

UH Extension
MĀNOA College of Tropical Agriculture and Human Resources

People, Place, Promise

Varietal Screenings to Minimize Pests

J. Sugano, J. Uyeda, Steve Fukuda, Koon-Hui Wang & T. Radovich

University of Hawai'i at Mānoa
College of Tropical Agriculture and Human Resources
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Integrated Pest Management Pest Identification: Common Pests

Pests identification and understanding the nature of the pest are the key steps in developing the best management strategy.

<p>Chewing Pests  Caterpillars feed on the leaves, stems, flowers, and fruit of many plants. They are the most common pest of many crops. They can be identified by their size, shape, and color. They often leave irregular holes in the leaves.</p> <p>Sucking Pests  These pests pierce plants with their mouthparts and suck the sap. They can cause stunted growth, yellowing of leaves, and the formation of galls. They are often found in large numbers on the undersides of leaves.</p> <p>Mites  Mites are tiny, eight-legged arachnids that feed on plant tissue. They can cause stippling, yellowing, and necrosis of leaves. They are often found in large numbers on the undersides of leaves.</p> <p>Nematodes  These microscopic worms feed on plant roots and stems. They can cause stunted growth, yellowing of leaves, and the formation of galls. They are often found in large numbers in the soil.</p> <p>Plant Hoppers  These insects feed on the leaves and stems of many plants. They can cause stunted growth, yellowing of leaves, and the formation of galls. They are often found in large numbers on the undersides of leaves.</p>	<p>Ants  Ants can damage plants by feeding on roots, stems, and leaves. They can also transport plant pathogens. They are often found in large numbers in the soil.</p> <p>Fruit Flies  These tiny flies feed on the fruit of many plants. They can cause stunted growth, yellowing of leaves, and the formation of galls. They are often found in large numbers around the fruit.</p> <p>Thrips  These tiny insects feed on the leaves and stems of many plants. They can cause stunted growth, yellowing of leaves, and the formation of galls. They are often found in large numbers on the undersides of leaves.</p> <p>Slugs and Snails  These mollusks feed on the leaves and stems of many plants. They can cause stunted growth, yellowing of leaves, and the formation of galls. They are often found in large numbers in the soil.</p> <p>Weeds  Weeds can compete with crops for nutrients and water. They can also harbor pests and diseases. They are often found in large numbers in the soil.</p>
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Integrated Pest Management Pest Identification: Common Diseases

Plant diseases are the result of a pathogen or physiological change in a plant that results in abnormal growth, appearance or development due to a pathogen. Pathogens are plants organisms that cause a disease. Pathogens include: fungi, bacteria, viruses, nematodes, plant viruses.



The fungus in the right shows the three factors required for disease development: a living plant, a viable pathogen and a favorable environmental condition. Managing these factors can also help prevent and suppress disease progression.

<p>Fungal Pathogens  Fungi are the most common plant pathogens. They can cause a wide range of diseases, including leaf spots, blights, and wilts. They are often found in large numbers in the soil.</p> <p>Viral Pathogens  These tiny particles are spread by insects and other organisms. They can cause stunted growth, yellowing of leaves, and the formation of galls. They are often found in large numbers in the soil.</p> <p>Phytoplasmas  These tiny bacteria-like organisms are spread by insects and other organisms. They can cause stunted growth, yellowing of leaves, and the formation of galls. They are often found in large numbers in the soil.</p>	<p>Nematode Pathogens  These microscopic worms feed on plant roots and stems. They can cause stunted growth, yellowing of leaves, and the formation of galls. They are often found in large numbers in the soil.</p> <p>Bacterial Pathogens  These tiny bacteria cause a wide range of diseases, including leaf spots, blights, and wilts. They are often found in large numbers in the soil.</p>
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Example of a Plant Vector

These insects are often found on the undersides of leaves. They can cause stunted growth, yellowing of leaves, and the formation of galls. They are often found in large numbers in the soil.


Integrated Pest Management Prevention Strategies

Prevention is an important step in avoiding and keeping a pest population below economic threshold levels. Prevention strategies include practices such as soil and equipment sanitation, utilizing pest-free or resistant planting material, managing alternative host materials, sanitation of propagation material, crop rotation, controlling crop spacing, trap crops, encouraging beneficial insects, timely crop destruction, etc.

<p>Soil Sanitization  Avoidance of soil-borne pests and diseases. Use of clean soil and equipment. Avoidance of soil-borne pests and diseases. Use of clean soil and equipment.</p> <p>Physical Measures  Use of physical barriers to prevent pest entry. Use of physical barriers to prevent pest entry.</p> <p>Cultural Measures  Use of cultural practices to prevent pest entry. Use of cultural practices to prevent pest entry.</p> <p>Biocontrol  Use of natural enemies to control pests. Use of natural enemies to control pests.</p> <p>Encouraging Beneficial Insects  Use of natural enemies to control pests. Use of natural enemies to control pests.</p>	<p>EXAMPLES  Examples of prevention strategies include: soil and equipment sanitation, utilizing pest-free or resistant planting material, managing alternative host materials, sanitation of propagation material, crop rotation, controlling crop spacing, trap crops, encouraging beneficial insects, timely crop destruction, etc.</p>
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Chewing Pests:

Feeding on the foliage, stems, fruit or roots.
Pests within this group include beetles, caterpillars, earwigs, leaf miners, etc.









Sucking Pests

These pest pierce plant's vascular tissue and withdraw plant sap. They cause plants to discolor, twist and distort. Pests within this group include aphids, whiteflies, mealy bugs, scales etc.



Thrips

Thrips have rasping and sucking mouthparts. Damage results in discoloration and scarring of leaves, stems, fruit and flowers. They are also plant vectors which are organisms that can transmit a pathogen such as a bacterium, virus, or phytoplasma into a plant.





