UH Extension
MĀNOA | College of Tropical Agriculture and Human Resources

Pest Management for UH CTAHR Master Gardeners

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

University of Hawai`i at Mānoa
College of Tropical Agriculture and Human Resources
March 2017

Master Gardeners at UH CTAHR

- Adults who love gardening, want to learn and to share their knowledge with others through volunteer educational services.
- Extension resource for expanded outreach into the community.
- Trained volunteers who help Extension meet the overwhelming demand for research based horticultural and gardening information to the public.

KAUAI · OAHU · MAUI · LANAI · MOLOKAI · BIG ISLAND

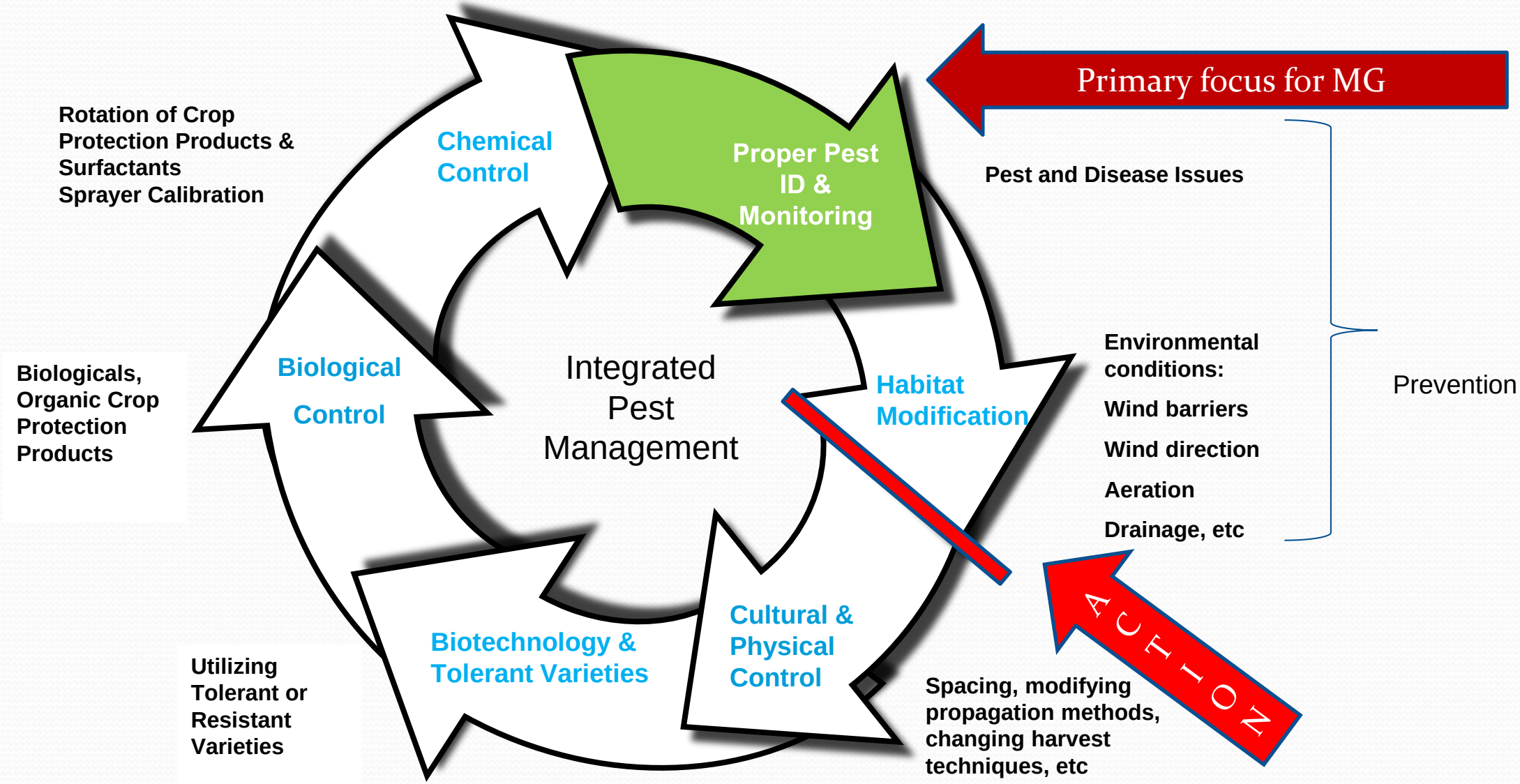
UNIVERSITY OF HAWAI'I
MASTER GARDENER
College of Tropical Agriculture & Human Resources

Increasing Demands for Information

Agricultural Crop Pests

- Plant or animal detrimental to humans or human concerns (agriculture or livestock production)
  - includes insects, animals and plant diseases that predate upon, or otherwise cause damage to plants

Source: Miriam-Webster dictionary


Primary focus for MG
Rotation of Crop Protection Products & Surfactants Sprayer Calibration
Chemical Control
Proper Pest ID & Monitoring
Pest and Disease Issues
Biologicals, Organic Crop Protection Products
Biological Control
Integrated Pest Management
Habitat Modification
Environmental conditions:
Wind barriers
Wind direction
Aeration
Drainage, etc
Prevention
Biotechnology & Tolerant Varieties
Cultural & Physical Control
ACTION
Utilizing Tolerant or Resistant Varieties
Spacing, modifying propagation methods, changing harvest techniques, etc

Sugano, 1997

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 scaring 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.

Photo credit: Dr. Ted Radovich Dr. Scot Nelson



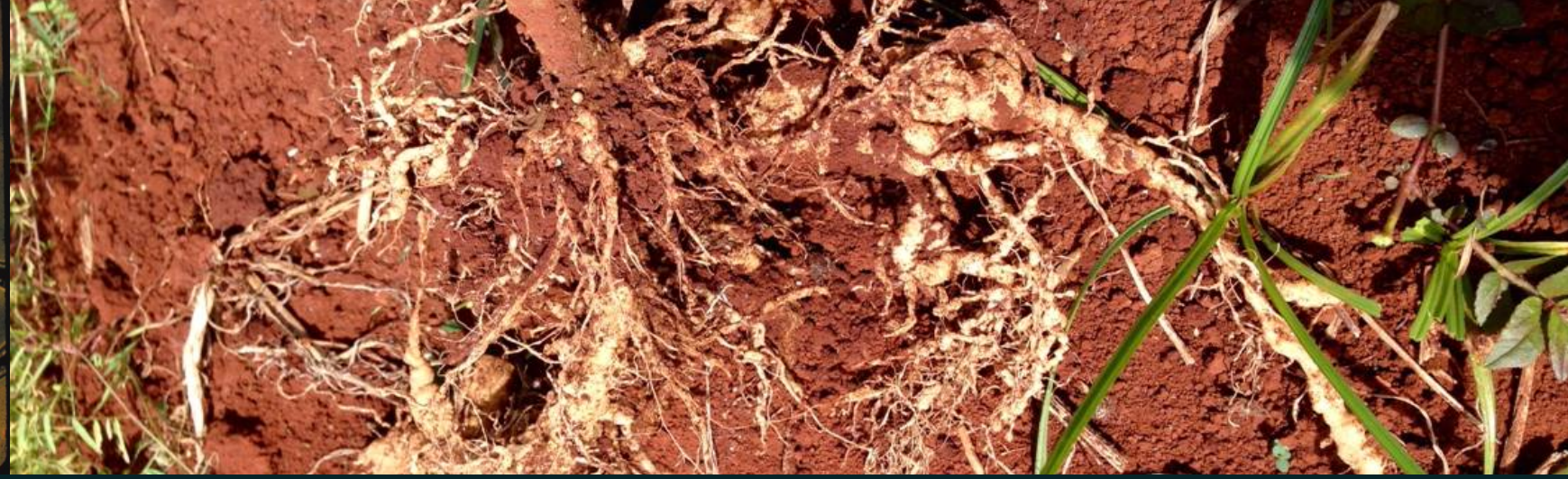

Fruit Flies

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.


Photo credit: USDA ARS

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.

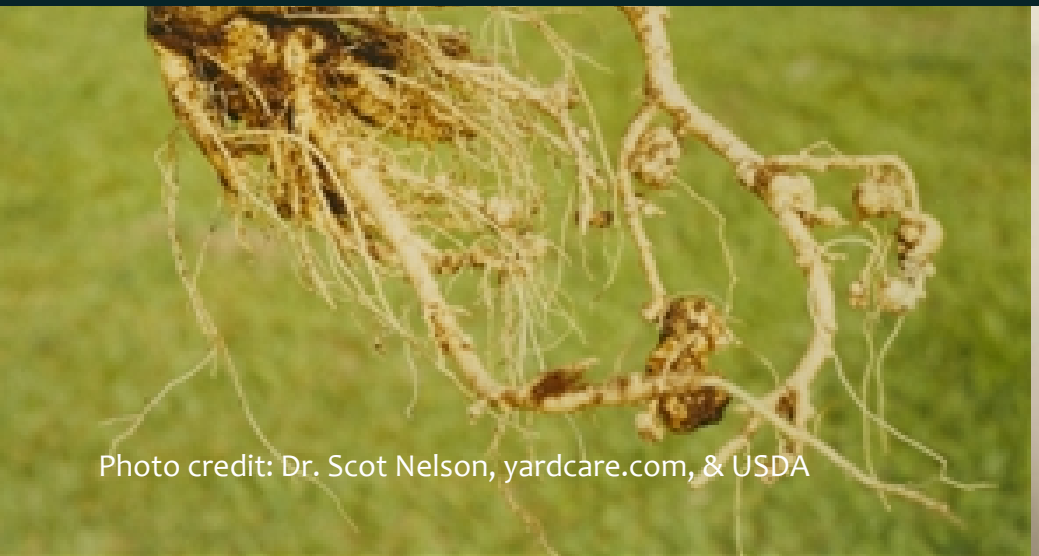
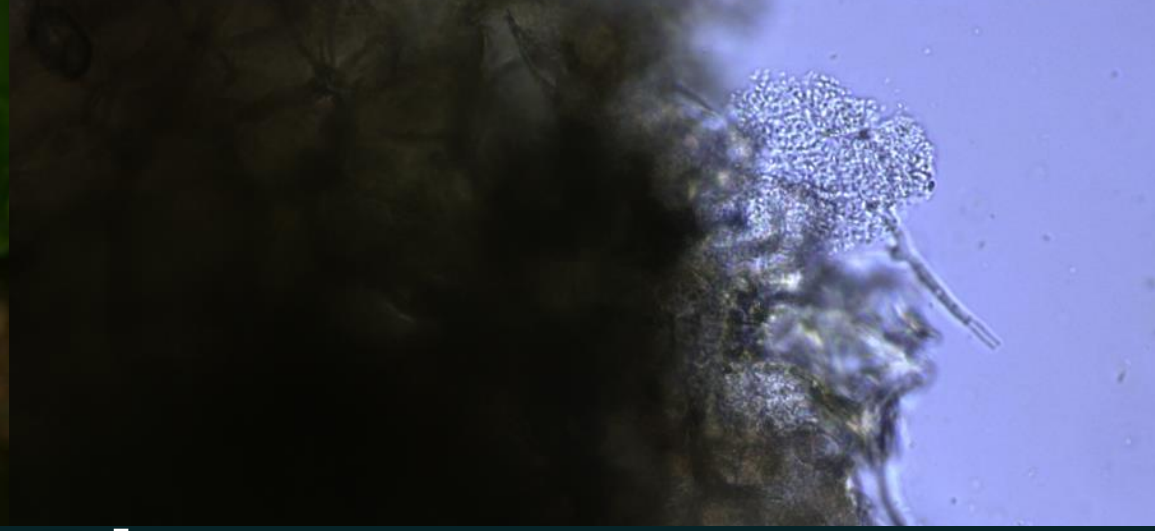


