriculture Workshop Series

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

Sustainable Pest Management Lab
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Our Goal: Non-chemical based IPM

Why a need for using non-chemical based IPM?

- Environmental hazard (bees, aquatic invertebrates)
- Low biodiversity
- 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.

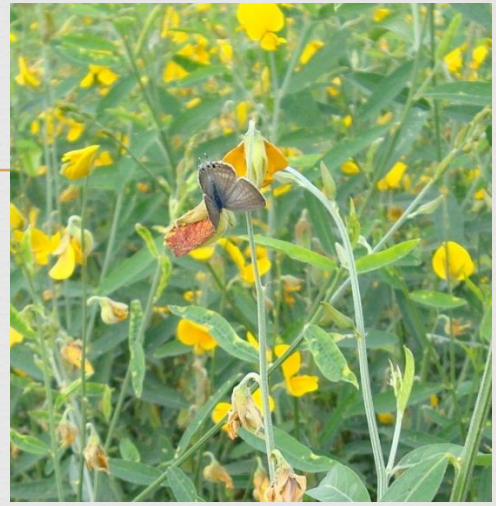
(http://www.ams.usda.gov/AMSv1.0/getfile?dDocName=STELPRDC5096045)

Outlines

- ***Non-chemical based insect pest management (3 Case Studies)***
  - Hydroponic green onion
  - Hydroponic pak choi
  - Terrestrial green onion
- ***Solarization for weed control***

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.

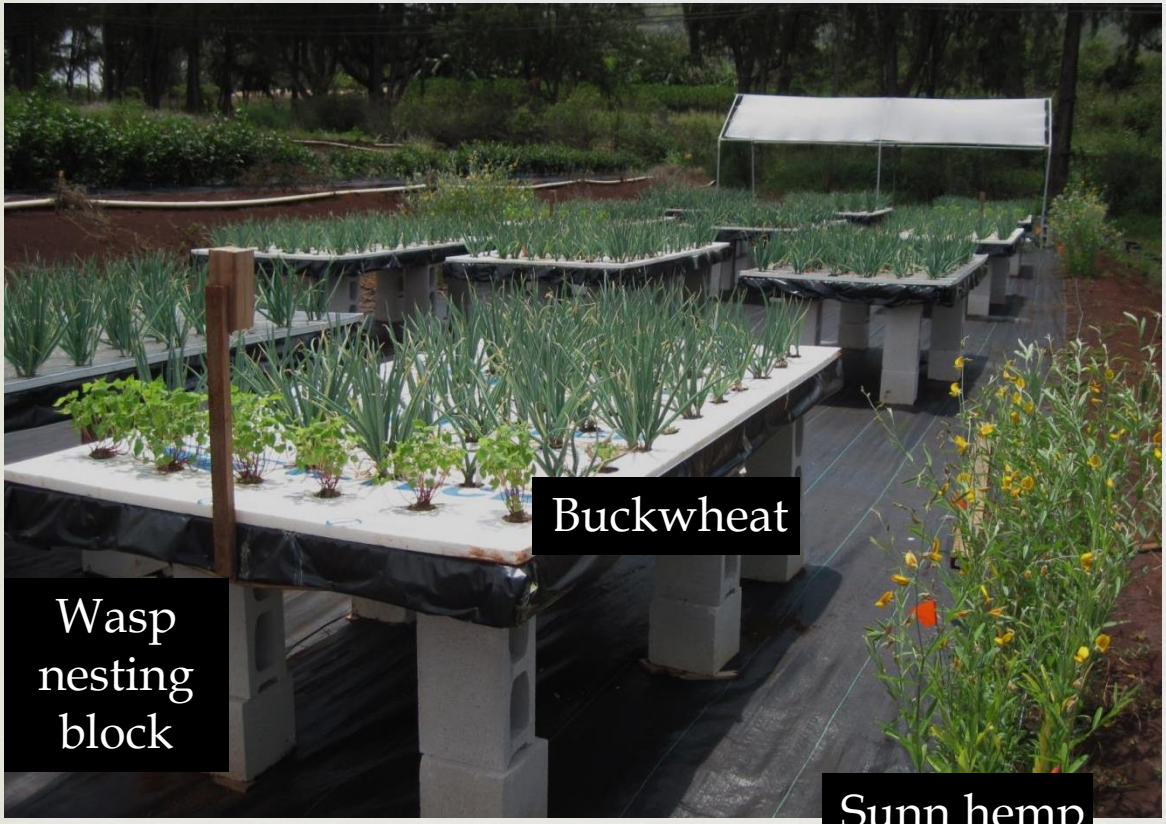


Sunn hemp flowers attracts Lycaenidae butterflies that drawn *Trichogramma* wasps to lay eggs on the Lepidopteran eggs.