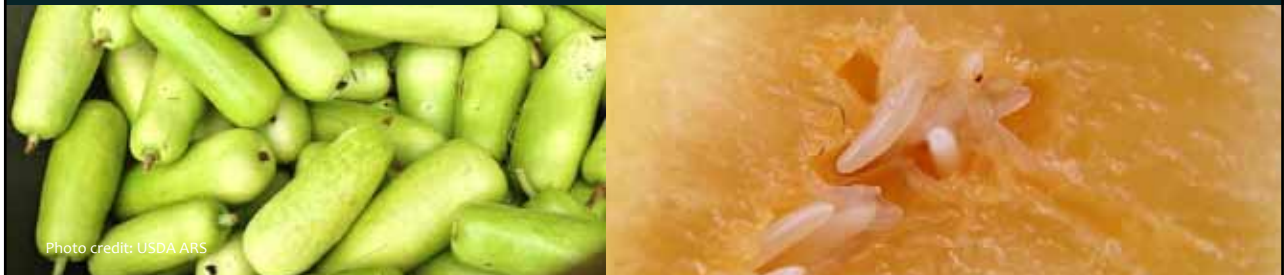
Mites

Mites have rasping and sucking mouthparts. Damage results in a brown to russet discoloration of leaves, stems, fruit and flowers.



Fruit Flies

There are 4 fruit flies in Hawaii: Oriental fruit fly, Melon fly, Mediterranean fruit fly, Malaysian fruit fly. Adult females sting fruits and vegetables resulting in blemishes. Larvae tunnel within fruit.





Slugs and Snails

Slugs and snail are problem for low-growing vegetables. They are active in the evenings and are commonly associated with seedlings magically disappearing overnight.

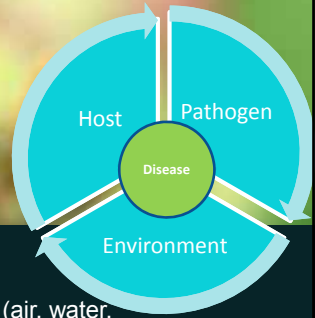


Nematodes

Roundworms that attack the root system of plants and impair water and nutrient uptake. Symptoms: stunting, poor plant growth, narrow and weak stems, foliar chlorosis, root rotting and galling, plant toppling and poor root development.



Photo credit: Dr. Scot Nelson, yardcare.com, & USDA



Fungal Diseases

Fungal diseases are caused by fungal pathogens. Reproduce and disperse by spores (air, water, soil and via humans too). Common fungal pathogen include: powdery mildew, downy mildew, *Alternaria*, *Cercospora*, *Phytophthora*, etc.



Photo credit: Chris Kadooka



Bacterial Diseases

Bacterial pathogens reproduce quickly and cause damage by degrading cell walls produce toxins, alter hormones, clog xylem of plant tissue. They are spread primarily via rain, or splashing water (seed and soil as well). They often enter plant tissue through natural openings or injury sites. Examples include: *Xanthomonas*, *Pseudomonas*, *Erwinia*, etc.



Photo credit: Chris Kadooka



Viral Diseases

Viruses are caused by viral organisms which cause stunting, malformation, mosaic mottling symptoms, etc. They can only survive on living plant tissue. Once infected there is no cure. They are mainly transmitted by insect vectors, farm tools, etc. Common plant viruses include: Banana Bunch Top Virus, Tomato Spotted Wilt Virus, etc.

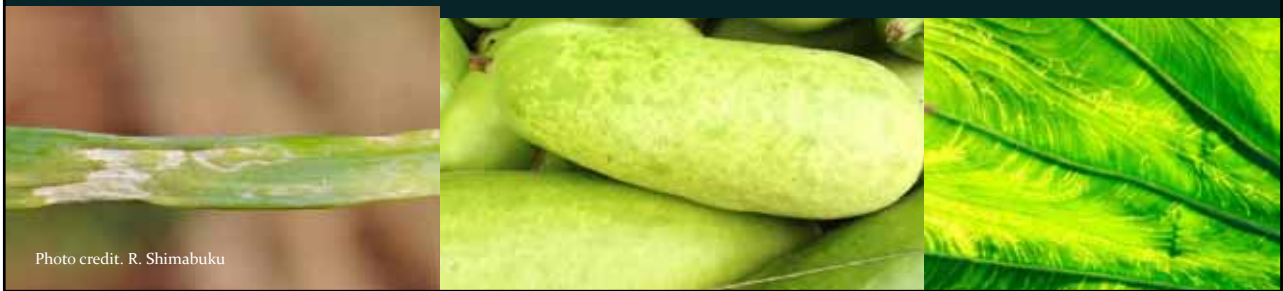


Photo credit. R. Shimabuku



Plant Hoppers

Plant hoppers damage leaves, stems, fruits, and flowers. They also serve as vectors for plant diseases, especially phytoplasmas.





Phytoplasma

Phytoplasma are plant diseases that are caused by a bacteria which parasitizes on the phloem of plant tissue via a sucking type of insect vector. Symptoms range from yellowing of plant tissue, cupping of leaves, witches broom, stunting and even death of infected plants. Leafhoppers are often associated with vectoring of phytoplasmas like the Watercress Aster Yellow (WAY)