Photo credit: Dr. Scot Nelson, yardcare.com, & USDA

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*, *Phythophthora*, etc.



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: *Xanthamonous*, *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)

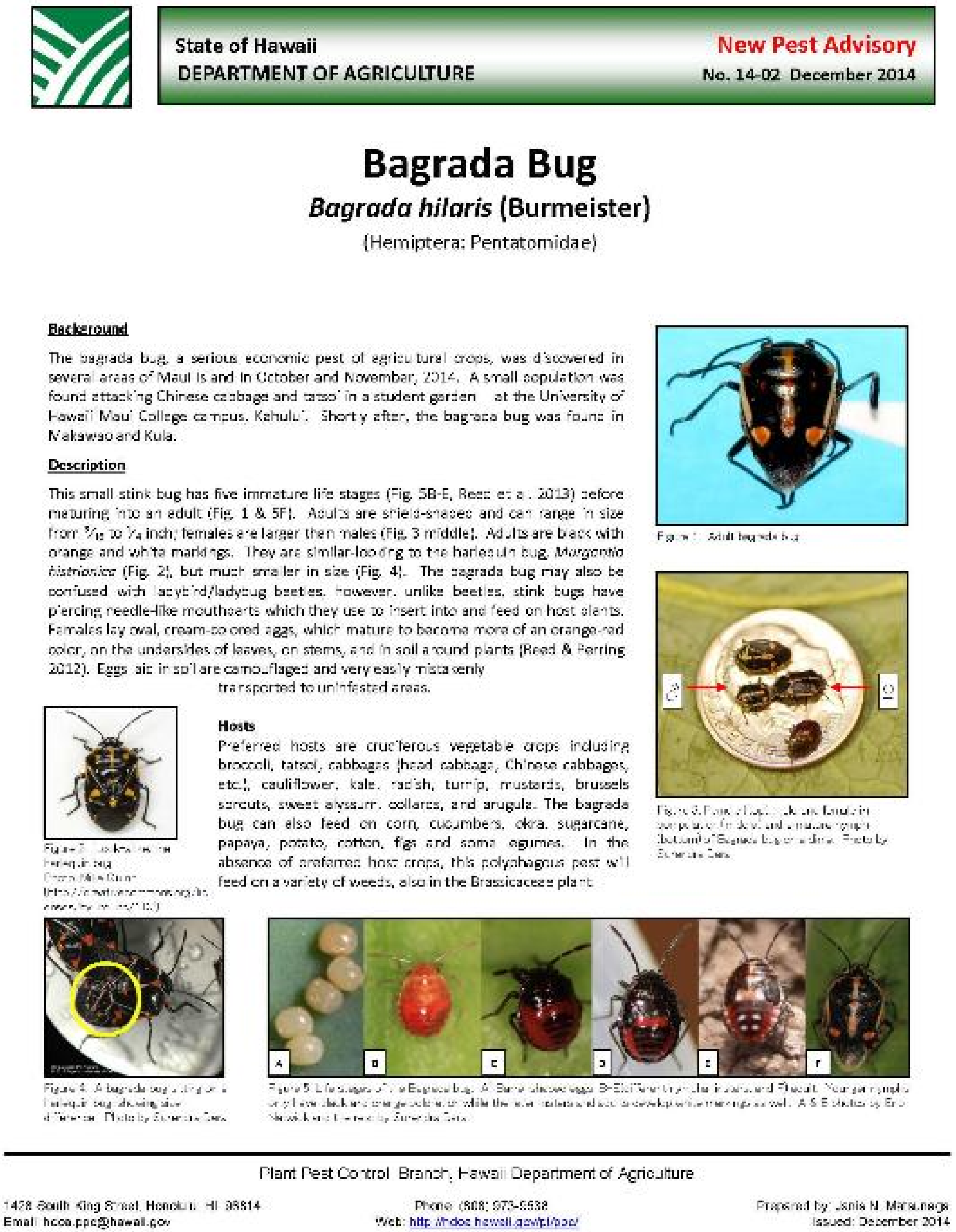
Photo credit. S. Fukuda



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).


New diseases..
Taro Vein Chlorosis Virus



State of Hawaii
DEPARTMENT OF AGRICULTURE

New Pest Advisory
No. 14-02 December 2014

Bagrada Bug

Bagrada hilaris (Burmeister)

(Hemiptera: Pentatomidae)

Background

The bagrada bug, a serious economic pest of agricultural crops, was discovered in several areas of Maui Island in October and November, 2014. A small population was found attacking Chinese cabbage and tatsoi in a student garden at the University of Hawaii Maui College campus, Kahului. Shortly after, the bagrada bug was found in Makawao and Kula.

Description

This small stink bug has five immature life stages (Fig. 5B-E, Reed et al. 2013) before maturing into an adult (Fig. 1 & 5F). Adults are shield-shaped and can range in size from 3/16 to 1/4 inch; females are larger than males (Fig. 3 middle). Adults are black with orange and white markings. They are similar-looking to the harlequin bug, *Murgantia histrionica* (Fig. 2), but much smaller in size (Fig. 4). The bagrada bug may also be confused with ladybird/ladybug beetles, however, unlike beetles, stink bugs have piercing needle-like mouthparts which they use to insert into and feed on host plants. Females lay oval, cream-colored eggs, which mature to become more of an orange-red color, on the undersides of leaves, on stems, and in soil around plants (Reed & Perring 2012). Eggs laid in soil are camouflaged and very easily mistakenly transported to uninfested areas.

Figure 1. Adult bagrada bug

Figure 2. [illegible]

Figure 3. [illegible]

Hosts

Preferred hosts are cruciferous vegetable crops including broccoli, tatsoi, cabbages (head cabbage, Chinese cabbages, etc.), cauliflower, kale, radish, turnip, mustards, brussels sprouts, sweet alyssum, collards, and arugula. The bagrada bug can also feed on corn, cucumbers, okra, sugarcane, papaya, potato, cotton, figs and some legumes. In the absence of preferred host crops, this polyphagous pest will feed on a variety of weeds, also in the Brassicaceae plant

Figure 4. [illegible]

Figure 5. [illegible]

Plant Pest Control Branch, Hawaii Department of Agriculture

1428 South King Street, Honolulu, HI 96814
Email: hdoa.ppc@hawaii.gov

Phone: (808) 973-9538
Web: http://hdoa.hawaii.gov/pi/ppc/

Prepared by: Janis N. Matsunaga
Issued: December 2014

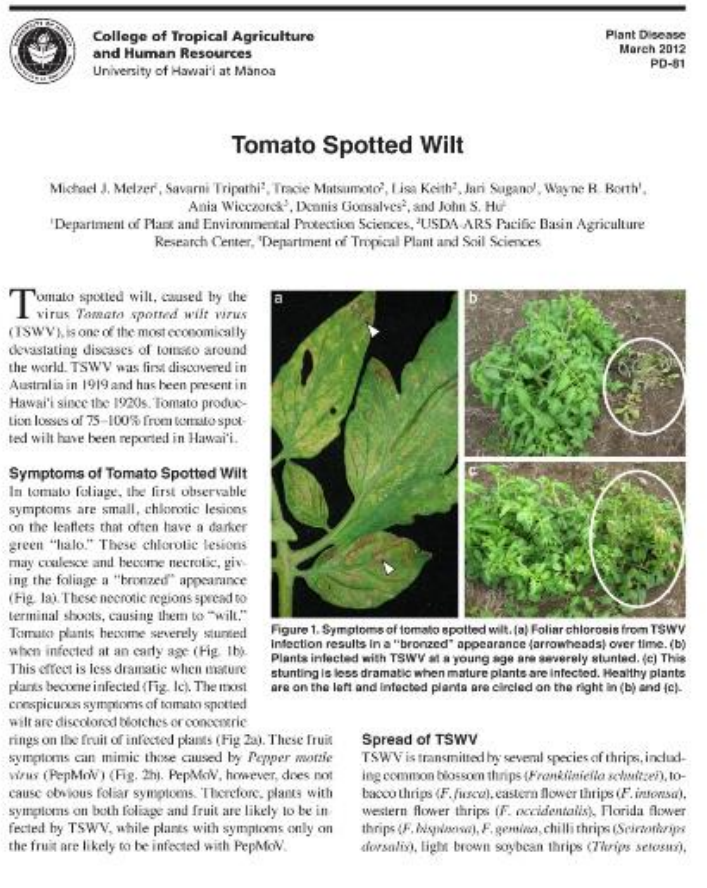
3/25/17: Bagrada Bug damage and insect found in Waimanalo

