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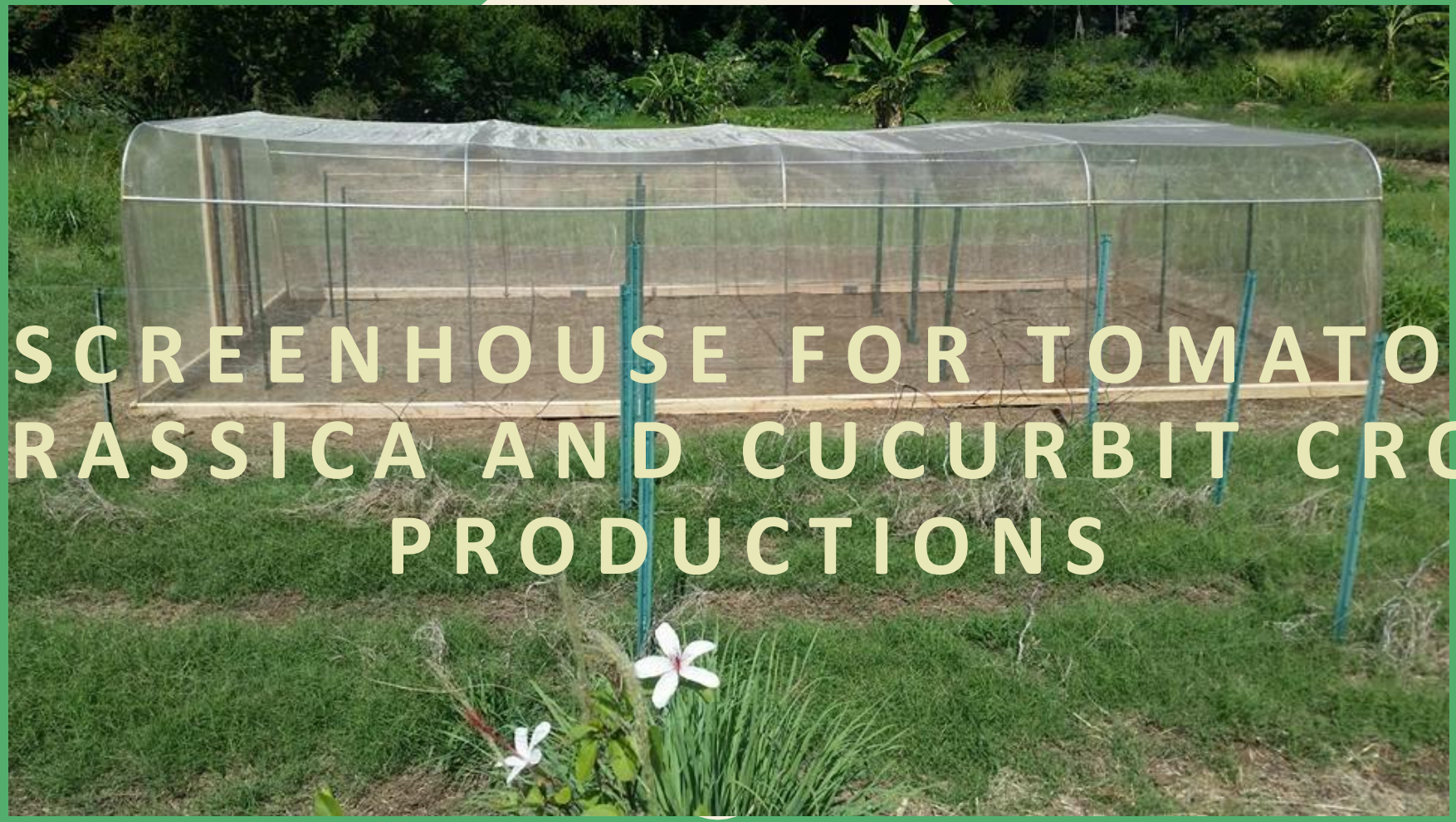
University of Hawaii at Manoa



SCREENHOUSE FOR TOMATO, BRASSICA AND CUCURBIT CROP PRODUCTIONS

KOON-HUI WANG, JARI SUGANO, STEVE FUKUDA, JENSEN UYEDA, DONNA MEYER, SHELBY CHING, JONATHAN KAM

- Western Sustainable and Agriculture Professional and Producer (WSARE P&P) program and the CTAHR Supplemental Fund funded a 2-year project for our team to develop and promote the use of screenhouses for small-scale vegetable crop producers. This report summarizes our screen house development in collaboration with three groups of participa
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WESTERN SARE
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OBJECTIVE