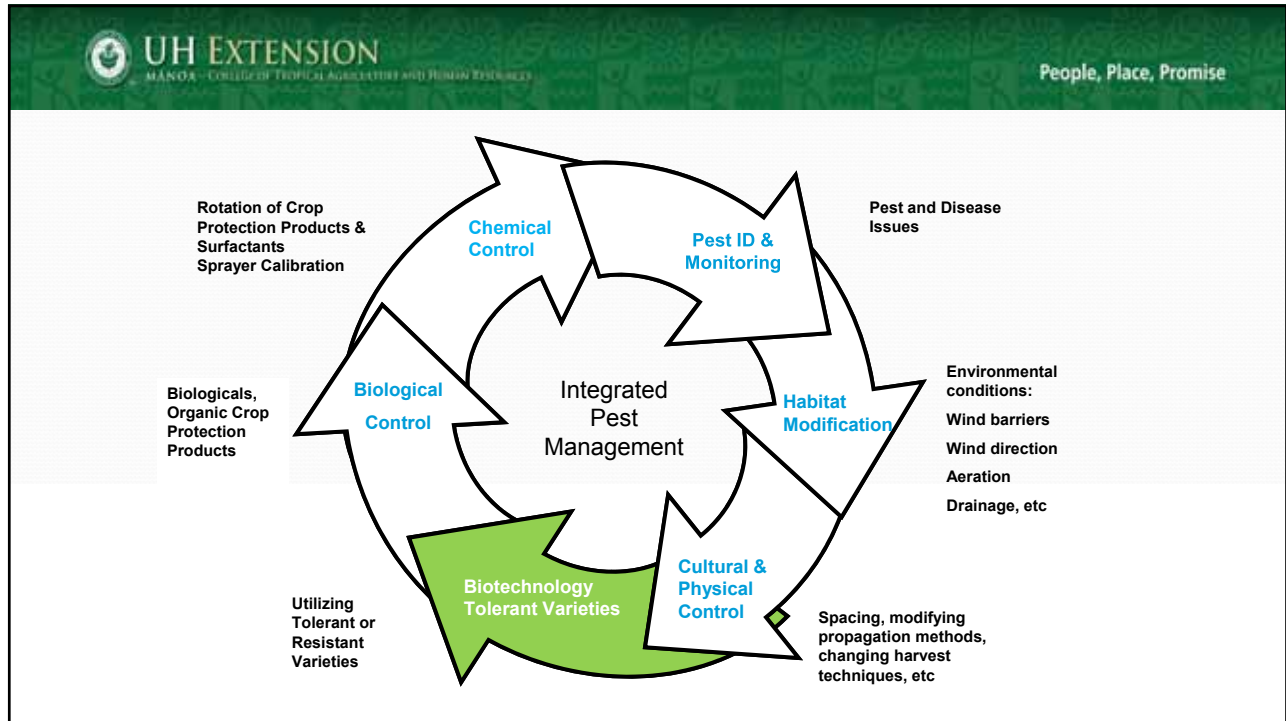
Photo credit: S. Fukuda



Weeds

Weeds (annuals, biennials, perennials, etc.) often outcompete plants for food, sunlight, etc. They are fast growing, prolific seed producers, etc. Some weeds may be alternative hosts for crop pests (insects and diseases).





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Importance of Variety Screenings

- High influx of new pest and diseases annually
- Existing pest populations easily adapt
- Environmental conditions are changing
- New varieties being developed annually
- Utilizing varieties with natural tolerance to pests may help ease other pest management efforts

State of Hawaii
DEPARTMENT OF AGRICULTURE

New Pest Advisory
No. 19-01 December 2014

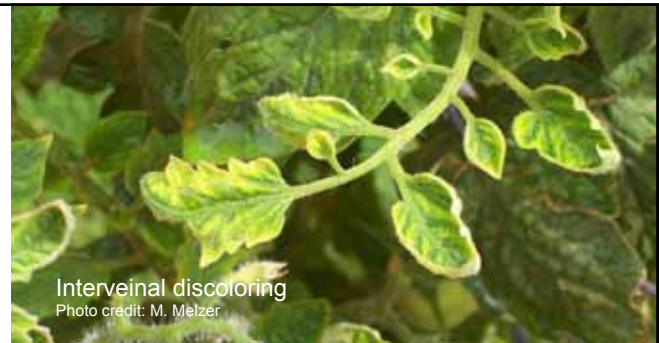
Bagra Bug
Bagra hilaris (Burmester)
(Hemiptera: Pentatomidae)

Abstract
The invasive B. hilaris, a widely distributed pest of agricultural crops, was discovered in a recent survey of B. hilaris in Hawaii and Indonesia. This is a small, dark, oval-shaped insect that feeds on various crops and is a major pest of the ornamentals of Hawaii. B. hilaris is a highly mobile pest, and its presence in Hawaii is a significant concern. B. hilaris is a highly mobile pest, and its presence in Hawaii is a significant concern.



Tomato Yellow Leaf Curl Virus

- Devastating disease of tomato first detected in 2009
- Vectors are the silver leaf (*Bemisia tabaci*) and the sweet potato whitefly (*Bemisia argentifolii*)
- UH CTAHR screened several dozen varieties for TYLCV tolerance in replicated field trials from 2009-2016





Summary: UH Field Trials from 2009-2016 (with Melzer, Kaufman, Tateno, & Wright, etc.)

- Varieties exist with tolerance to TYLCV strains on Oahu based on tissue blot test:
 - Beef Steak Type (12):
 - Adonis, PIK Ripe 461, Pamela, Sacramento, VT-62940, VT-62966, Tovi Star, Tovi Roca, VT-62966, Yaqui, Xaman (Roma) and Tygress
 - Specialty Type (7):
 - Grape: 72618, Rona, Rojita, Komohana
 - Cherry: Felicity, Hathor, Sarina

Online Publications:

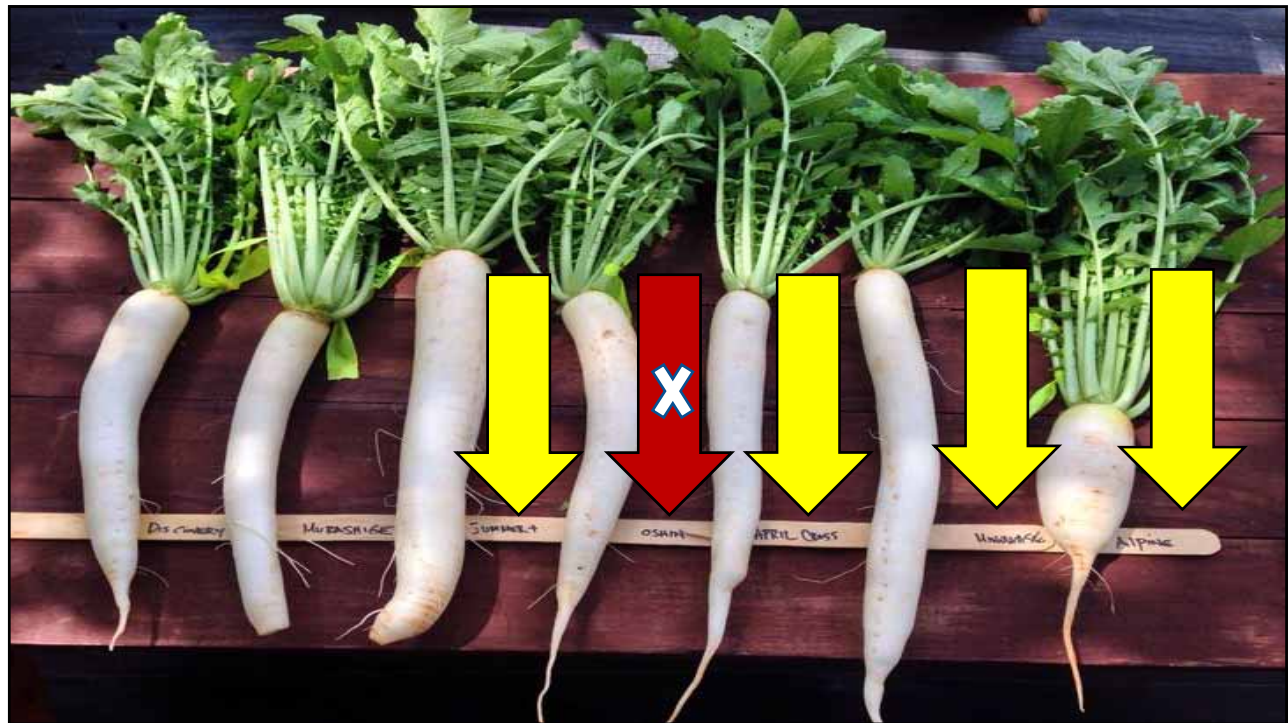
<http://www.ctahr.hawaii.edu/oc/freepubs/pdf/PD-70.pdf>