Hoverflies on buckwheat

Case Study 1: Hydroponic Green Onion

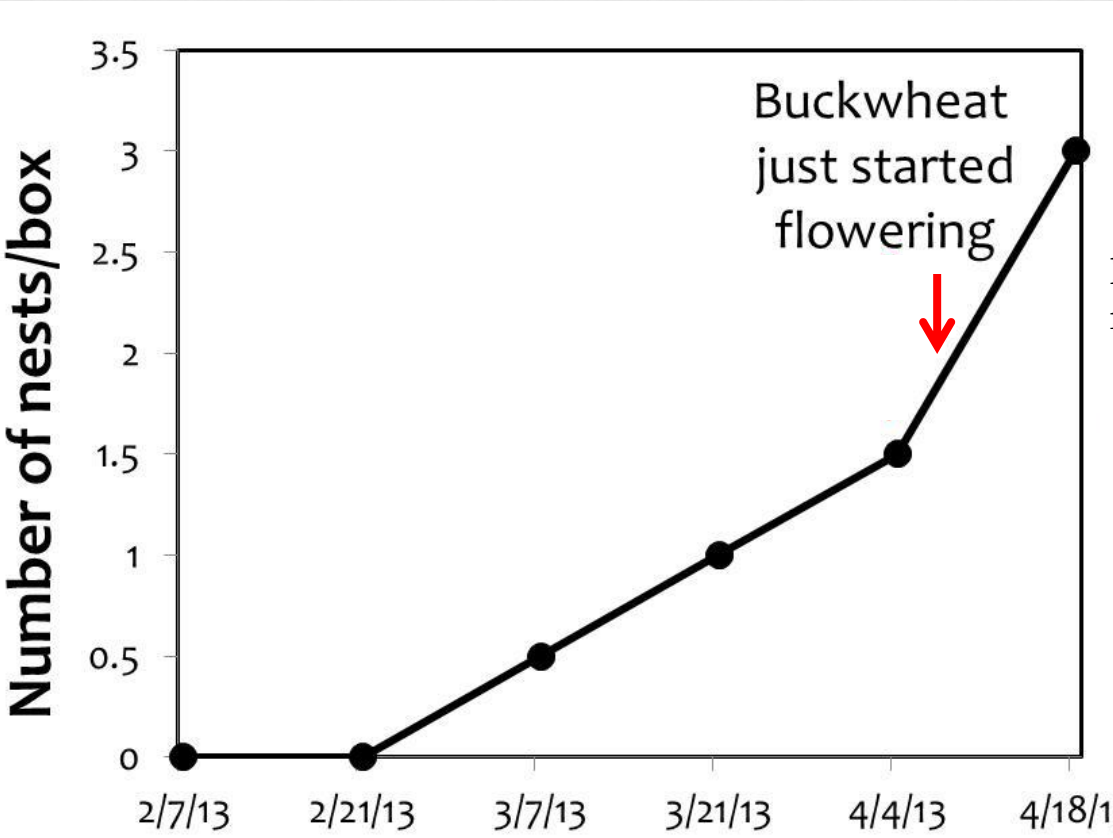
Insectary



Control

Reflecting board

Wasps Nesting Block



Keyhole wasp

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

Thrips Damage

Hoverfly

- Reflective (metallic) board is most effective in reducing thrips damage.
- Synchronize buckwheat flowering (3-week after planting) to onion planting