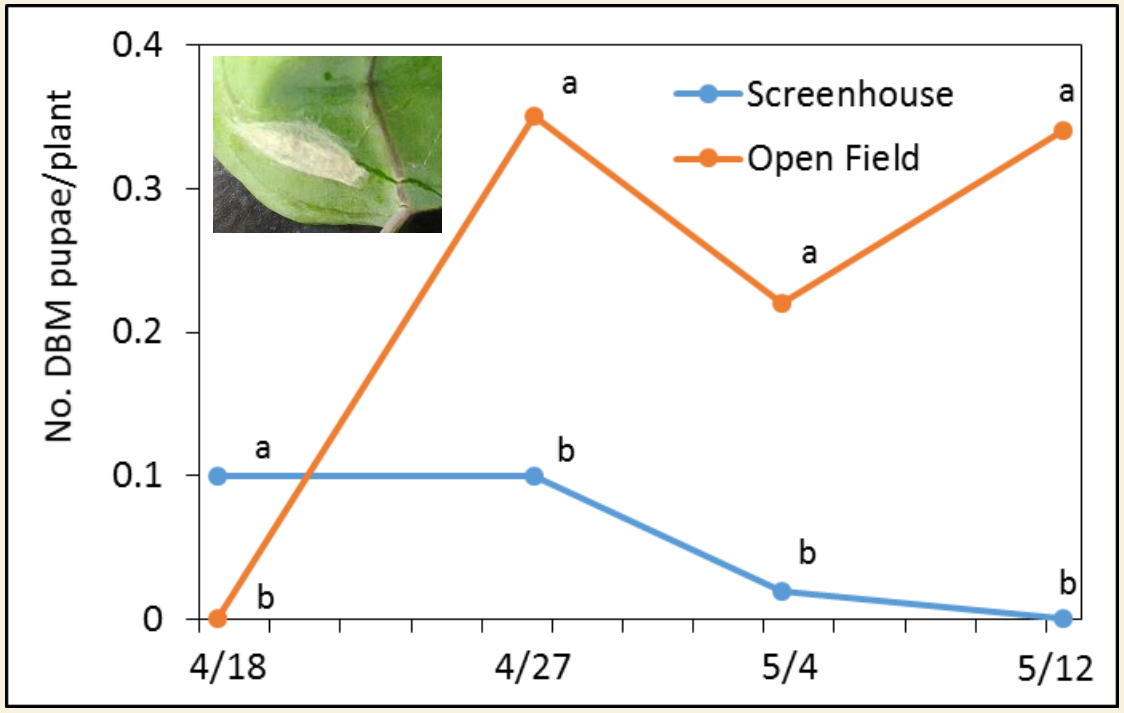
To evaluate the effects of using screenhouse (with 17 mesh screen) for managing insect pests that are difficult to be managed with insecticides in the tropic.

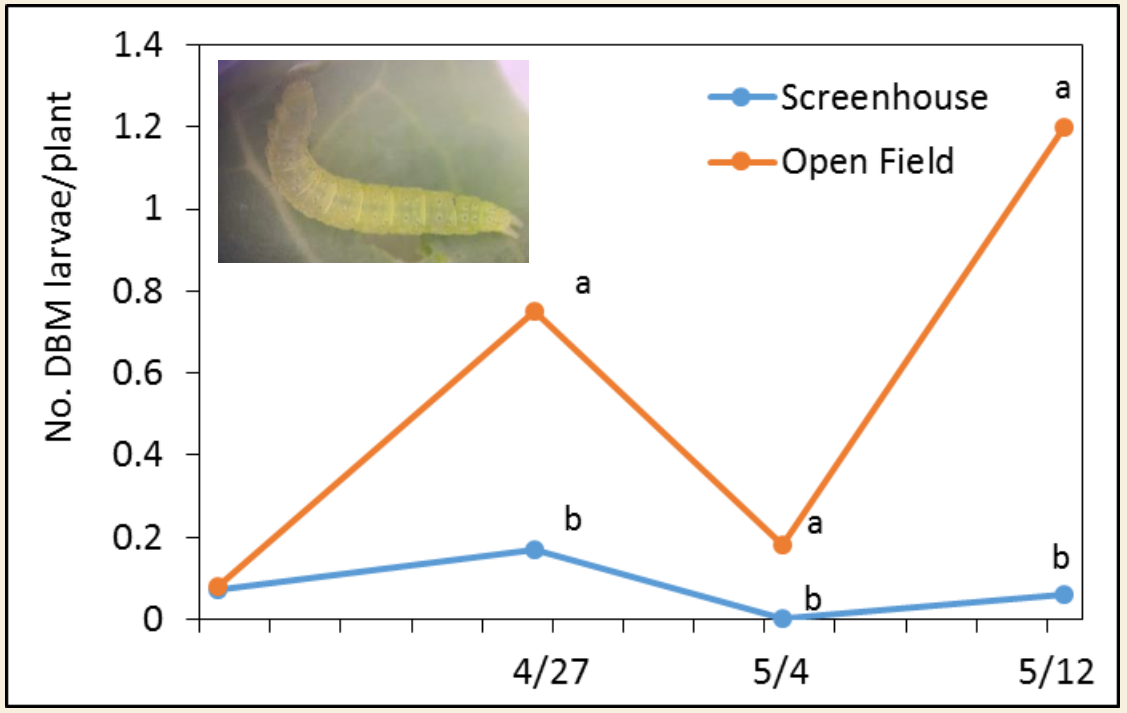
	Target Pests
Kale	Diamondback moth, imported cabbage worm, leaf miner, thrips
Zucchini	Pickle worm, fruit fly, aphids
Pumpkin	Pickle worm, fruit fly, whiteflies
Tomato	Fruit fly, pin worm, stink bugs, whiteflies

SCREENHOUSE PRODUCTION FOR KALE

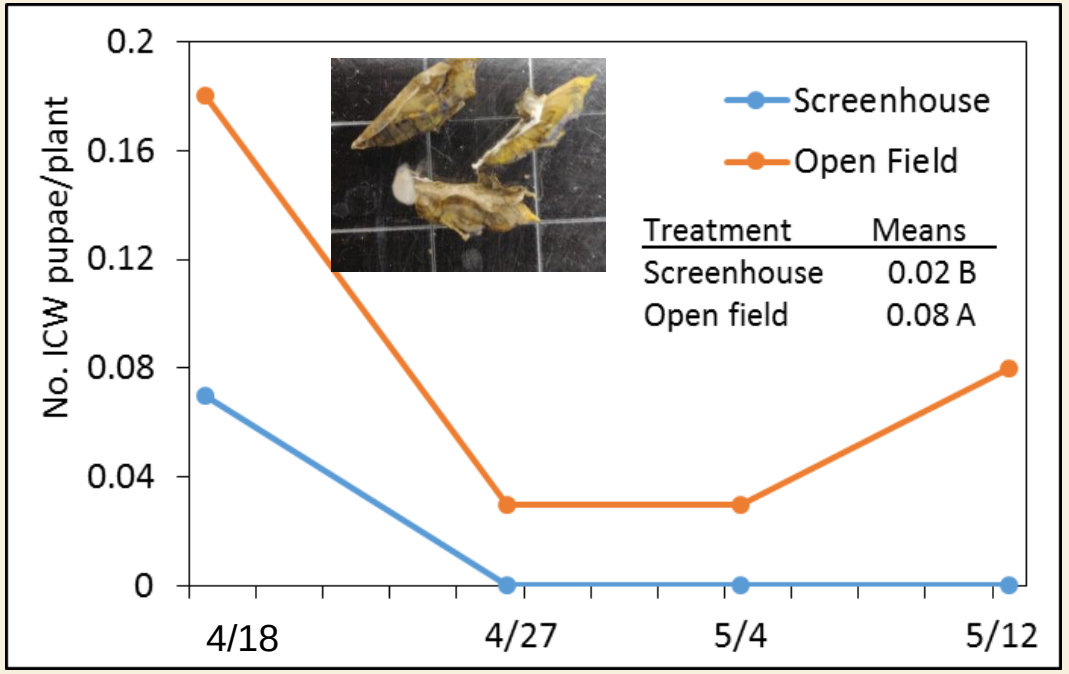
- 15 Varieties of kale were planted inside and outside of a screenhouse.
- 5 plants from 12 varieties were monitored for insect pests weekly from 4/18-5/12/16.