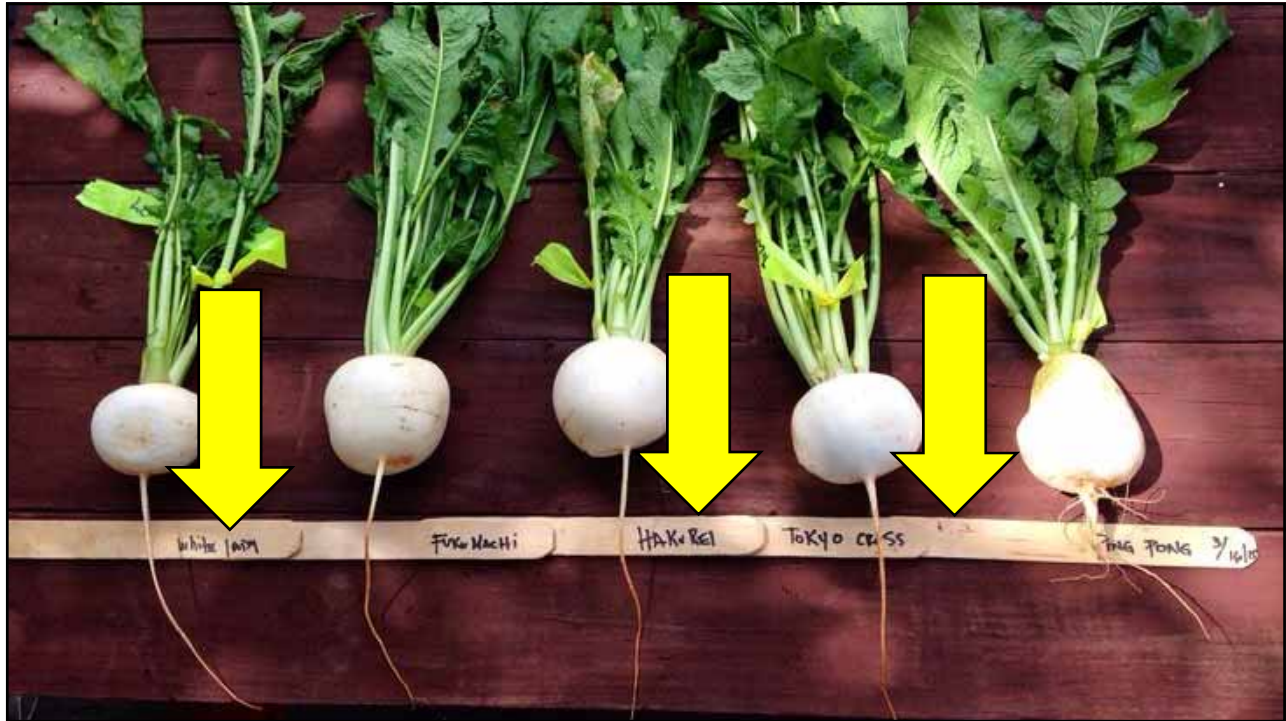
<http://www.ctahr.hawaii.edu/oc/freepubs/pdf/PD-78.pdf>