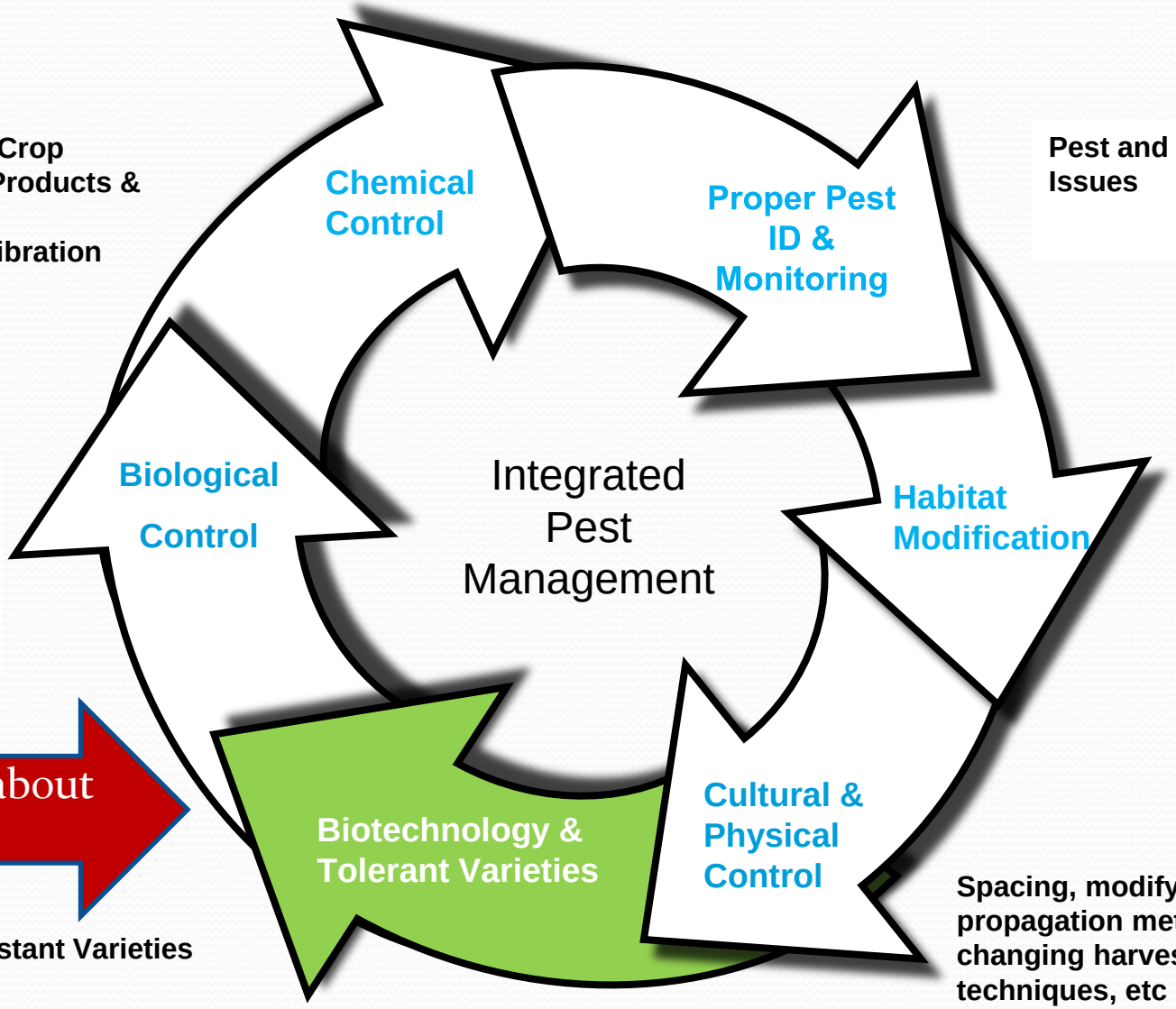

Banana Bract Mosaic Virus


Canna Yellow Mottle Virus

Available Resources

- MG Extension Agents
- Statewide Extension Agents
- Past MG graduates
- Plant Doctor
- ADSC Diagnostic Lab
- Various online Resources





Rotation of Crop Protection Products & Surfactants
Sprayer Calibration

Pest and Disease Issues

Biologicals, Organic Crop Protection Products

Environmental conditions:
Wind barriers
Wind direction
Aeration
Drainage, etc

Asked to Share about Field Trials

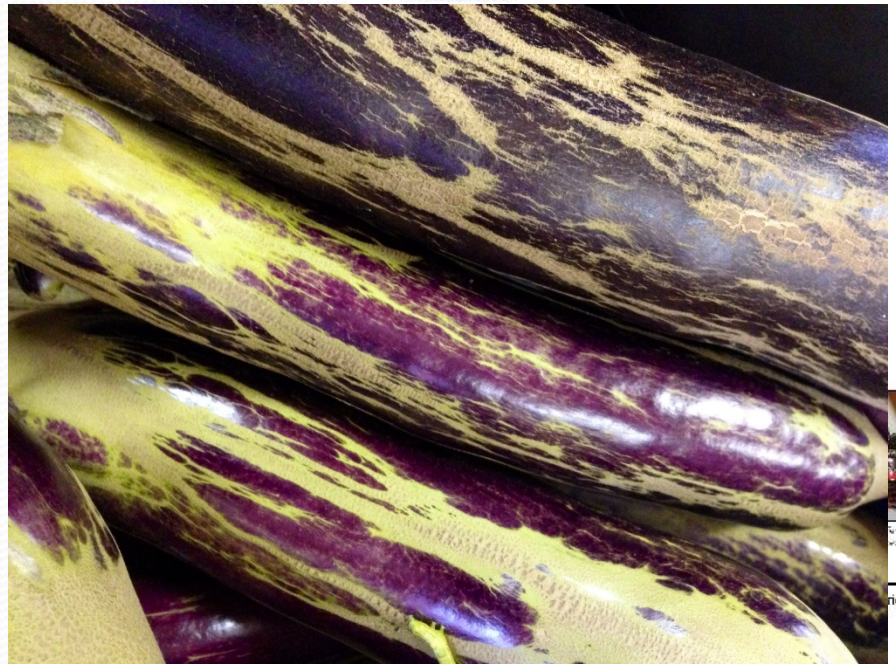
Utilizing Tolerant or Resistant Varieties