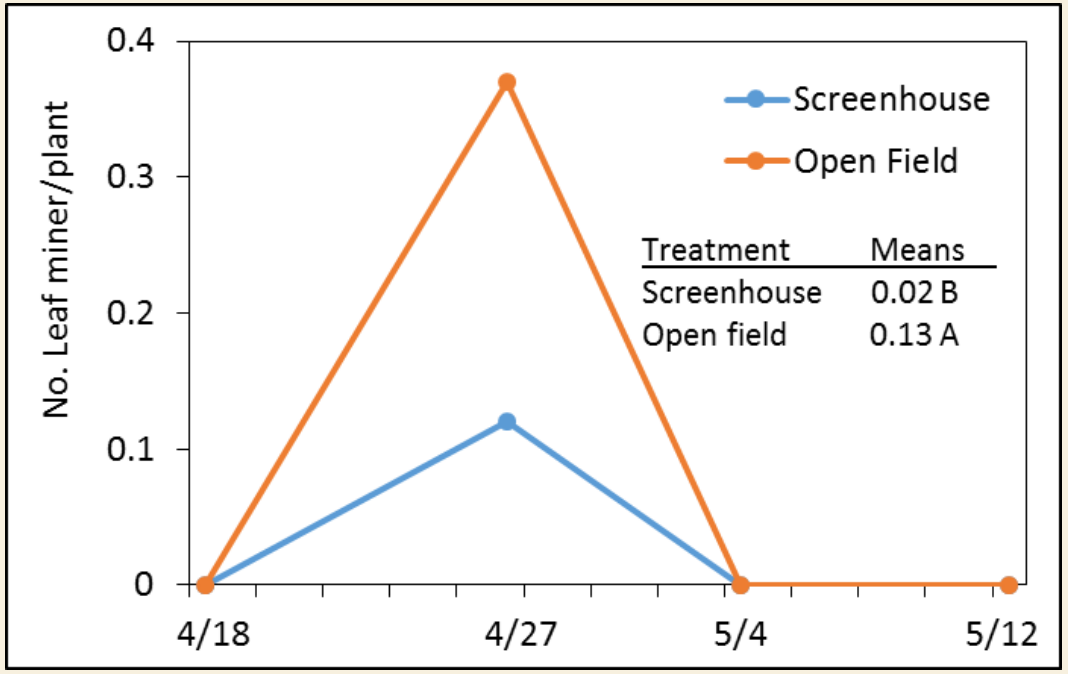
SCREENHOUSE REDUCED DIAMOND BACK MOTH (DBM)