<http://www.ctahr.hawaii.edu/sustainag/news/articles/V12-Uyeda-OrgTomato.pdf>

<http://www.ctahr.hawaii.edu/sustainag/news/articles/V22-Tateno-tomato.pdf>

http://www.ctahr.hawaii.edu/e-notes/downloads/Field_day_handout_last_version.pdf





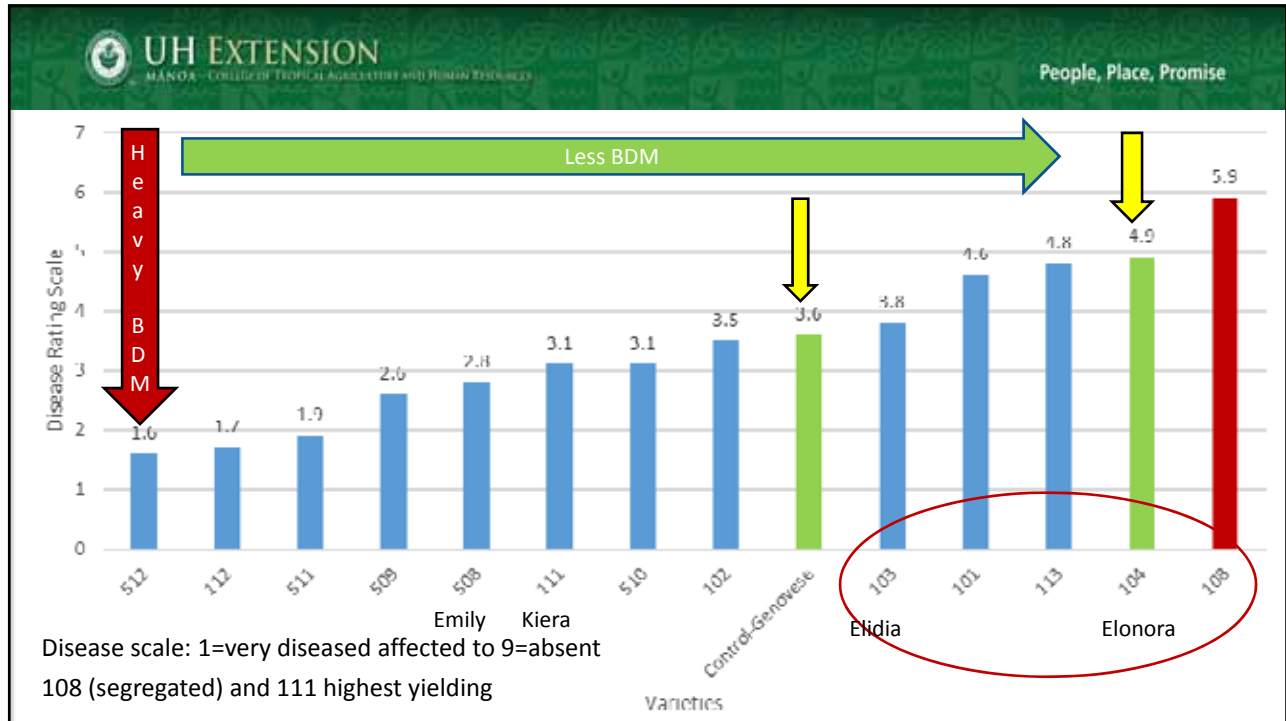

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UH Field Trials (2014-2015)

- Promising Daikon Varieties
 - Alpine, Minowase, Summer Cross, April Cross, Bravo (2016)
- Promising Turnip Varieties:
 - Tokyo Cross, Hakurei, White Lady







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Persian Cucumber (2014)

- Screened 12 varieties of Persian cucumbers
- Based on preliminary data:
 - Jawell, Unistars, Alexander, GVA 608, GVA 609, GVA 606

Online Publication:
<http://www.ctahr.hawaii.edu/sustainag/news/articles/V20-SuganoEtAl-PersianCuke.pdf>

Issue #6 / The Food Producer June | July | August 2014

QUICK & APPLIED AGRICULTURAL TRIAL
Persian Cucumber (Beit Alpha) Variety Screening 2014
 J. Sagan, J. Ujwala, S. Fukuda, S. Migita and K.-H. Wang
 University of Hawaii at Manoa, College of Tropical Agriculture and Human Resources


The economic success of food crop producers relies on the growers' ability to adapt farming principles and practices to integrate the latest technology and research developments. Celta CES establishes critical on-farm field experiments in conjunction with edible crop growers to tackle priority crop production issues that strive to improve productivity and profitability. We understand that time is critical in this industry and any crop production managerial decisions must reflect time and cost efficiency. Therefore, please find below a summary of a recent field trial evaluating different varieties of Persian cucumbers due to increased interest and popularity in the market place.

A cucumber field trial was conducted under screenhouse culture at the Punaohia Research Station in Waiakua, Oahu. Seeds were solicited and secured from De Ruiter, Golden Valley, Huteris and Johnny's Select Seed Company. A total of 12 varieties/hybrids were evaluated in this study.

The cucumbers were drip irrigated, planted on January 27, 2014 and harvest began on March 27, 2014. Harvest was conducted every other day. Harvest was terminated on May 2, 2014 (after 5 weeks of harvest). Plants were trained using "T"-posts and cucumber netting. The organic fertilizer, Sustane 4-6-4 fertilizer was applied at the rate of 300 lbs. per acre on March 12 and 26, 2014. A supplemental application of a complete fertilizer (15-15-15) was applied at the rate of 150 lbs. per acre. One application of an organic insecticide was utilized to maintain thrips populations below economic threshold levels.

Due to the limited space under the screen house, the trial was not replicated. The screen house was the limiting factor in the number of plants / treatment as it provided a physical, non chemical barrier against fruit fly and pickleworm pests. Varieties were planted in 20 feet plots (21 plants maximum). Production data is presented based on yield per plant values.

Fruit from the selected varieties in the trial had a dark green color, crisp and pleasant fresh cucumber taste based on testimonials. Overall, Jewell and Unistars were early yielders compared to the remaining varieties. Unistars had short dark green, glossy fruits compared to others in the trial. In summary, Jewell, Unistars, Alexander, and GVA hybrids stood out among the varieties based on its horticultural characteristics and production data.




Heat Tolerance Field Trials

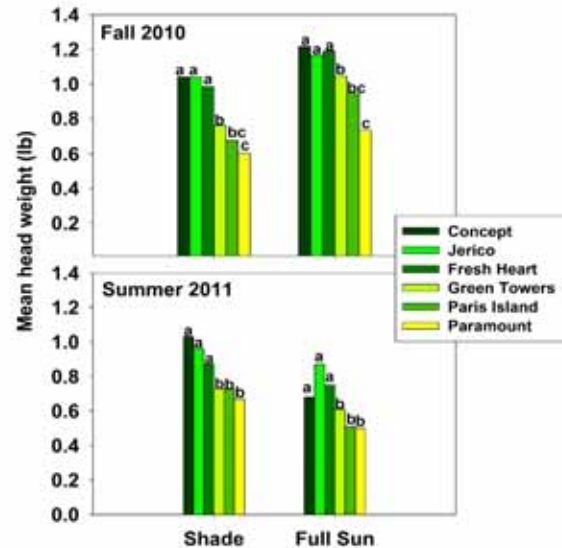
Romaine (29), red and green (30+) leaf lettuce



Evaluated Shade (2010)

Field trials w/ Migita, Valenzuela & Goo

- 6 top producing Romaine varieties
- 30% shade Fall and Summer
- 4 replications with shade and full sun
- Results suggest shade is only needed in the summer months for Romaine production at low elevation sites on Oahu



Evaluated 29 Romaine Varieties (2014)

- Jerico remains top producer, but color unacceptable
- Jerico, Valmaine, Ridgeline had the highest yields
- Caesar and Wildcat were promising for processors- small core
- Spretnak, Claremont were baby romaine types

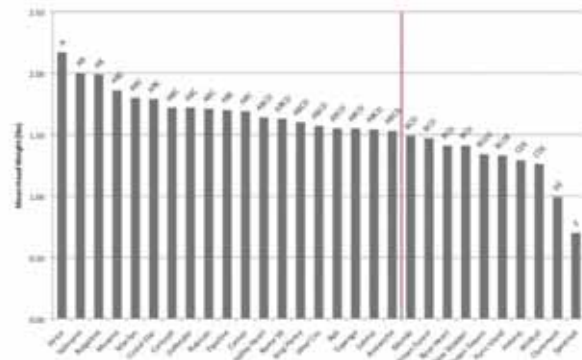


Figure 3: Mean head weight per variety of Romaine lettuce planted November 2013 and harvested January 2014 at the Poamoho Research Station. Letters represent mean separation using Tukeys HSD. Means with the same letter are not significantly different. The varieties to the left of the red line show potential for commercial production, while the varieties on the right may not be adequate, based on yield.