Case Study 2: Hydroponic Pak Choi Trial

Insect Pests

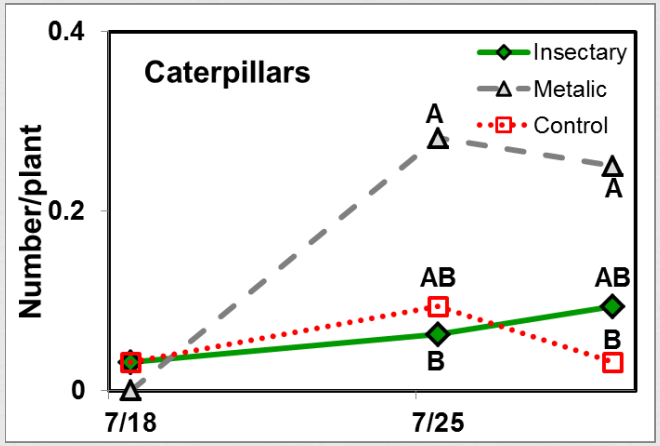
Diamondback moth (DBM) larva

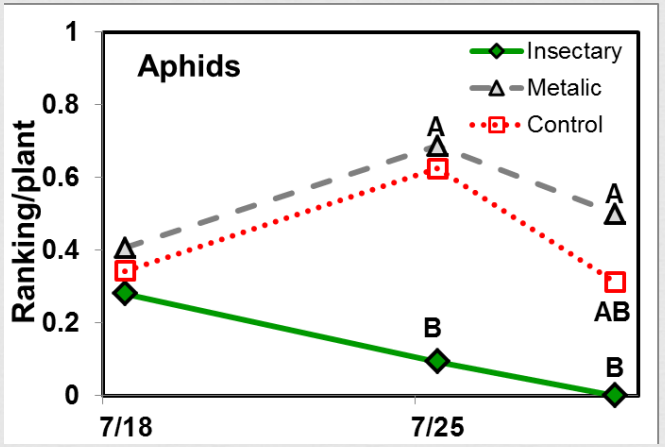
Imported cabbage worm larva

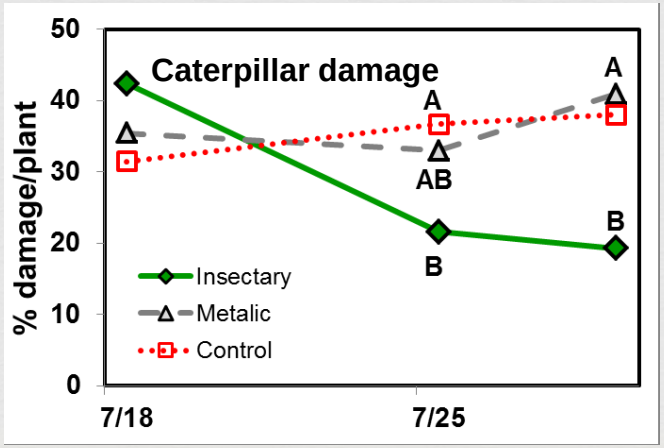
Imported cabbage web worm larva

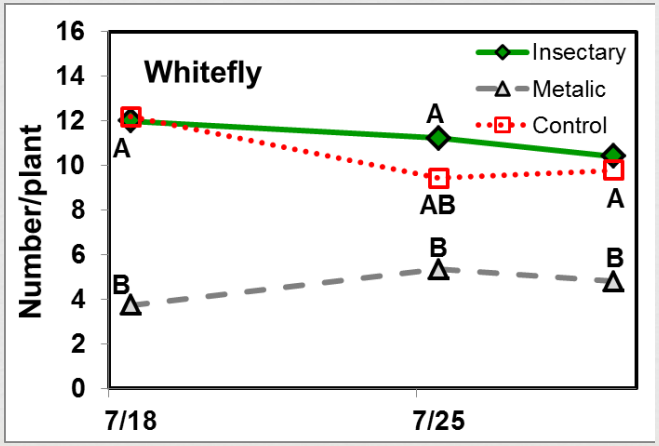
Aphids

Results on Insect Pests









Beneficial Insects

Trichogramma wasp

Parasitized aphids