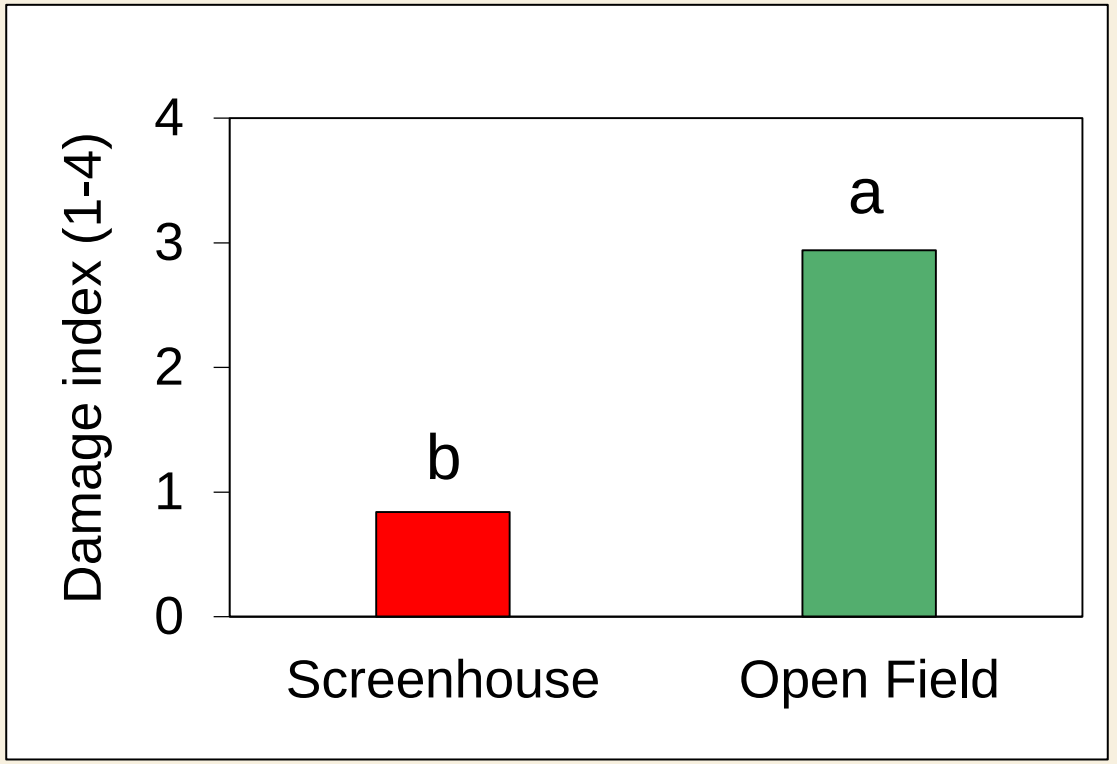
SCREENHOUSE REDUCED IMPORTED CABBAGE WORMS (ICW) & LEAF MINERS





CATERPILLAR DAMAGE

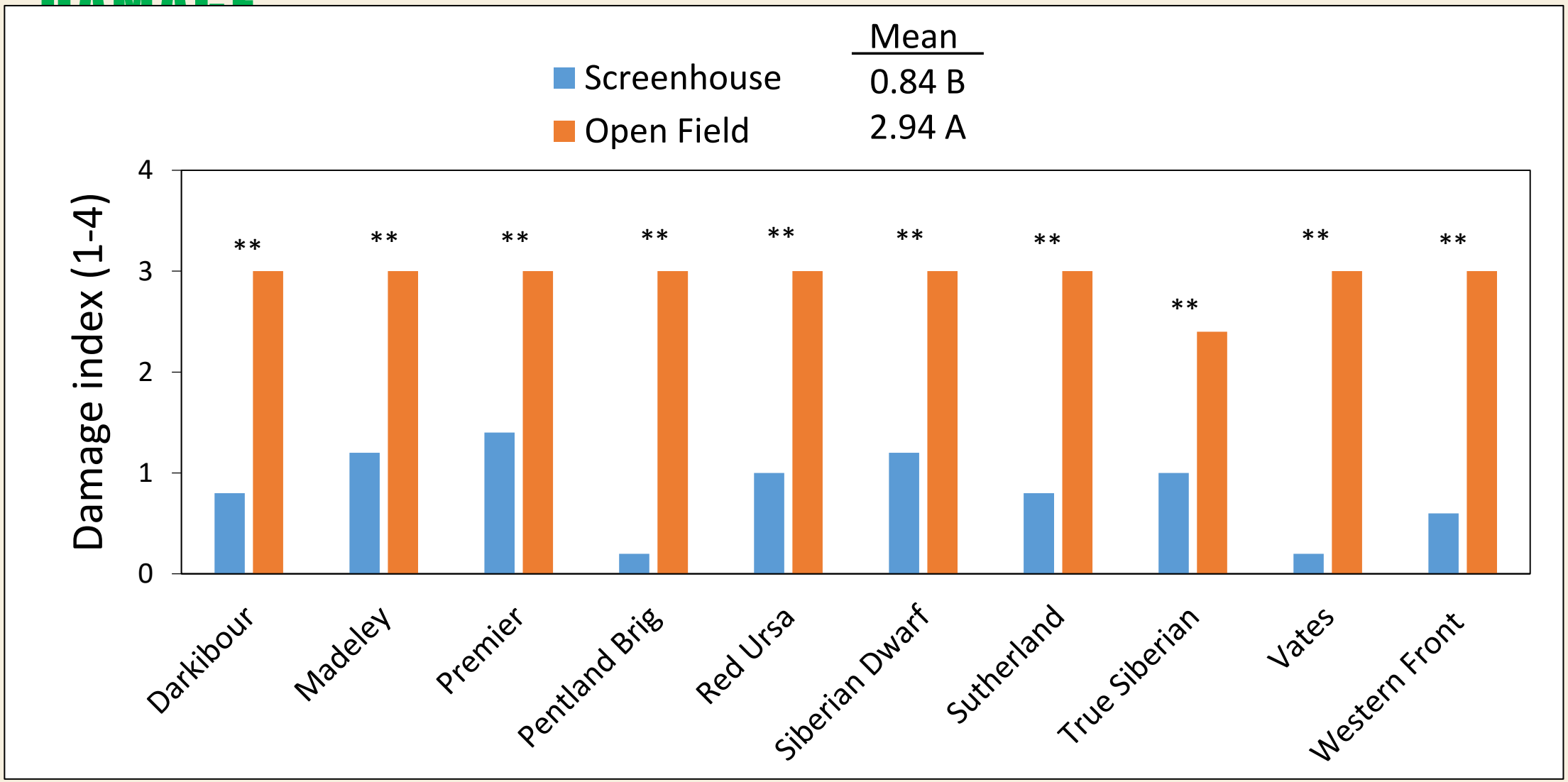
Screenhouse



Some varieties are less preferred by the caterpillars present.