Online Publication:
<http://www.ctahr.hawaii.edu/oc/freepubs/pdf/VC-3.pdf>



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30 Box Red & Green Lettuce Variety Trials

Quick response to aquaponic and leafy green growers' request for heat tolerant varieties



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Evaluating Varieties with Putative Heat Tolerance

Red-Cherokee, Rouxai, Pomegranate Crunch (baby romaine), Multi red, Cannatrix, Salanovas, Roxy, Fossey, Red Sail, etc.

Green-Anuenue, Nancy, Adriana, Spretnak (baby romaine), Dragoon (baby romaine), Tropicana, Nevada, Kiribati, Concept, Gecko, Panisse, Rex, etc.



2015: Heat and Diamond Back Moth (DBM) Tolerance

Head Cabbage (23) and Chinese Cabbage (13) & Broccoli (4)

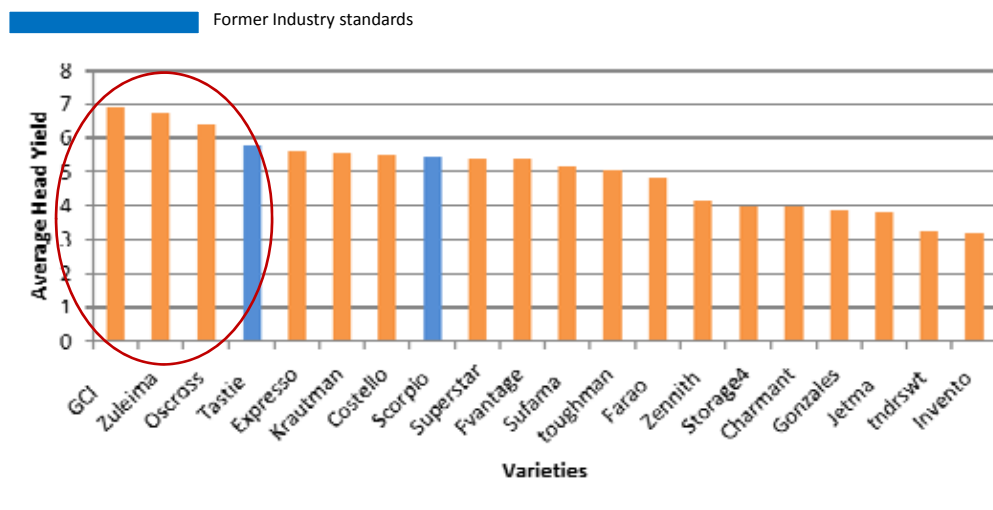
Maui and Oahu

w/ Migita, Shingaki, Shimabuku & Bost

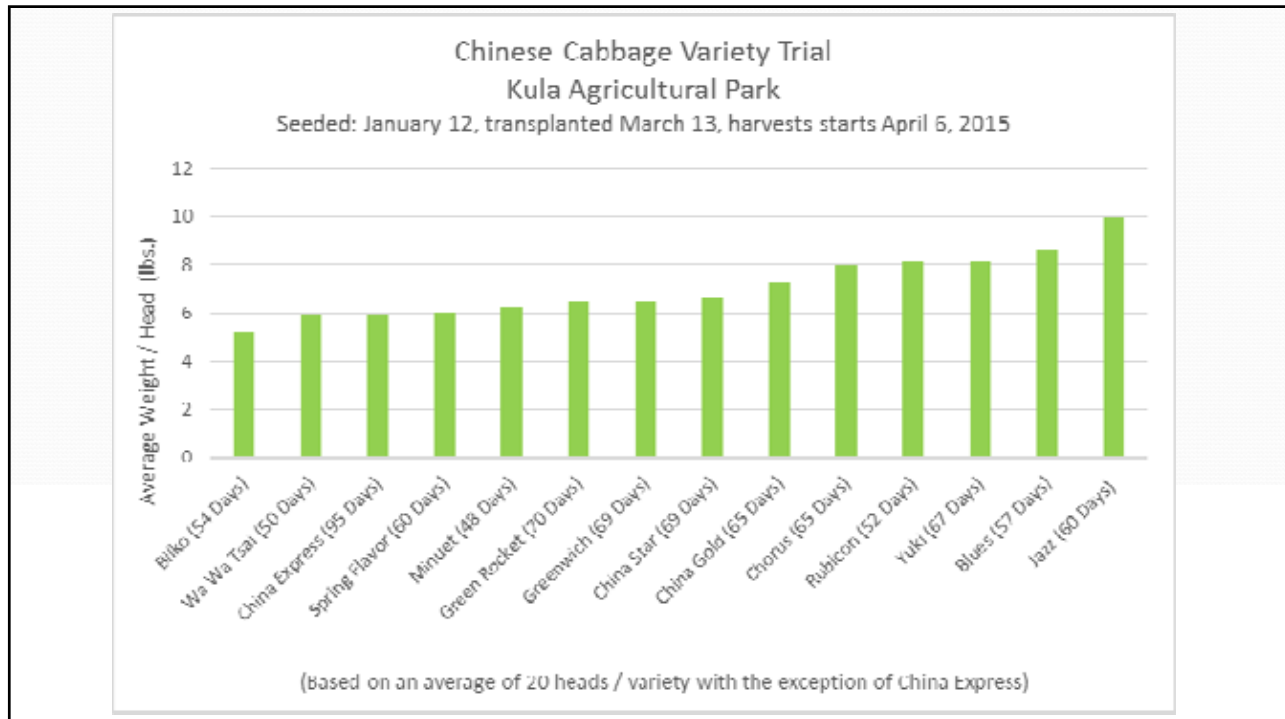
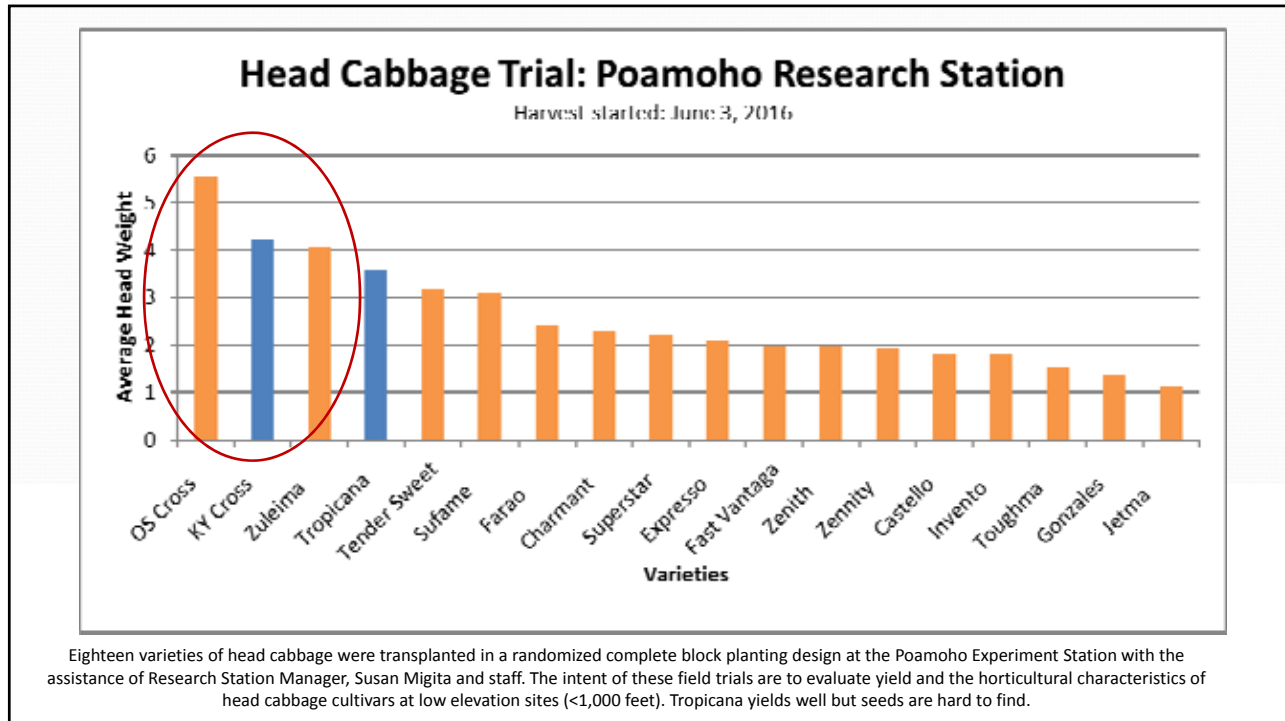