Spacing, modifying propagation methods, changing harvest techniques, etc

Sugano, 1997

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



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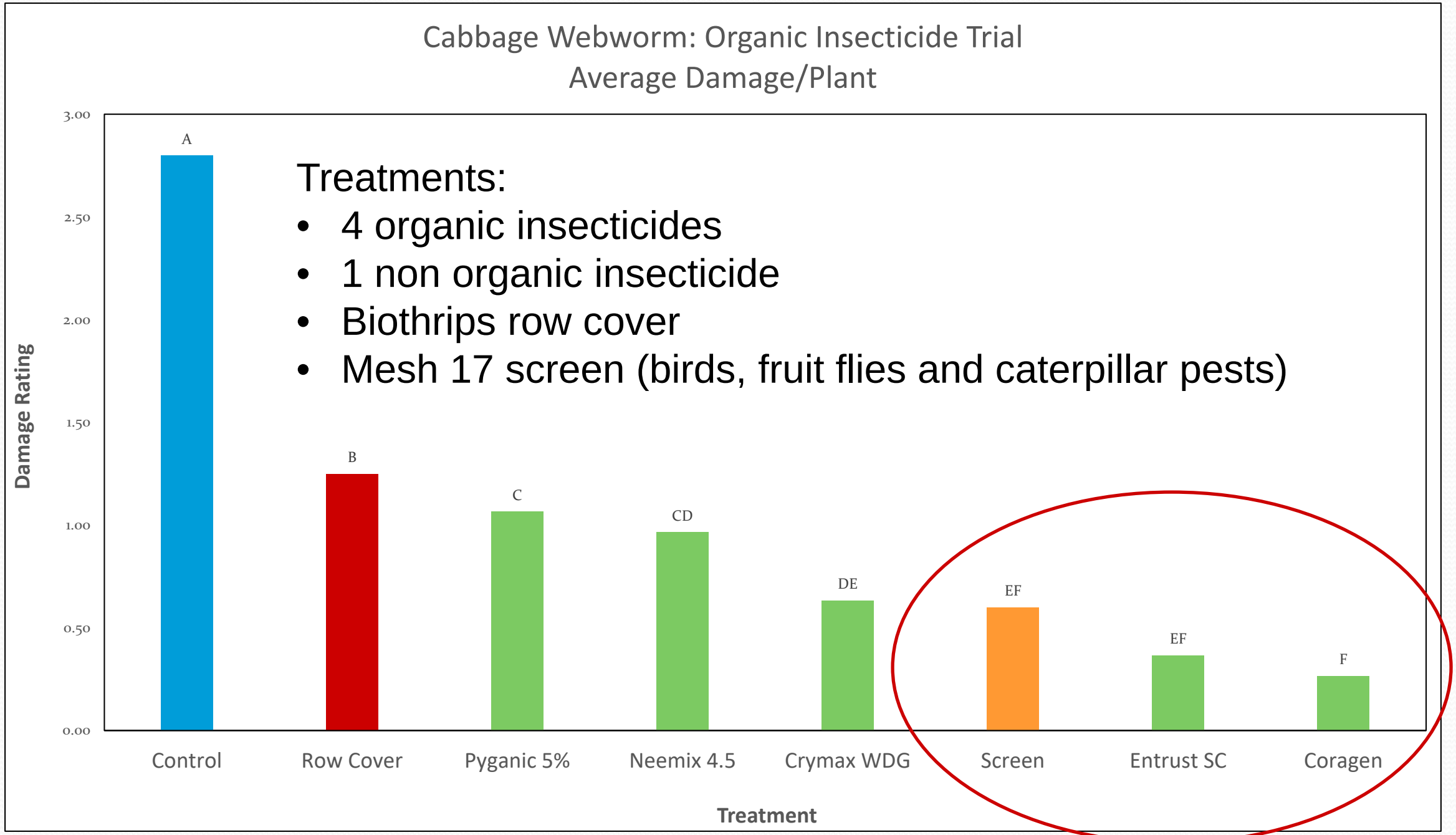
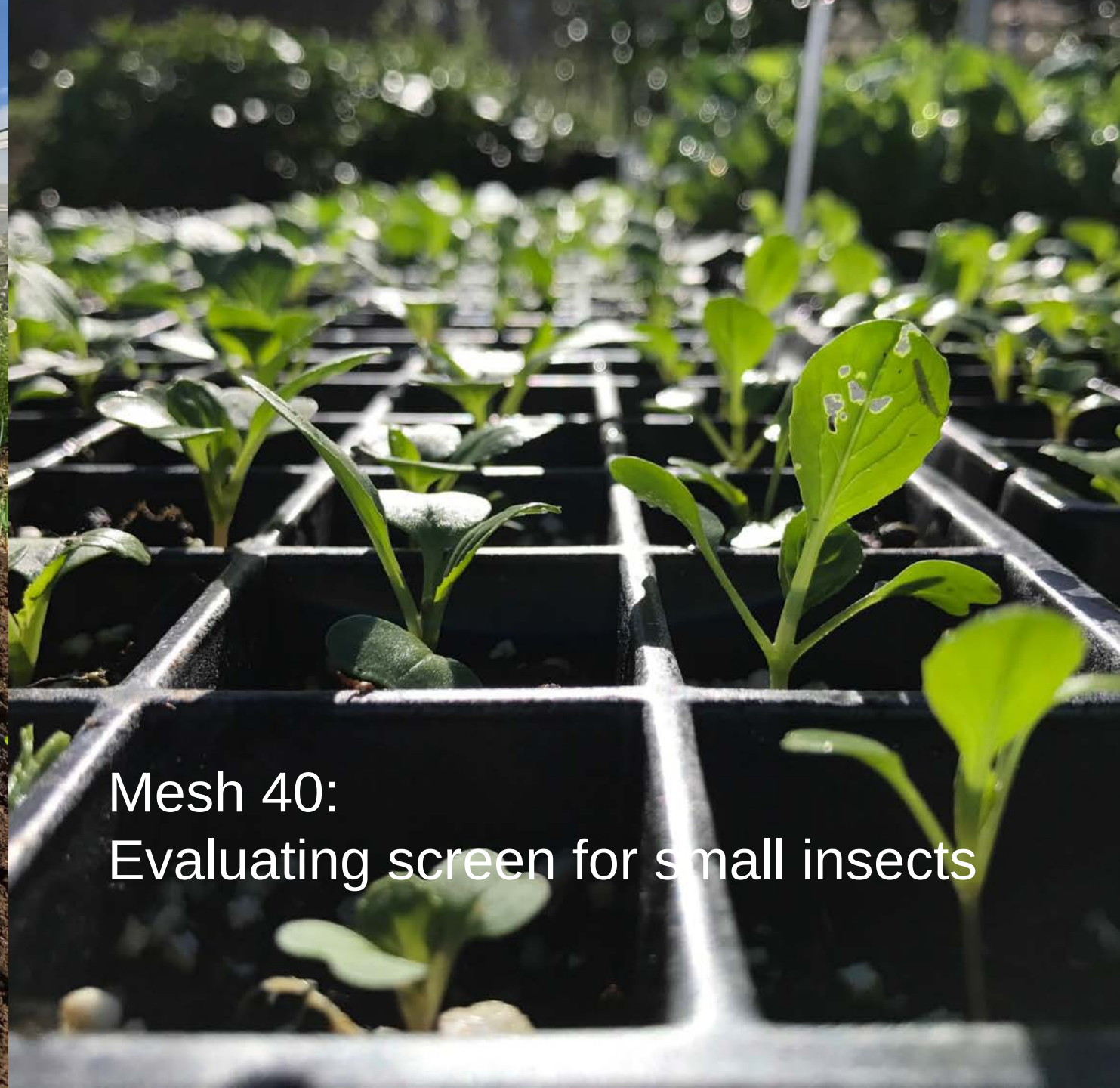
Prepared by: Janis N. Matsunaga
Issued: December 2014

SCREEN: Replicated Webworm Trial (2016)


KEEP OUT
NO ENTRE


Mesh 17
Row Cover
Smaller screen than Mesh 17


Cabbage Webworm: Organic Insecticide Trial
Average Damage/Plant
Treatments:
• 4 organic insecticides
• 1 non organic insecticide
• Biothrips row cover
• Mesh 17 screen (birds, fruit flies and caterpillar pests)
Damage Rating
3.00
2.50
2.00
1.50
1.00
0.50
0.00
A
B
C
CD
DE
EF
EF
F
Control
Row Cover
Pyganic 5%
Neemix 4.5
Crymax WDG
Screen
Entrust SC
Coragen
Treatment