Open Field

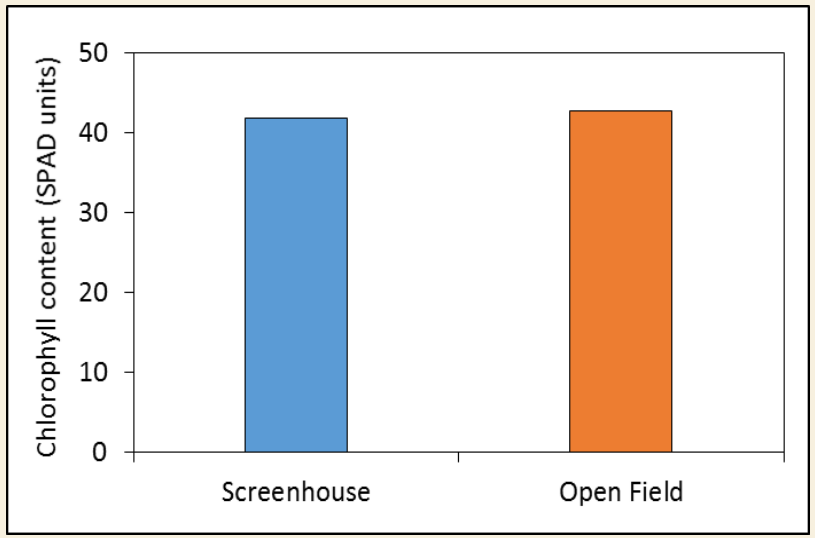
DIFFERENCE IN KALE VARIETIES TO CATERPILLAR DAMAGE

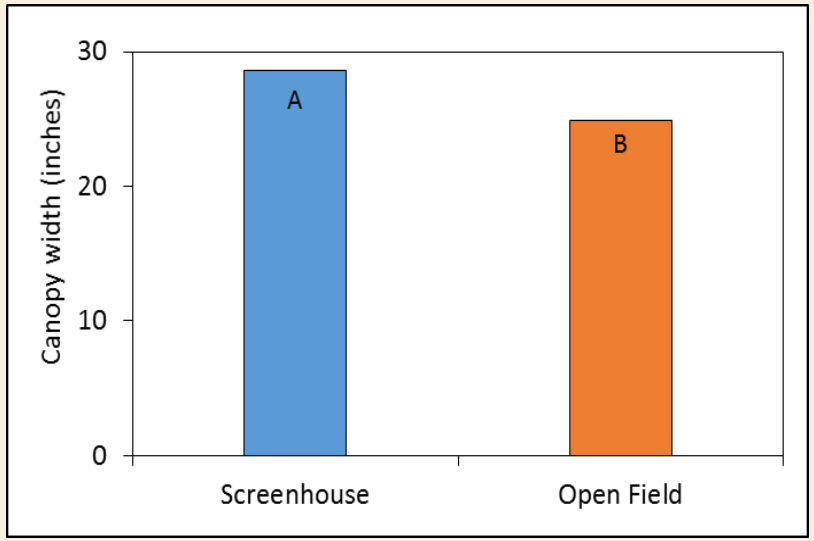


0 = 0 damage, 1 ≤ 25% leaves w/ damage, 2 (26-50% leaves w/ damage), 3 (51-75% leaves w/ damage), 4 (75-100% damage)

KALE GROWTH PARAMETERS

1 month after transplanting



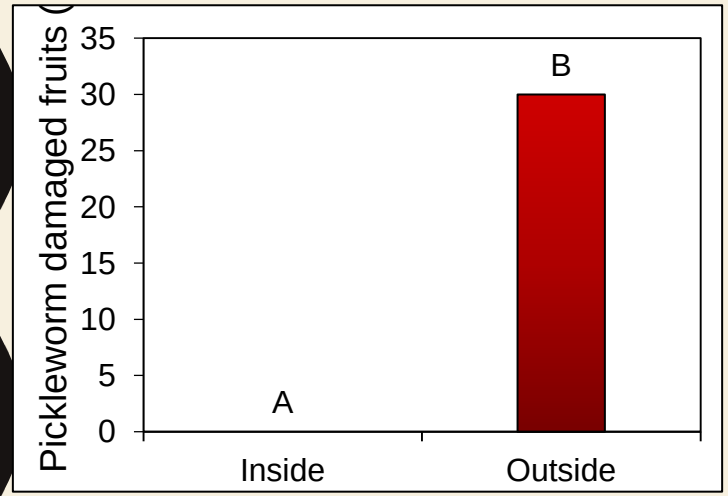


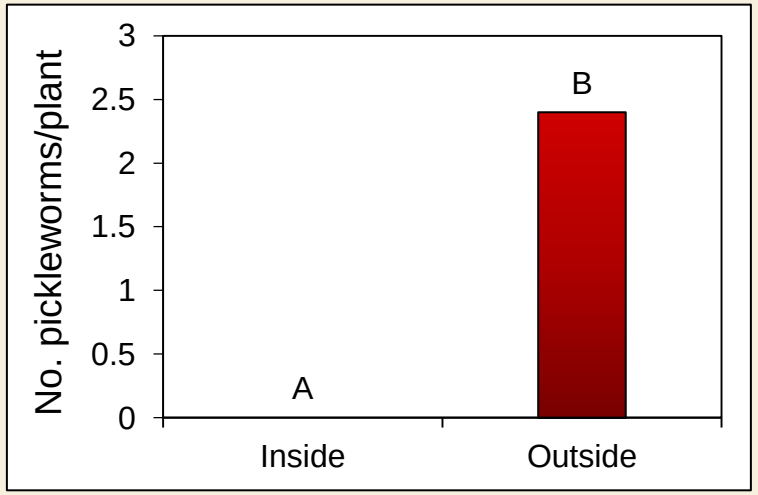
- Based on the 12 varieties monitored, screenhouse did not affect kale photosynthesis rate, and resulted in wider kale canopy ($P < 0.05$).

Screenhouse for Zucchini at Pūpūkea

PARTICIPATING FARMER:
MELEANA JUDD-COX

Damage caused by pickleworm outside the screenhouse was significantly worse than inside.

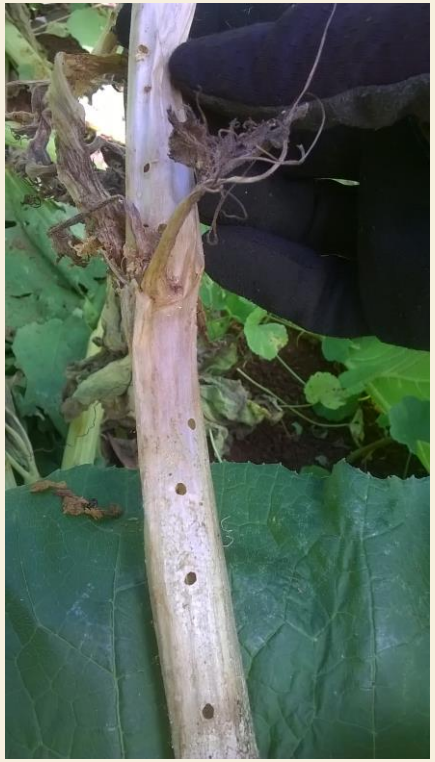




PUMPKIN

Pumpkin grown under the protection of a screen can increase marketability, but hand pollination or parthenocarpic seeds is necessary.