Head Cabbage: Kula Research Station

Seeded March 10, transplanted April 21, harvest started June 8, 2015

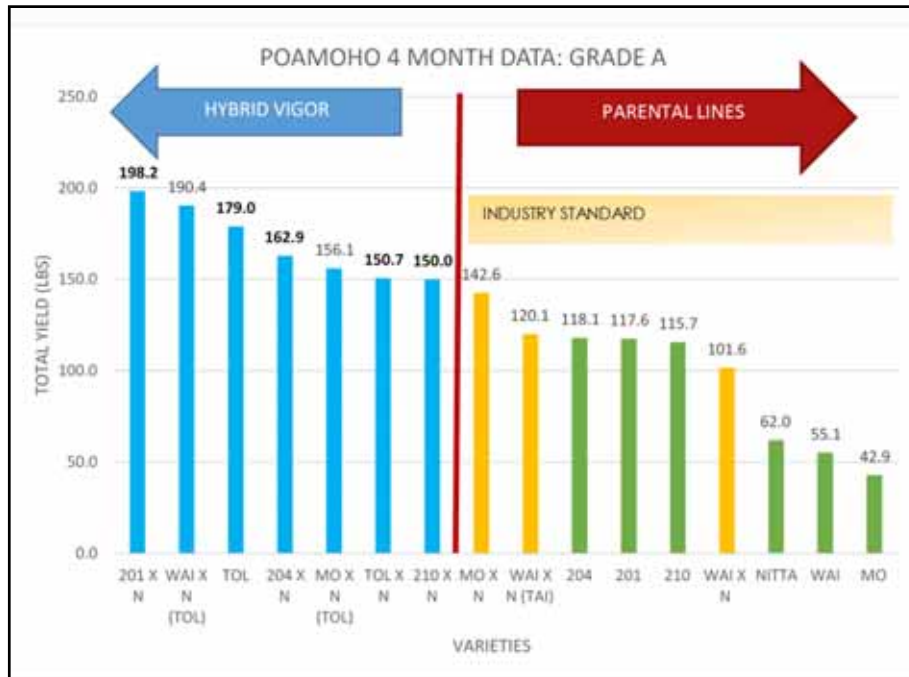


Approximately 40-70 heads of each head cabbage variety were grown in replication in Kula, Maui. The average weight per head was calculated based on a random selection of twelve heads per replication. There were three replications (36 heads)/ variety.