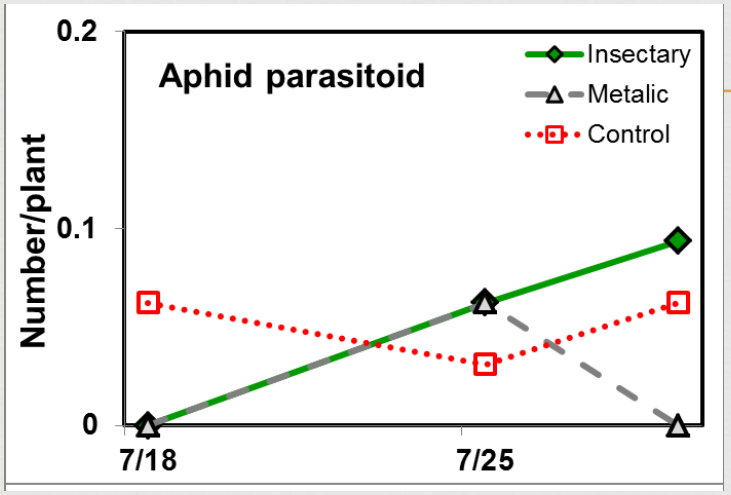
Hoverfly larvae eating an aphid

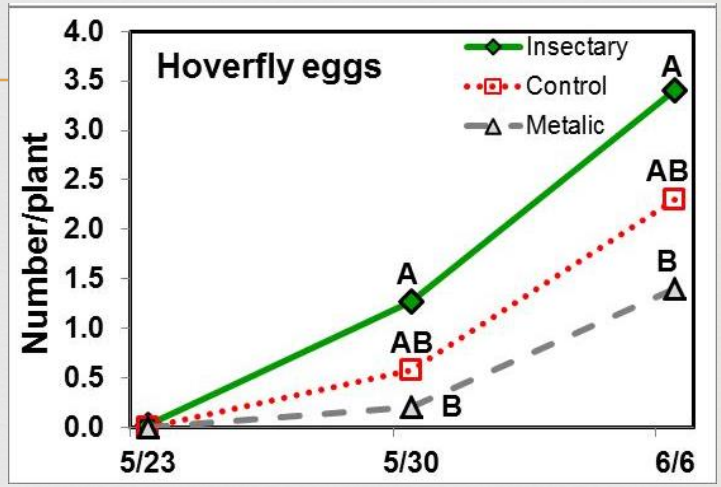
Evidence of the DBM parasitoid wasp

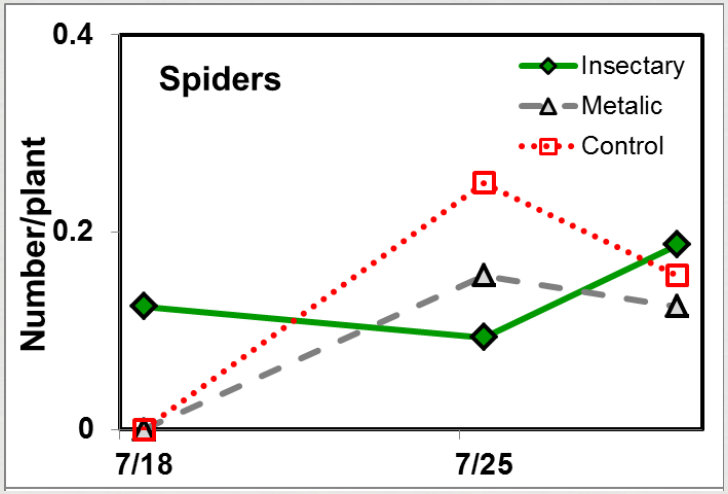
Spiders

Hoverfly eggs among aphids

Results on Beneficials







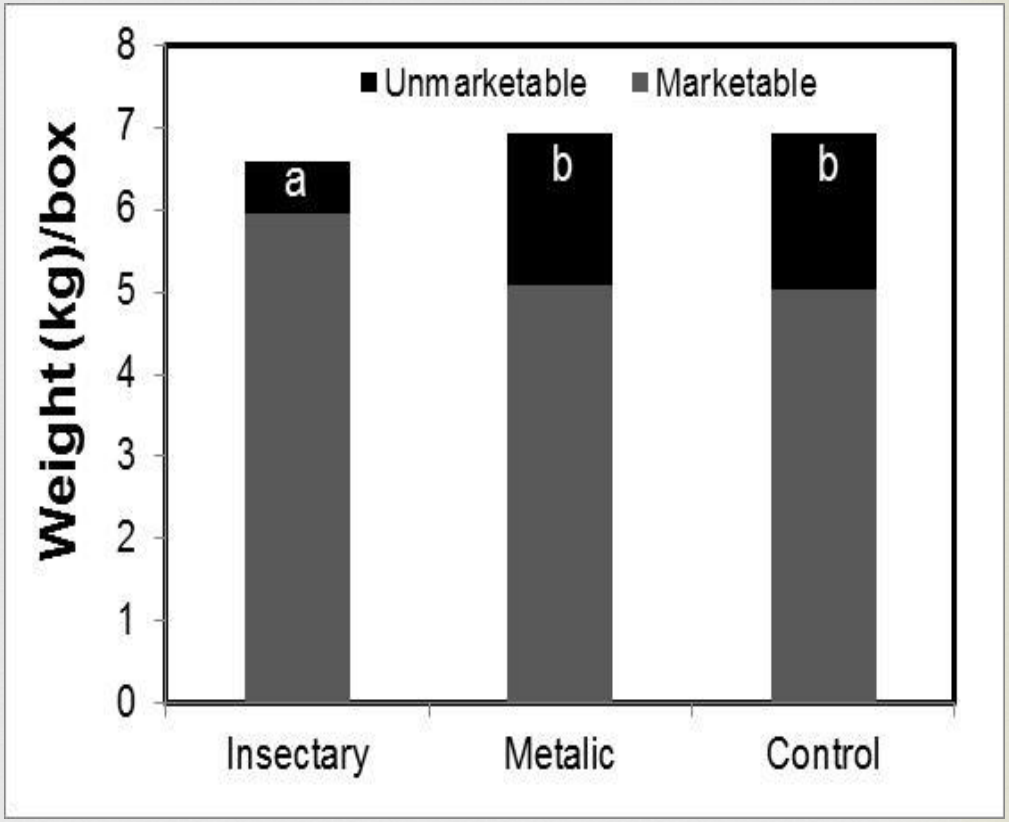
Insectary plots –

- more aphid parasitoids, less aphids,
- Less caterpillars, caterpillar damage pak choi ($P < 0.05$).