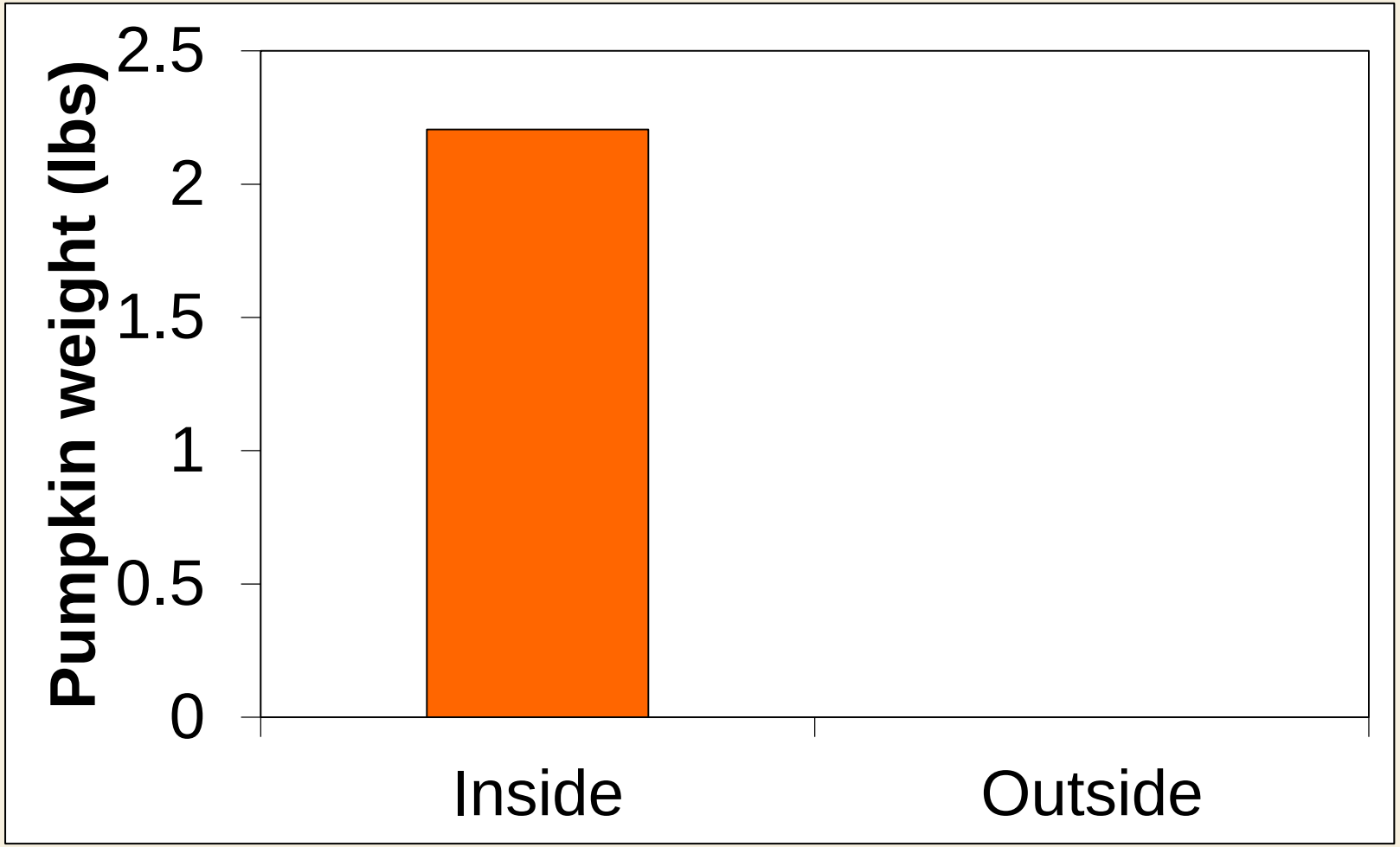
INSECT DAMAGE ON PUMPKIN OUTSIDE OF THE SCREEN HOUSE



Pickle worms (PW) and melon flies (MF) caused total crop failure for pumpkin production outside of the screenhouse:

- Early infestation of PW or MF resulted in no fruit development.
- Pickle worms bored into stem tissues can cause entire stem die back.
- Late infestation of PW or MF caused unmarketable fruits.

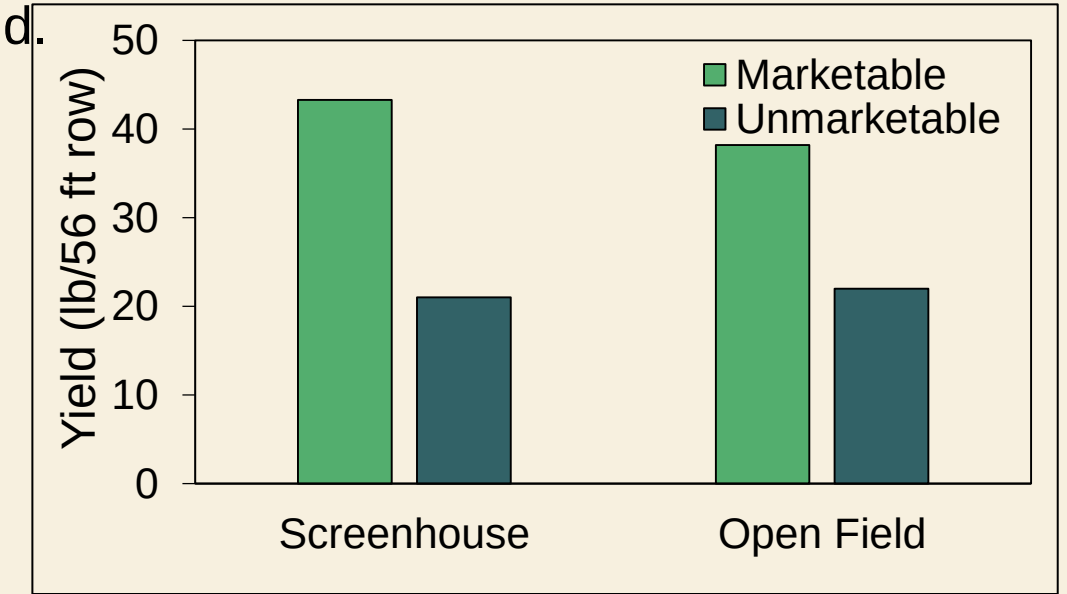
PUMPKIN YIELD



PARTICIPATING FARMER:
ANTHONY DELUZE

Screenhouse did not protect peach tomatoes from *Tomato yellow leaf curl virus* transmitted by whiteflies.