Mesh 40:
Evaluating screen for small insects

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


Tomato Yellow Leaf Curl Virus
Stunted due to shortened internodes


Interveinal discoloring
Photo credit: M. Melzer


Chlorotic (yellowing)
Photo credit: M. Melzer


Leaflets curl or cup upwards


Felicity
Olivia
7105
72767
HA-46204
72105

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, 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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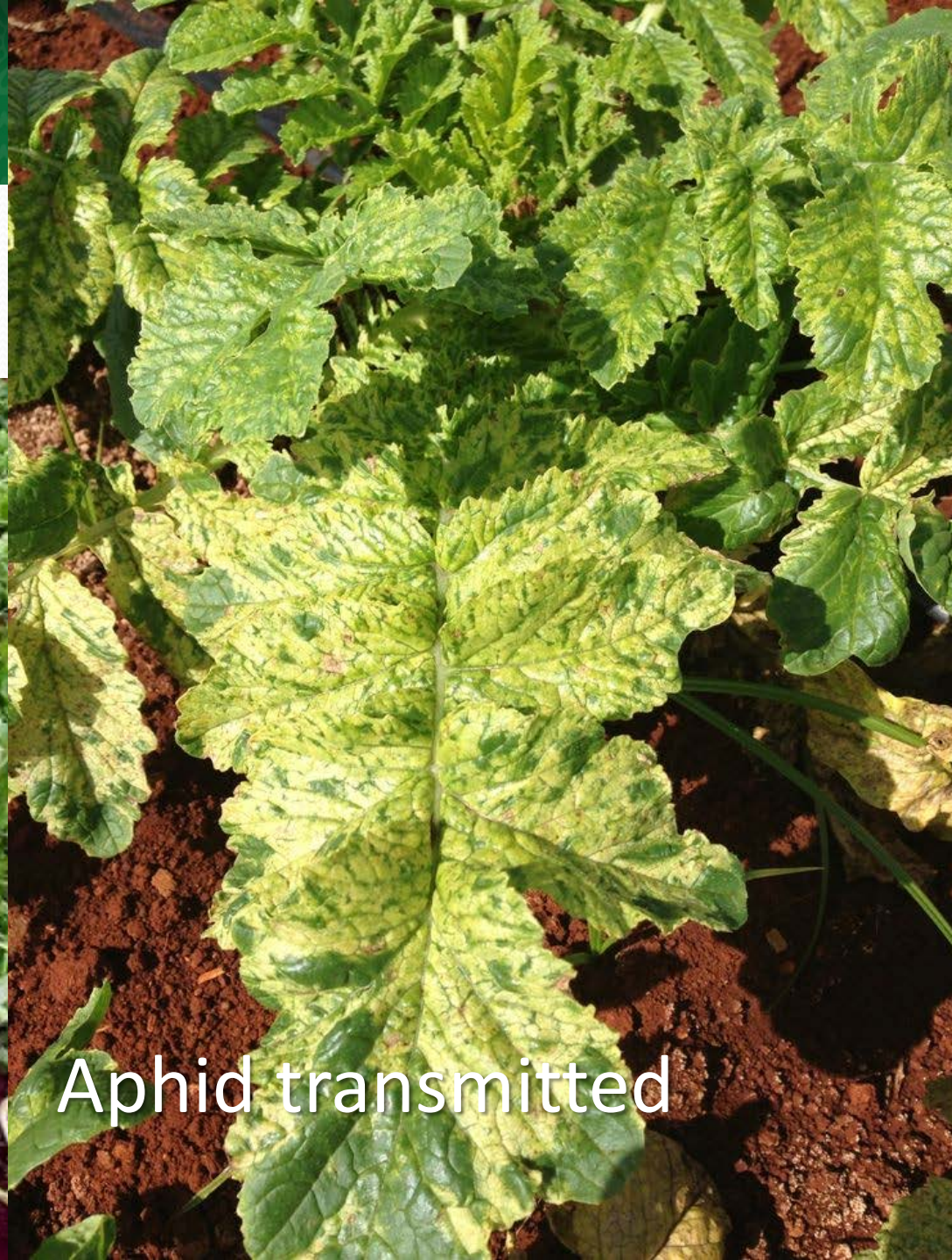
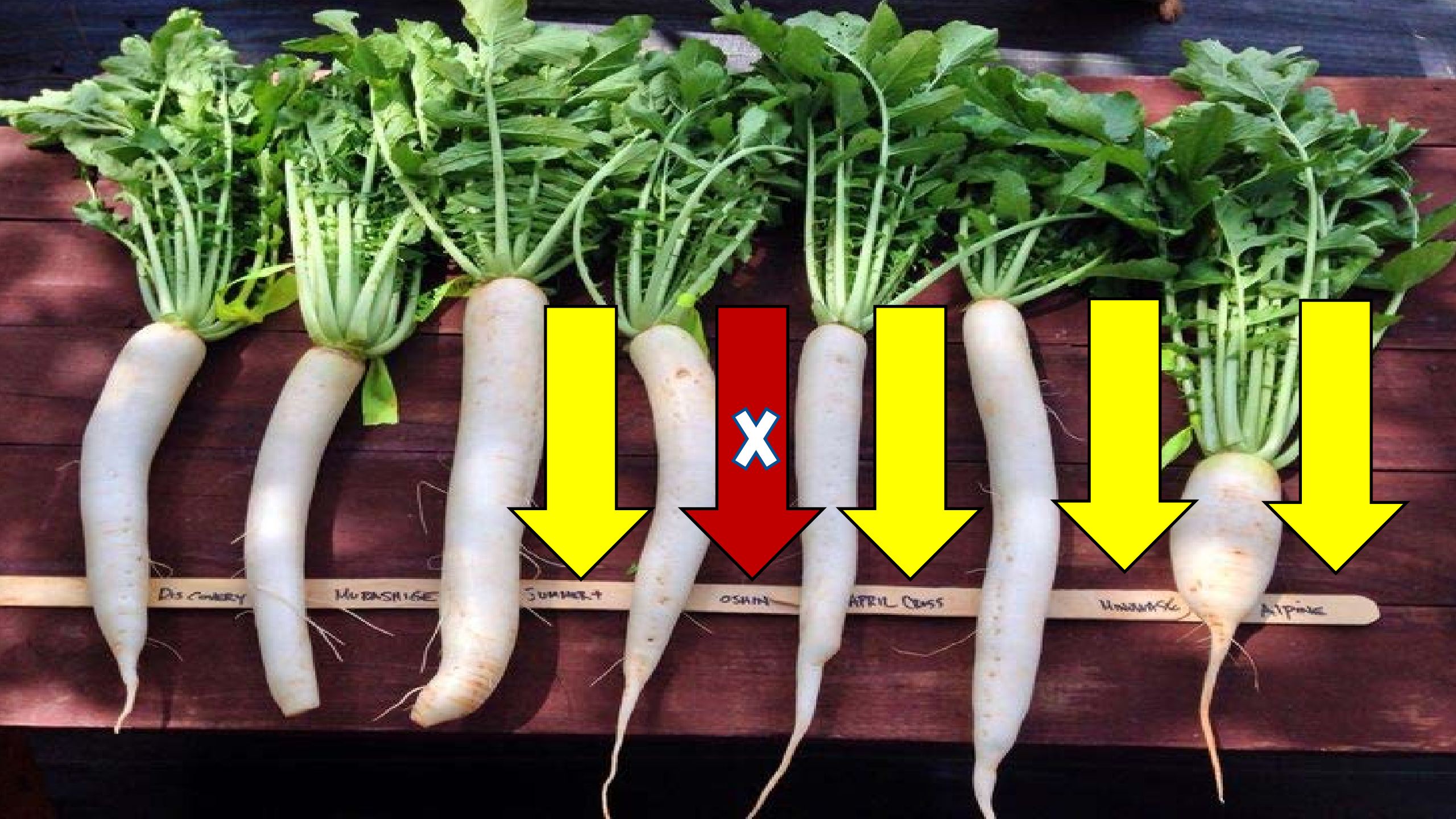
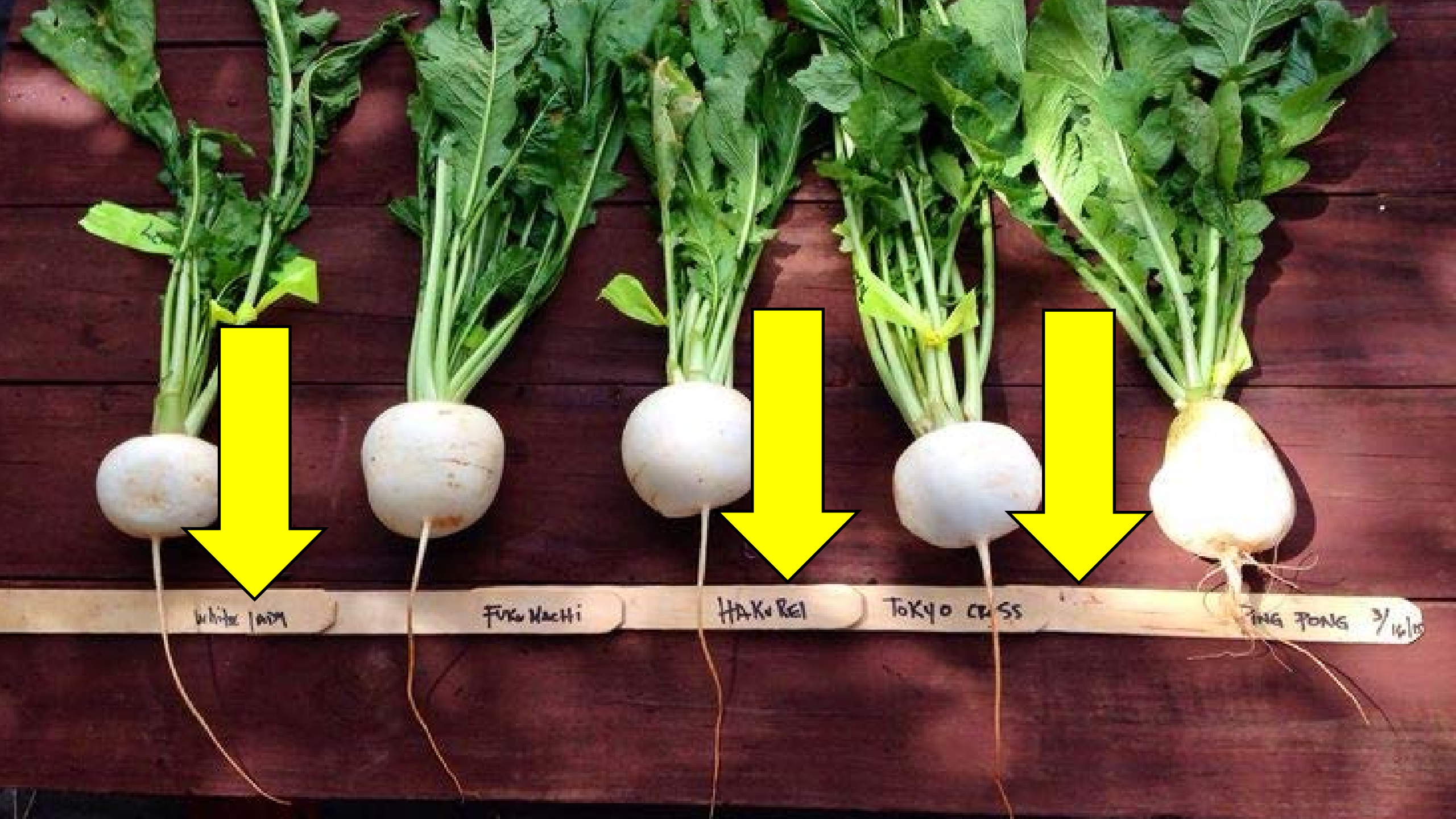
Turnip Mosaic Virus (2014)

14 varieties screened




Discovery
Alpine


White Icicle
Fuku Kuchi
Hakurei
Tokyo Cross
Ping Pong 3/16/15

UH Field Trials (2014-2015)

- Promising Daikon Varieties
  - Alpine, Minowase, Summer Cross, April Cross, Bravo, Bora King (2016)

  Promising Turnip Varieties:
  - Tokyo Cross, Hakurei, White Lady

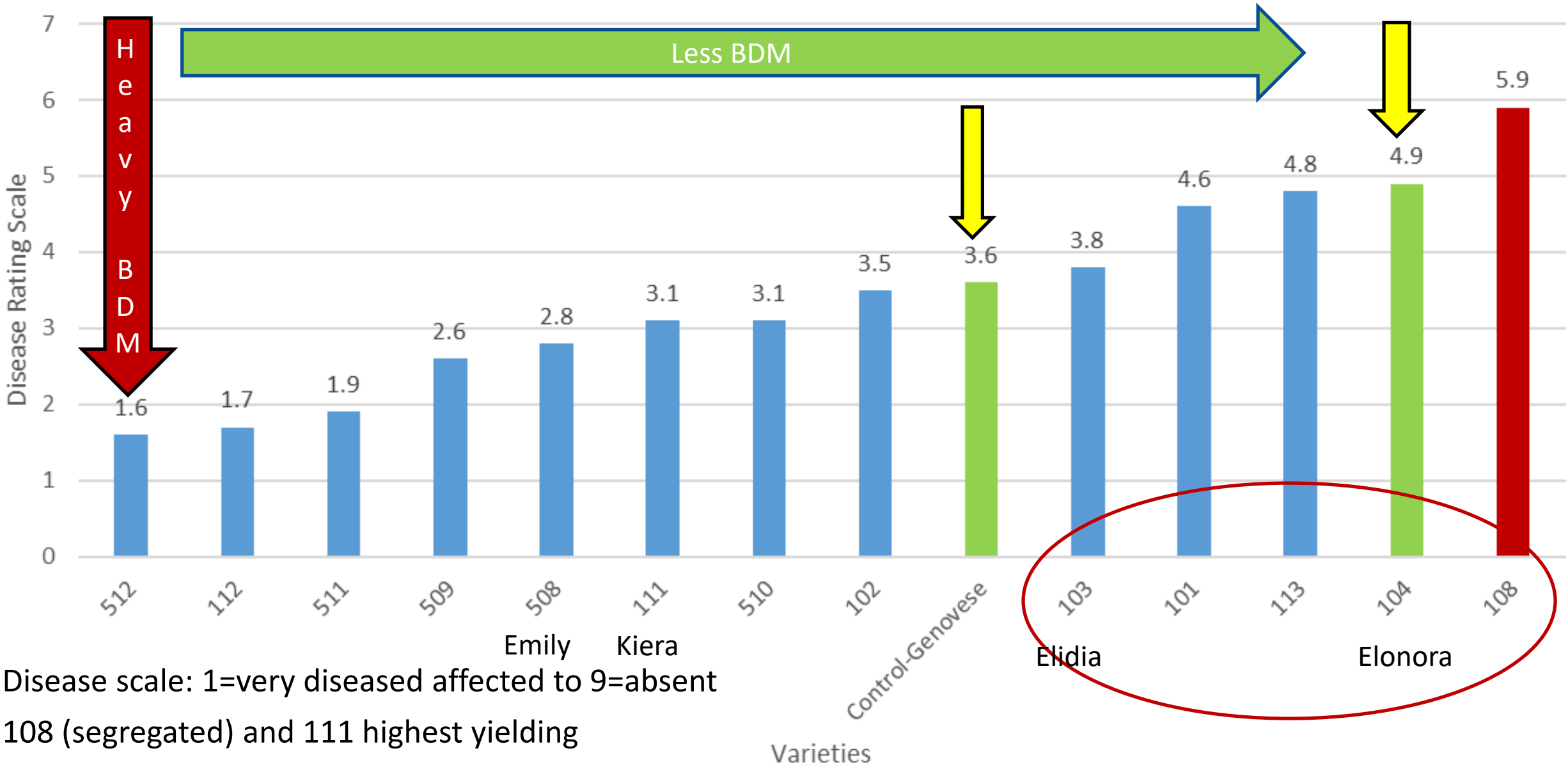
Basil Downy Mildew (2010)

Variety Field Trials w/ Tian and Bost (2015)

Basil Downy Mildew Screenings (2015)

14 Varieties

Photo credit: J. Uchida & C. Kadooka



Disease scale: 1=very diseased affected to 9=absent

108 (segregated) and 111 highest yielding

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

QUICK & APPLIED AGRICULTURAL TRIAL

Persian Cucumber (Beit Alpha) Variety Screening 2014

J. Sugano, J. Uyeda, S. Fukuda, S. Migita and K.-H. Wang
University of Hawai'i at Mānoa, 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. Oahu 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 Poamoho Research Station in Waialua, Oahu. Seeds were solicited and secured from De Ruiter, Golden Valley, Hazera 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 trellised 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 (16-16-16) 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, Jawell 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, Jawell, Unistars, Alexander, and GVA hybrids stood out among the varieties based on its horticultural characteristics and production data.