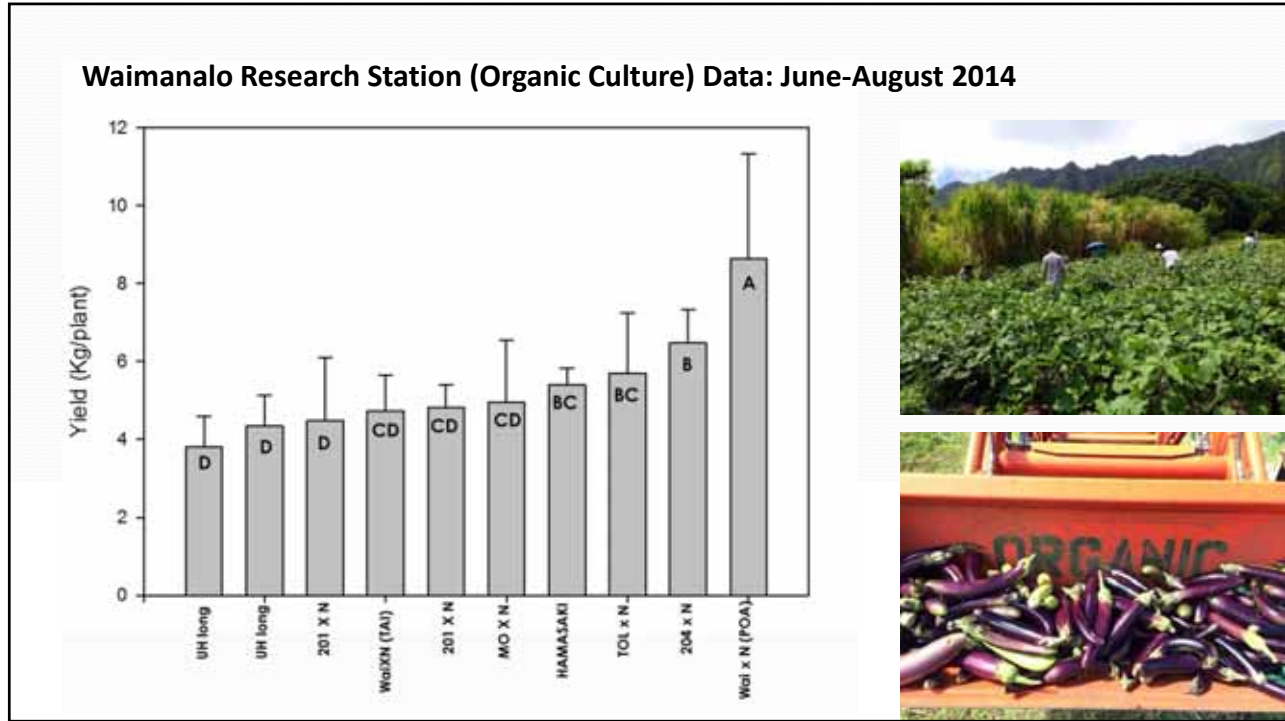
2015: Statewide Hybrid Eggplant Variety Trial

(w/Migita, Takeda, Shingaki, Shimabuku, & Motomura)



Oahu, Maui, & Hawaii (7 sites). Molokai (2015)





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New Crop Evaluations

Field trials with Migita, Nakamoto, Hamasaki, Kawabata(s) & Whitmore Ag Development

- 16 varieties evaluated
- Yield and brix data collected
- Grown under a plastic covering (rust) and netting (birds)
- Project ended in September 2014 due to tropical storm

Blueberry Field Trial Summary

3/7/14-8/29/14

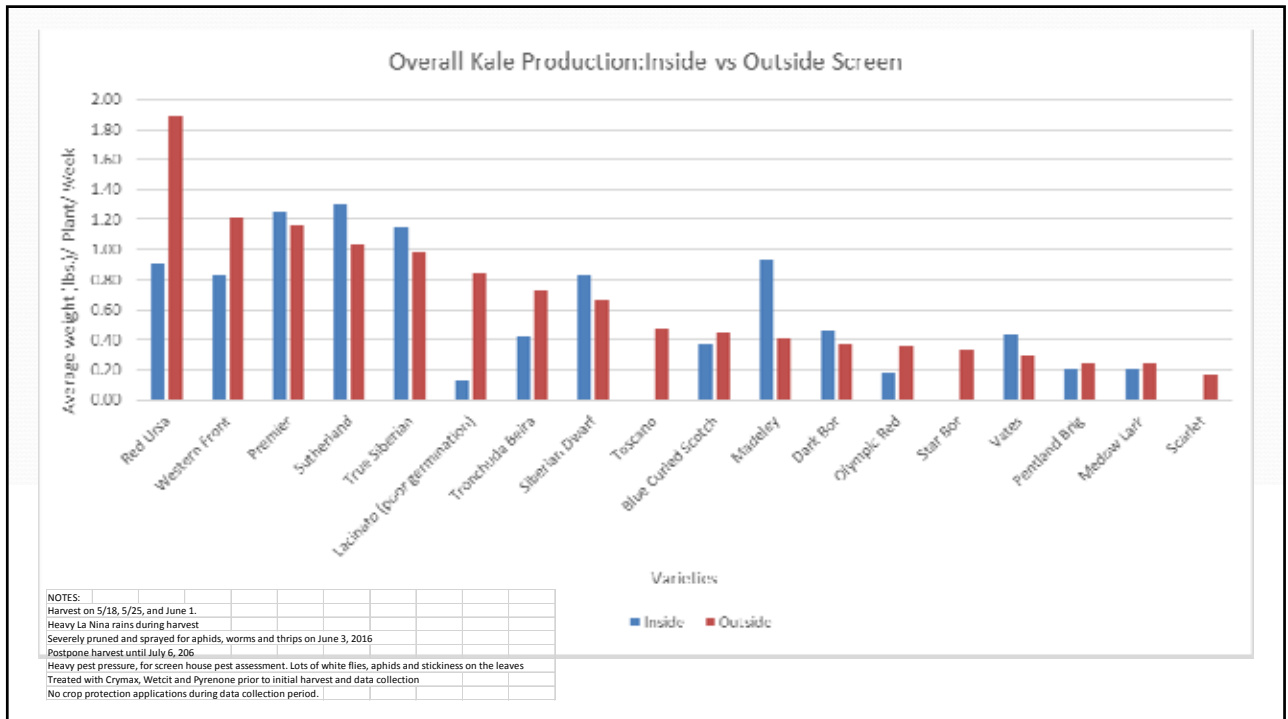
Variety	Total Yield (gram/plant)
Bilobé	~450
Snow Chaser	~230
Emerald	~190
Misty	~180
Spring High	~160
Sunshine Blue	~130
Sun Joaquin	~130
Jewel	~120
Veprara	~100
Blue Gold	~80
Duke	~60
Legacy	~40
Blue Crop	~30
O'Neil	~20
Sunchaser	~15
Star	~10



2016: Kale Variety Trial



2016: DBM & Caterpillars: Kale (18)



Suitability

- Each location varies
- Screen recommended varieties in your respective areas
- Stay current with seed companies and their offerings
 - Hawaii's market share is small, varieties can be discontinued without notice
- Utilizing varieties with tolerance to pests and disease is just way to manage pest in an IPM system



For More Information

Jari S.K. Sugano
 University of Hawaii at Manoa
 College of Tropical Agriculture and Human Resources
 Department of Plant and Environmental Protection Sciences
 Wahiawa Extension Office
suganoj@ctahr.hawaii.edu
 622-4185



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