'Nyagous' is resistant to TYLC virus, yield inside the screenhouse was higher than that in the open field.



Most unmarketable fruit is from fruit cracking due to blossom end rot (fluctuating weather and insufficient Ca) and bird damage

'Nyagous' tomato

FARMER'S TESTIMONY

- "I think the screenhouse has been an awesome tool and love the design. The soil outside of the screenhouse was much richer in nutrients to begin with, under different circumstances, tomatoes inside the screenhouse would yield much higher. "

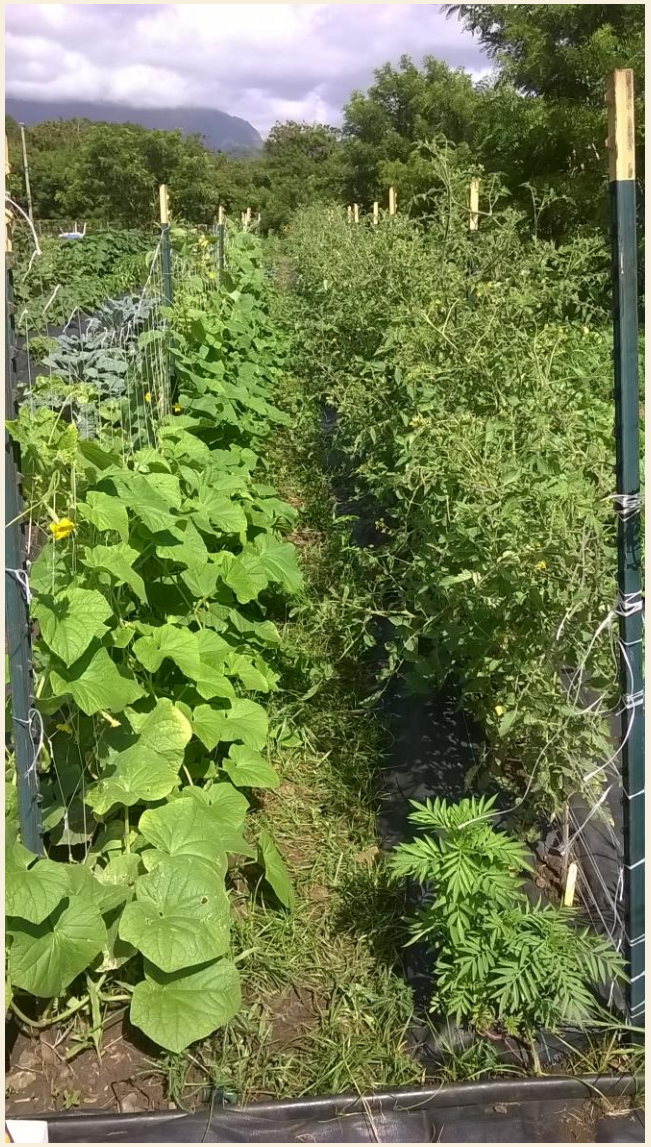
Anthony Deluze

- "I'm trying to figure out as soon as possible how to fund another screenhouse in my farm. I think the screen is the most expensive part. That's the one we got to find a way to get more cost efficient."

Screenhouse for Tomato at Waimanalo

Inside

Outside



PARTICIPATING FARM COACH: JAY BOST

Tomato cultivars:

- ‘Rojita’
- ‘Taiwan AA’
- ‘Felicity’ (TYLCV resistant)