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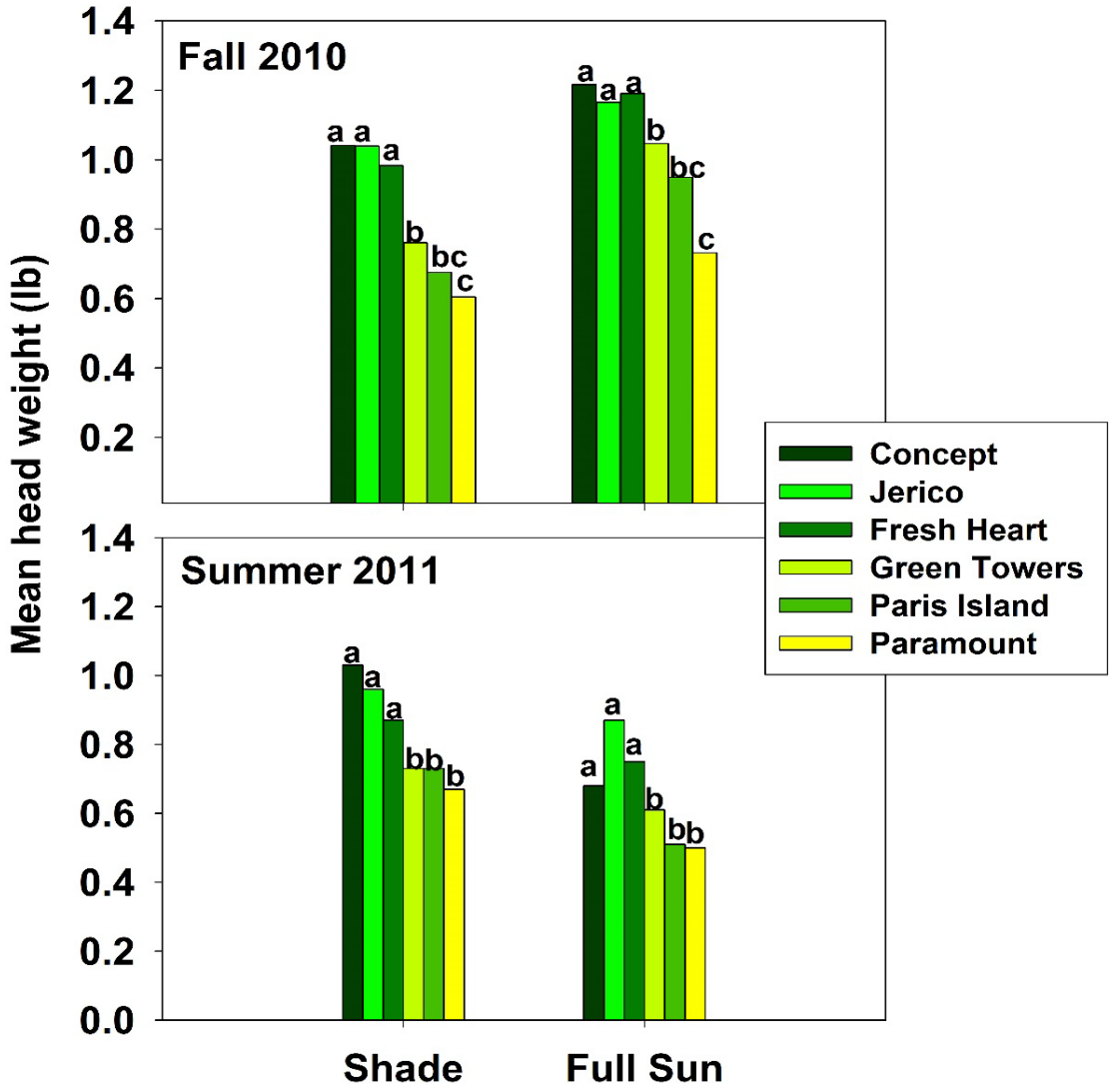
Heat Tolerance Field Trials

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 a 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

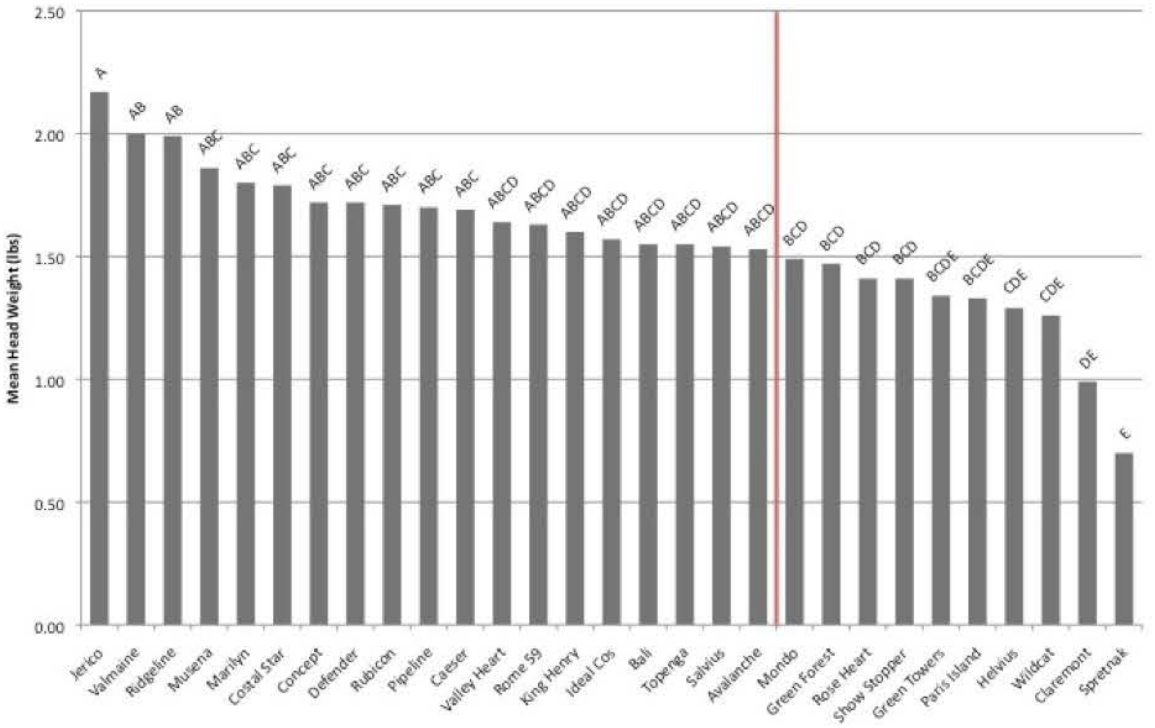


Figure 3: Mean head weight per variety of Romaine lettuce planted November 2013 and harvested January 2014 at the Poamoho Research Station. Letters represent mean separation using Tukeys HSD. Means with the same letter are not significantly different. The varieties to the left of the red line show potential 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

Yield, Color, Core, etc.