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.



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Case Study 3: Terrestrial Green Onion

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1) Sunn hemp & Insectary

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

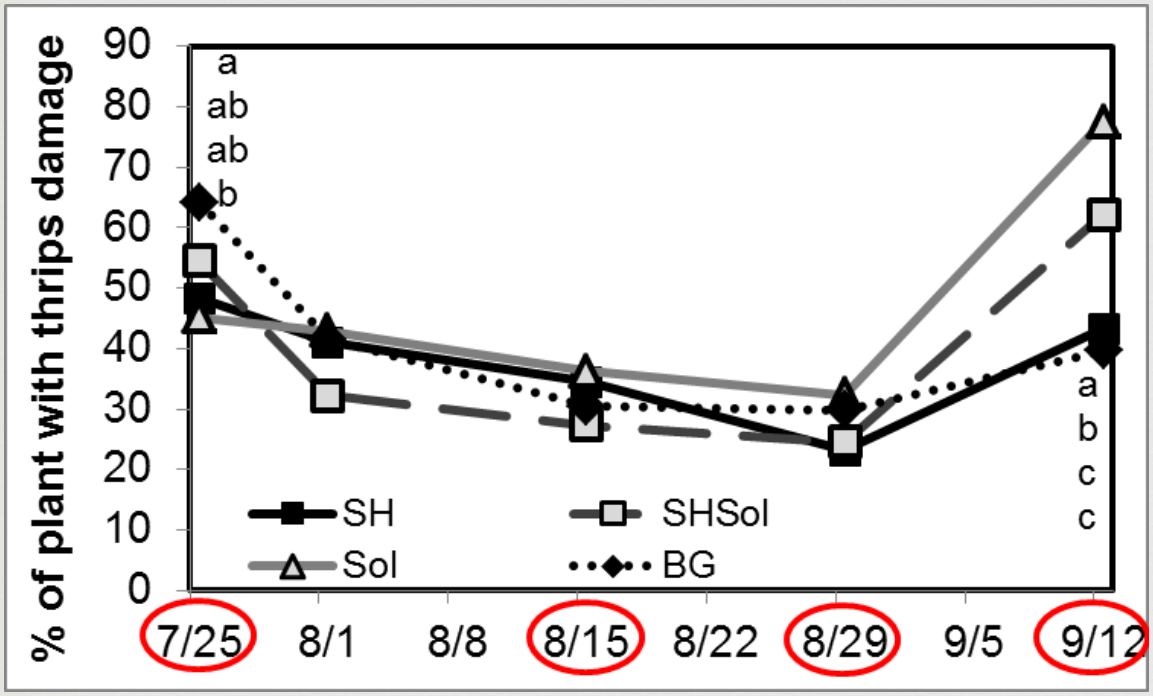
Case Study 3: Terrestrial Green Onion

4) Bare ground (BG)