Target Pests of Tomato at Waimanalo

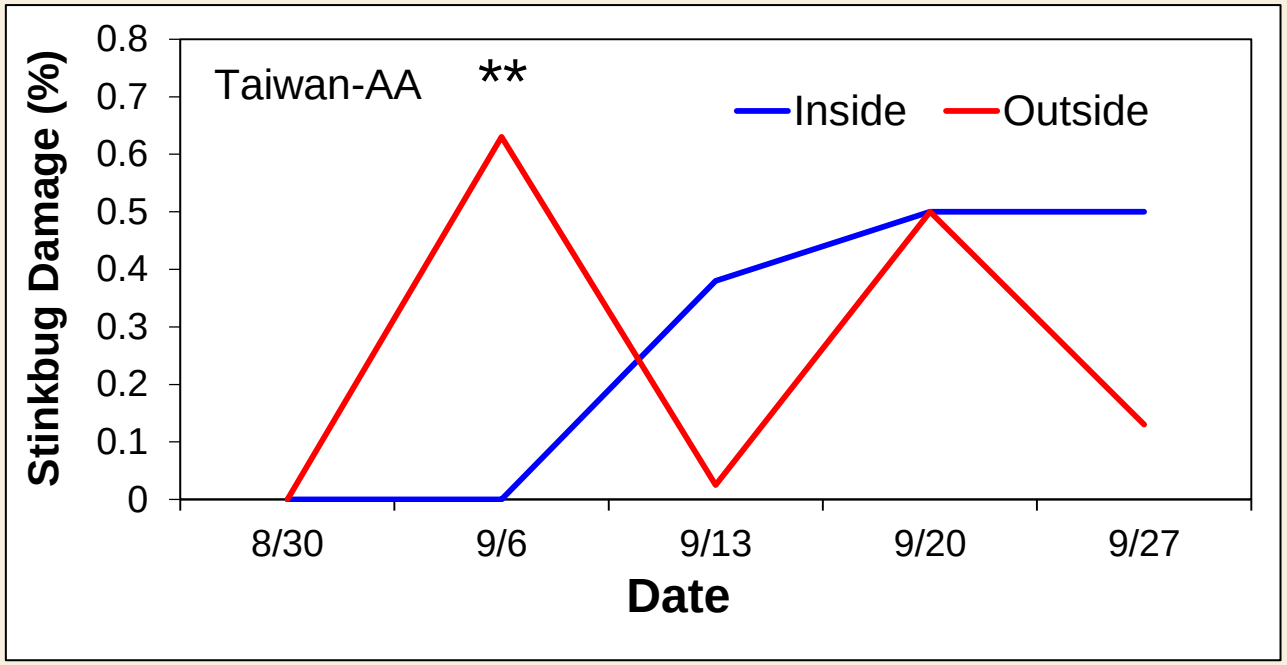
Stinkbug on Taiwan AA

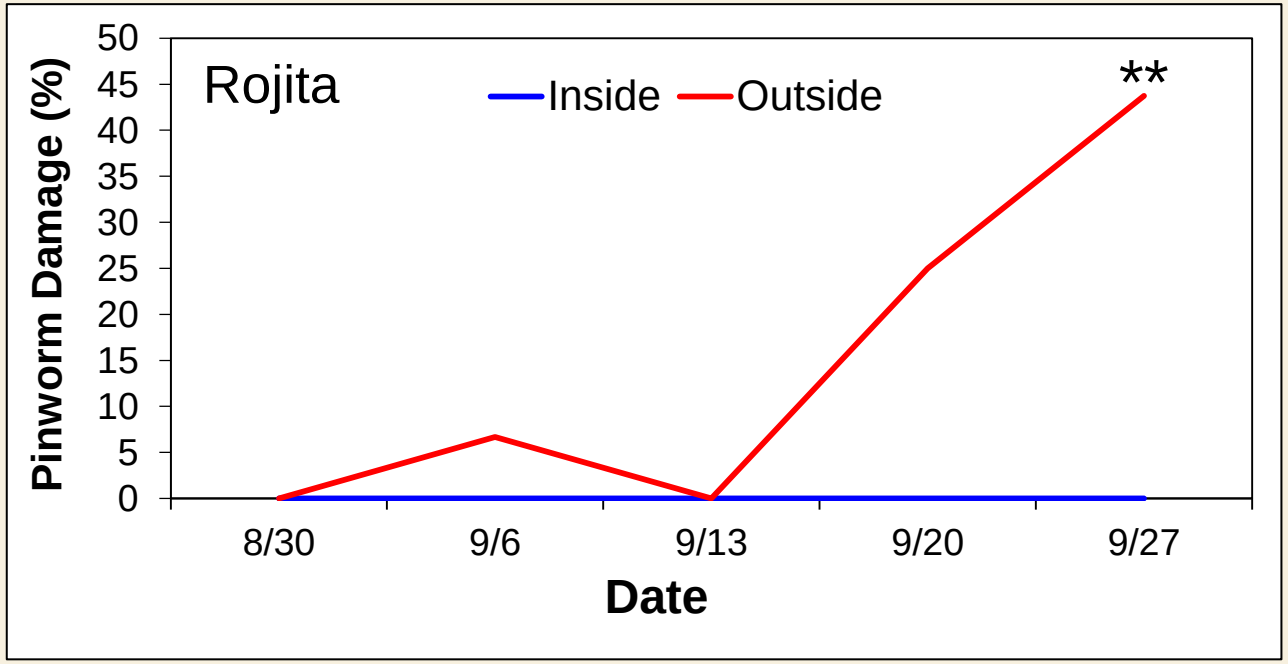
Bird damage

Tomato pinworm

Mite damage

Insect Damage on Plants





FARMER TESTIMONY JAY:

- “LOVED the screenhouse, zucchini and tomato fruit were pest free, but there was heavy aphid pressure.”
- “Cucumbers did not work out probably due to lack of pollinators, but should try parthenocarpic varieties.”
- “Larger slice tomatoes had decent yield from inside the screenhouse something we have never been able to do in field due to fruit fly.”
- “The pepper in the screen has no fruit fly or pepper weevil, both of which infect nearly 100% in the field.”

PROBLEMS OF SCREENHOUSE PRODUCTION

1. Due to lack of natural enemies in the screenhouse, small arthropod pests that can move through the mesh can also cause an outbreak inside the screenhouse.
2. Cucurbit and many fruit crops require pollination to set fruits. Parthenocarpic seeds are usually expensive.

Ex: Aphids outbreak on a cucumber crop ~2 months after planting.

PROBLEMS OF SCREENHOUSE PRODUCTION

3. Although kale in the screenhouse was not damaged by caterpillars, thrips damage was more severe inside the screenhouse than outside.

4. Although one can increase mesh size to 60-mesh to exclude smaller insects, ventilation with this screen would be significantly decreased and might increase heat stress.

Thrips damage on kale.

FUTURE DIRECTION

- Virus resistant varieties
- Integrate with insecticides to control soft bodied insects
- Evaluating different screen material
- Weed control within the screenhouse
- Nematode control

ACKNOWLEDGEMENT

- Philip Waisen, Shova Mishra, Josiah Marquez, Bryan Januar, Kaori Suda, Caio Sousa.
- Farm Crews from Poamoho and Waimanalo.
- Anthony Deluze, Jay Bost, Mele Judd-Cox.

This project is supported in part by NIFA CRATE program (project number 2013-04774), WSARE P&P (OW15-019), and in part by CTAHR Supplement fund (9022H)

Uyeda's Video collection related to SPM

- https://youtu.be/cBP52egYG9
- https://vimeo.com/166306088
- https://vimeo.com/166306170

Websites

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