Jerico

Ridgeline

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Everyone ❤ Manoa Lettuce

Field trials w/Nagata, Teves, Shingaki, & Shimabuku

30 Box Red & Green Lettuce Variety Trials

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

Evaluating Varieties with Putative Heat Tolerance

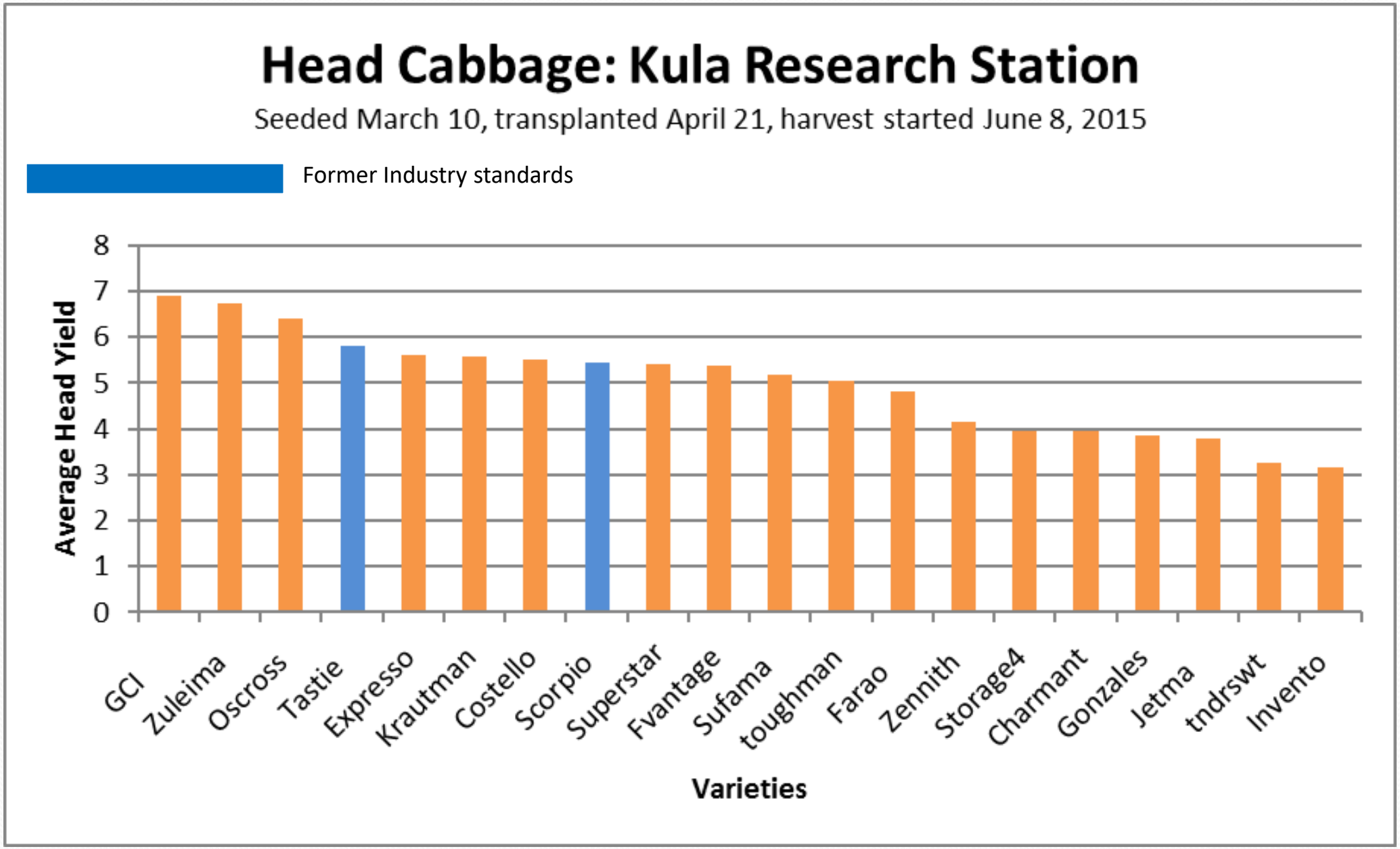
Red-Cherokee, Rouxai, Pomegranate Crunch (baby romaine), Multi red, Cannatrix, Salanovas, Roxy, Fossey, Red Sail, etc.
Green-Anuenue, Nancy, Adriana, Spretnak (baby romaine), Dragoon (baby romaine), Tropicana, Nevada, Kiribati, Concept, Gecko, Panisse, Rex, etc.

2015: Heat and Diamond Back Moth (DBM) Tolerance

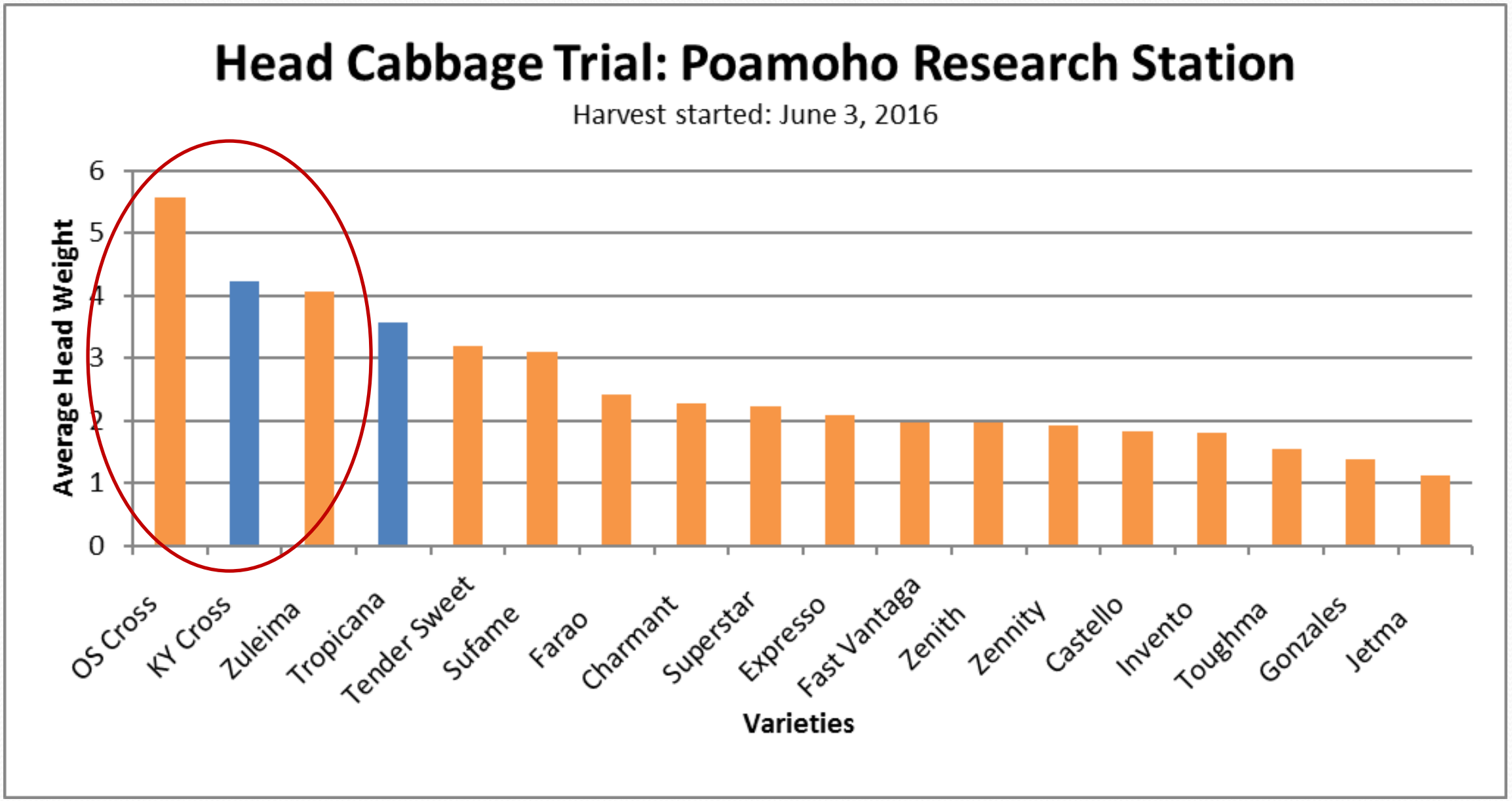
Head Cabbage (23) and Chinese Cabbage (13) & Broccoli (4)

Maui and Oahu

w/ Migita, Shingaki, Shimabuku & Bost

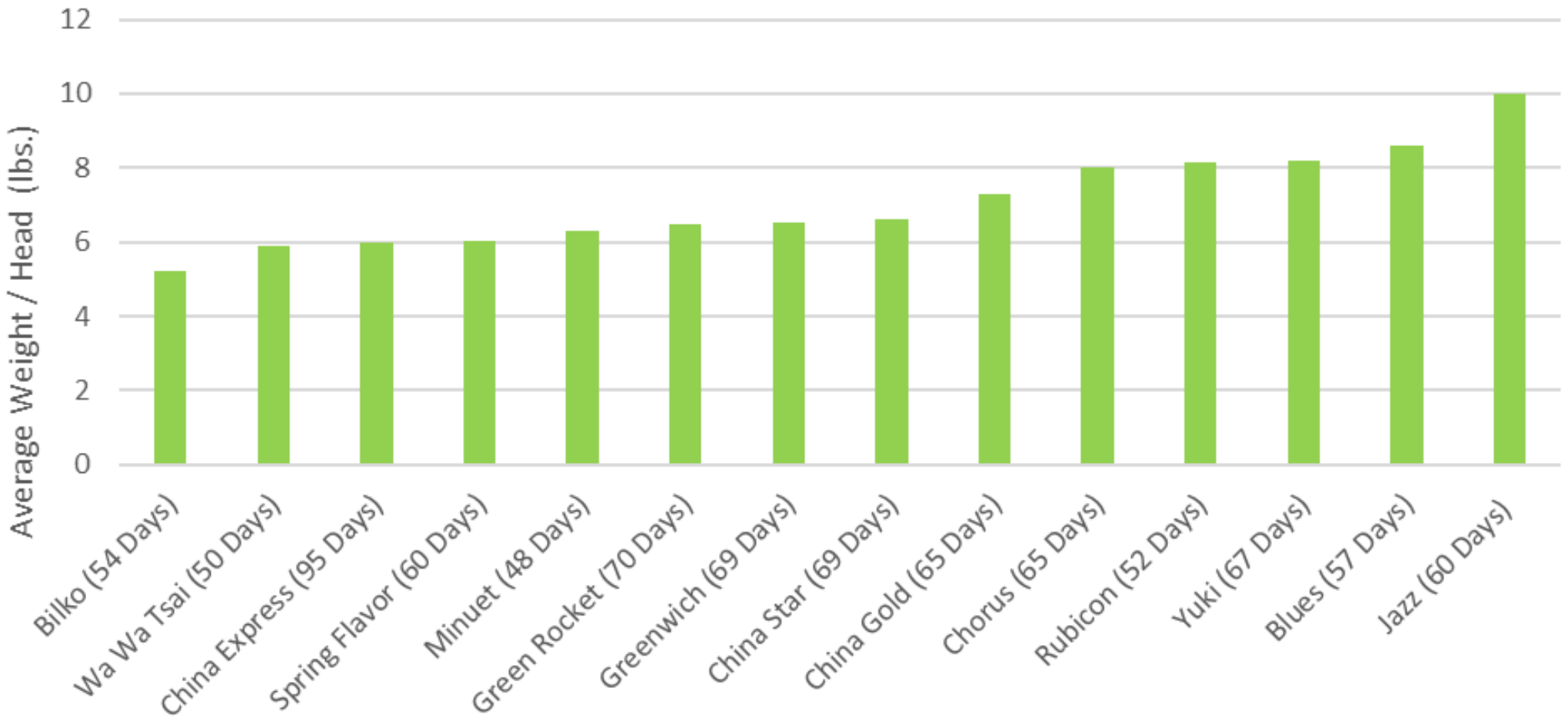


Approximately 40-70 heads of each head cabbage variety were grown in replication in Kula, Maui. The average weight per head was calculated based on a random selection of twelve heads per replication. There were three replications (36 heads)/ variety.