Tilled prior to planting +
Organic sprays for thrips:

- Entrust (spinosad)
- Pyganic (pyrethrum
- Trilogy (neem)

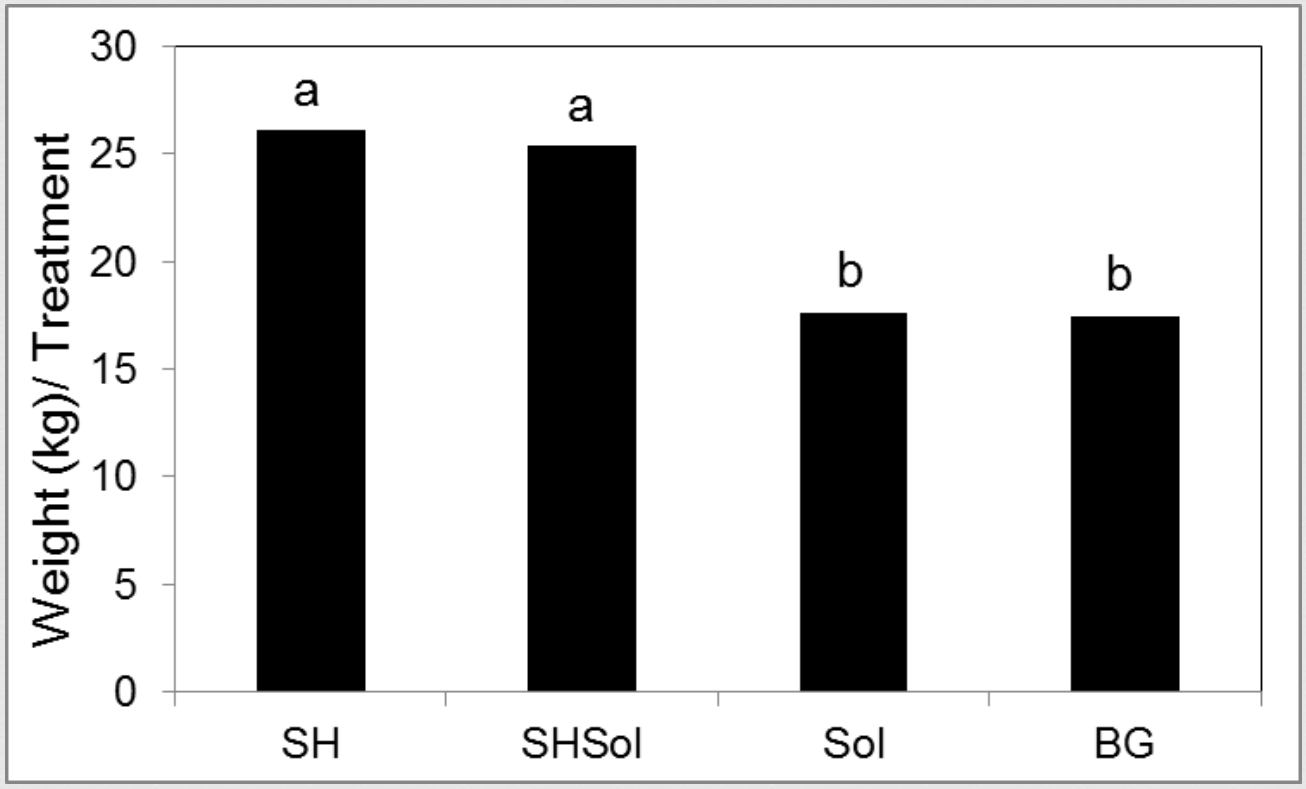
Effects of Insectary Settings and Sol on Thrips Damage



= insecticide treatment in the BG

- SH + insectary suppressed thrips equivalent to organic insecticides sprays.
- Solarization suppressed thrips damage initially, but not effective throughout the whole onion crop.

Onion Harvest



Sunn hemp cover crop increased onion yield.

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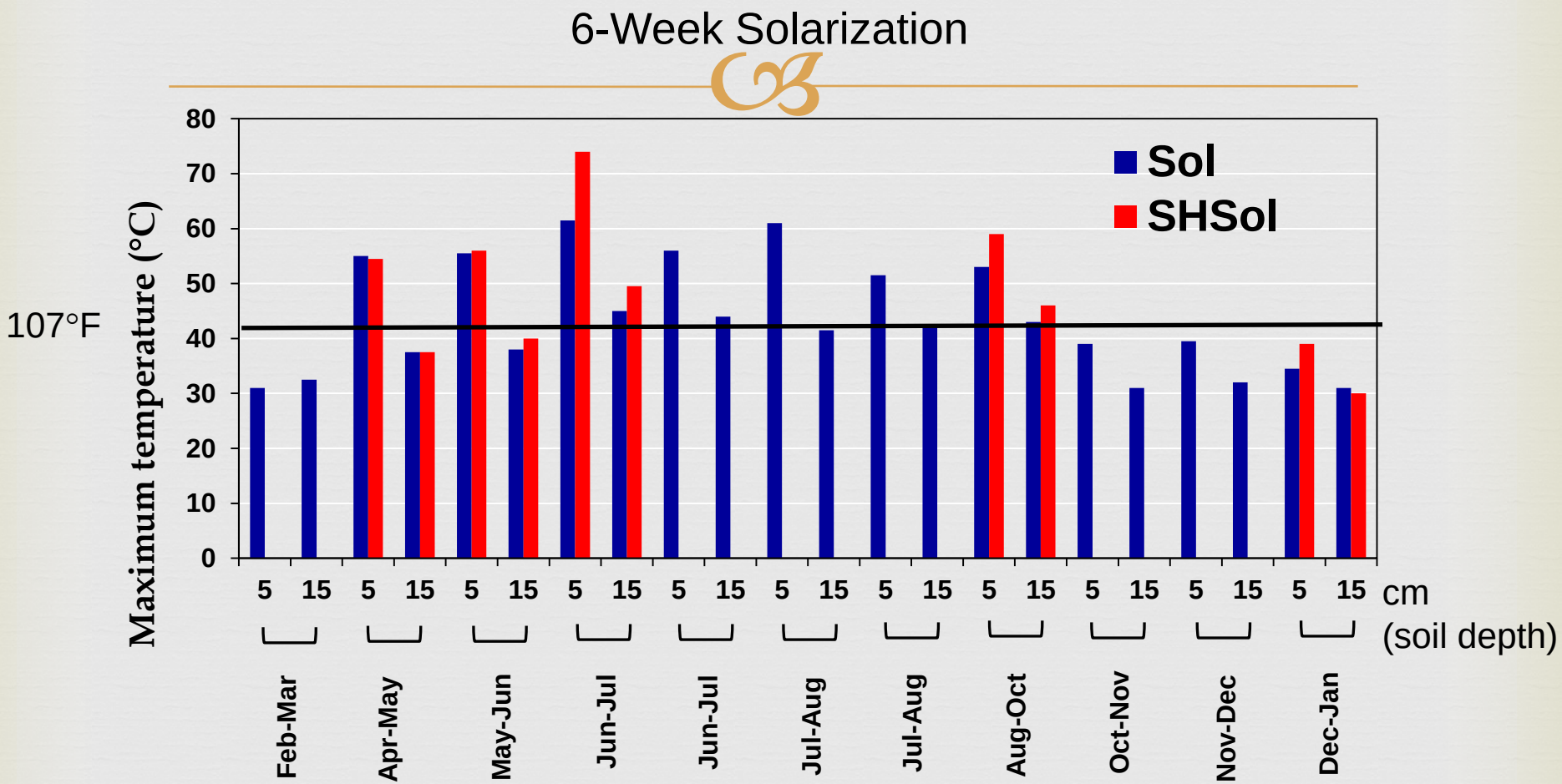
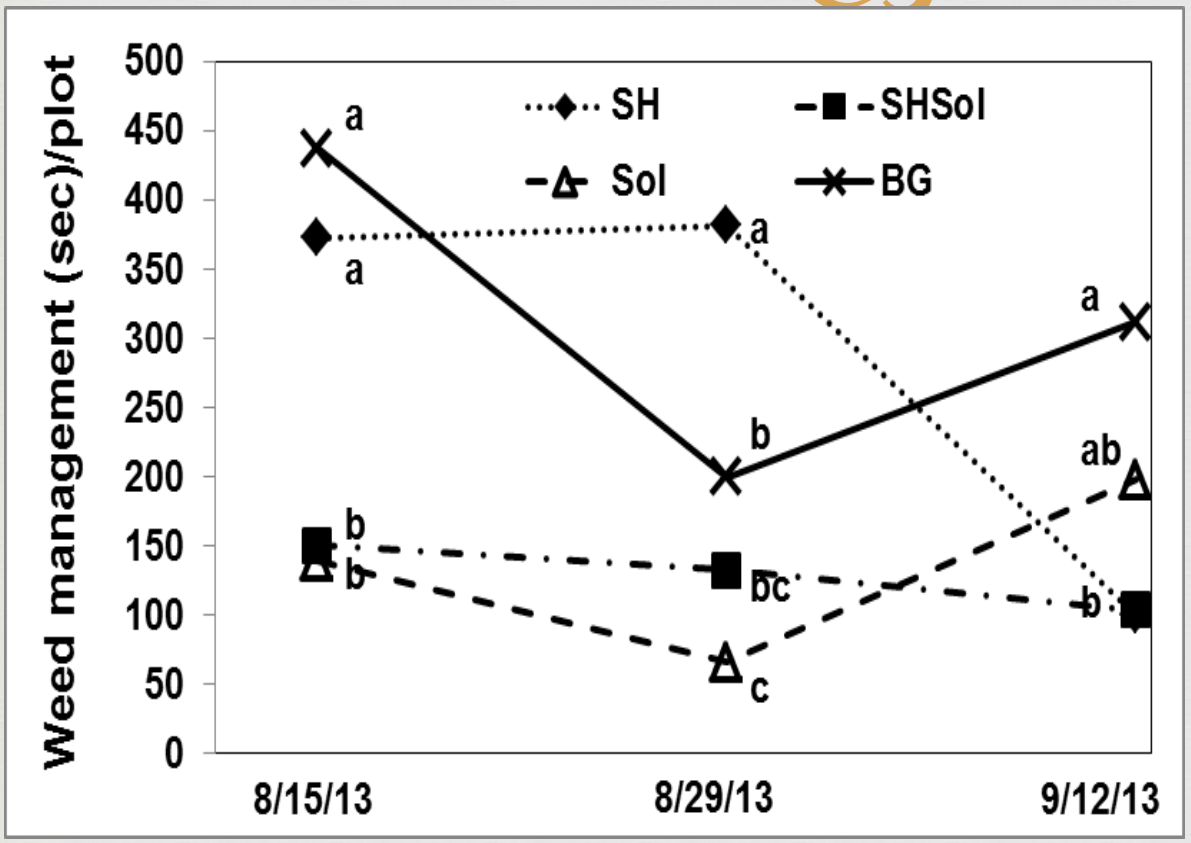
Reduce weed seed bank

Solarization Temperature Scheme in Hawaii



(Wang 2011)

Case Study 3: Terrestrial Green Onion



Weed Treatments

- SH = Spray GlyStar (a.i. glyphosate).
- BG received 2 times glyphosate prior to 8/15/13.
- Hand weed in Sol, SolSH and BG (after 8/15/13).

Solarization (Sol or SHSol) made manual weed removal feasible.

Cost of Weed Management

9/12/13	Cost ($)/plot
SH	0.28
SHSol	0.25
Sol	0.49
BG	0.74

- GlyStar cost $65.49/2.5 gal (approximately cost $0.20/fl oz), ~ $0.03/min
- Assuming labor cost $8.50/hour, i.e. $0.14/min
- Cost of solarization mulch = ~$550/acre (4-ft row spacing)

No-till SH also reduced weed seed bank overtime.

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Sustainable Pest Management Lab

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