Eighteen varieties of head cabbage were transplanted in a randomized complete block planting design at the Poamoho Experiment Station with the assistance of Research Station Manager, Susan Migita and staff. The intent of these field trials are to evaluate yield and the horticultural characteristics of head cabbage cultivars at low elevation sites (<1,000 feet). Tropicana yields well but seeds are hard to find.

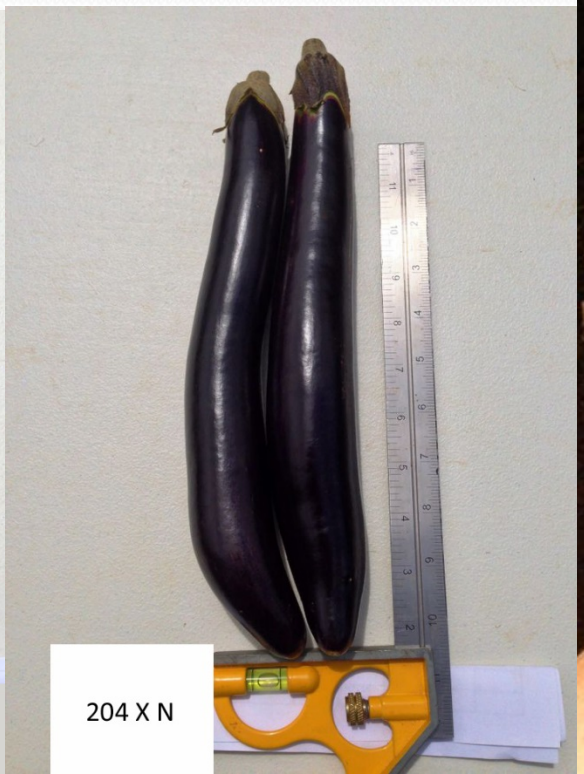
Chinese Cabbage Variety Trial
Kula Agricultural Park
Seeded: January 12, transplanted March 13, harvests starts April 6, 2015

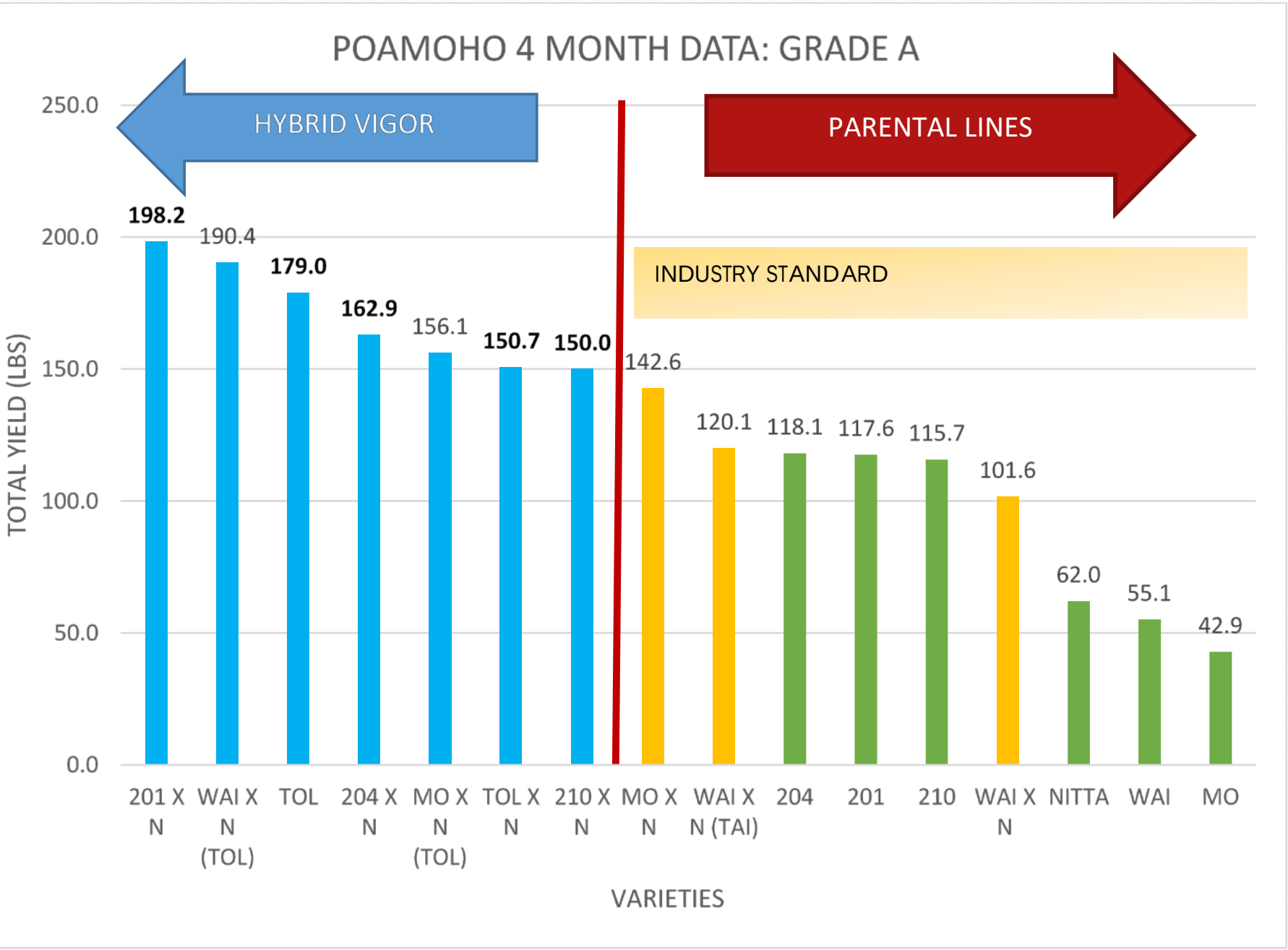


(Based on an average of 20 heads / variety with the exception of China Express)

2015: Statewide Hybrid Eggplant Variety Trial

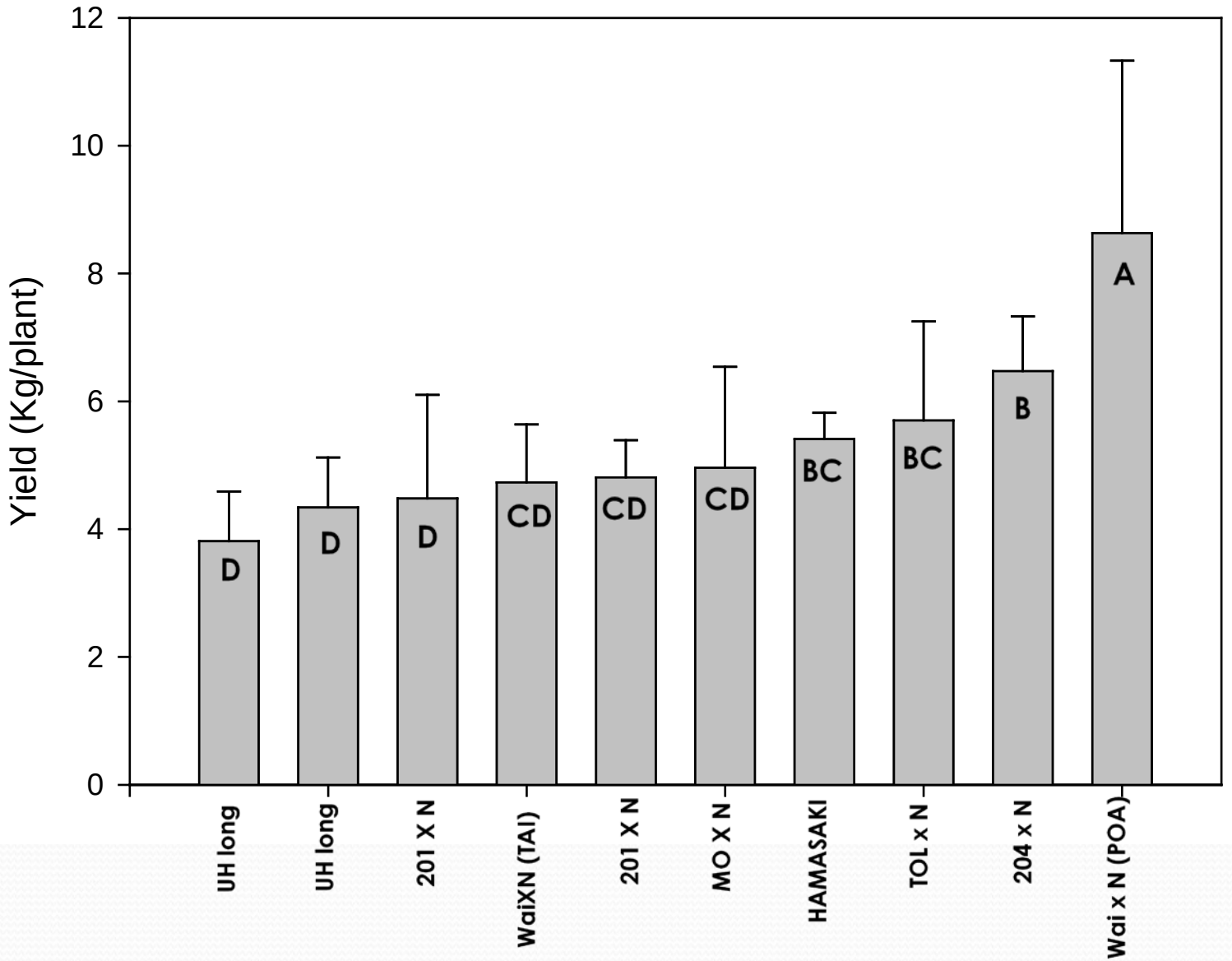
(w/Migita, Takeda, Shingaki, Shimabuku, & Motomura)





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

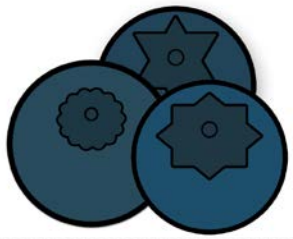
Waimanalo Research Station (Organic Culture) Data: June-August 2014

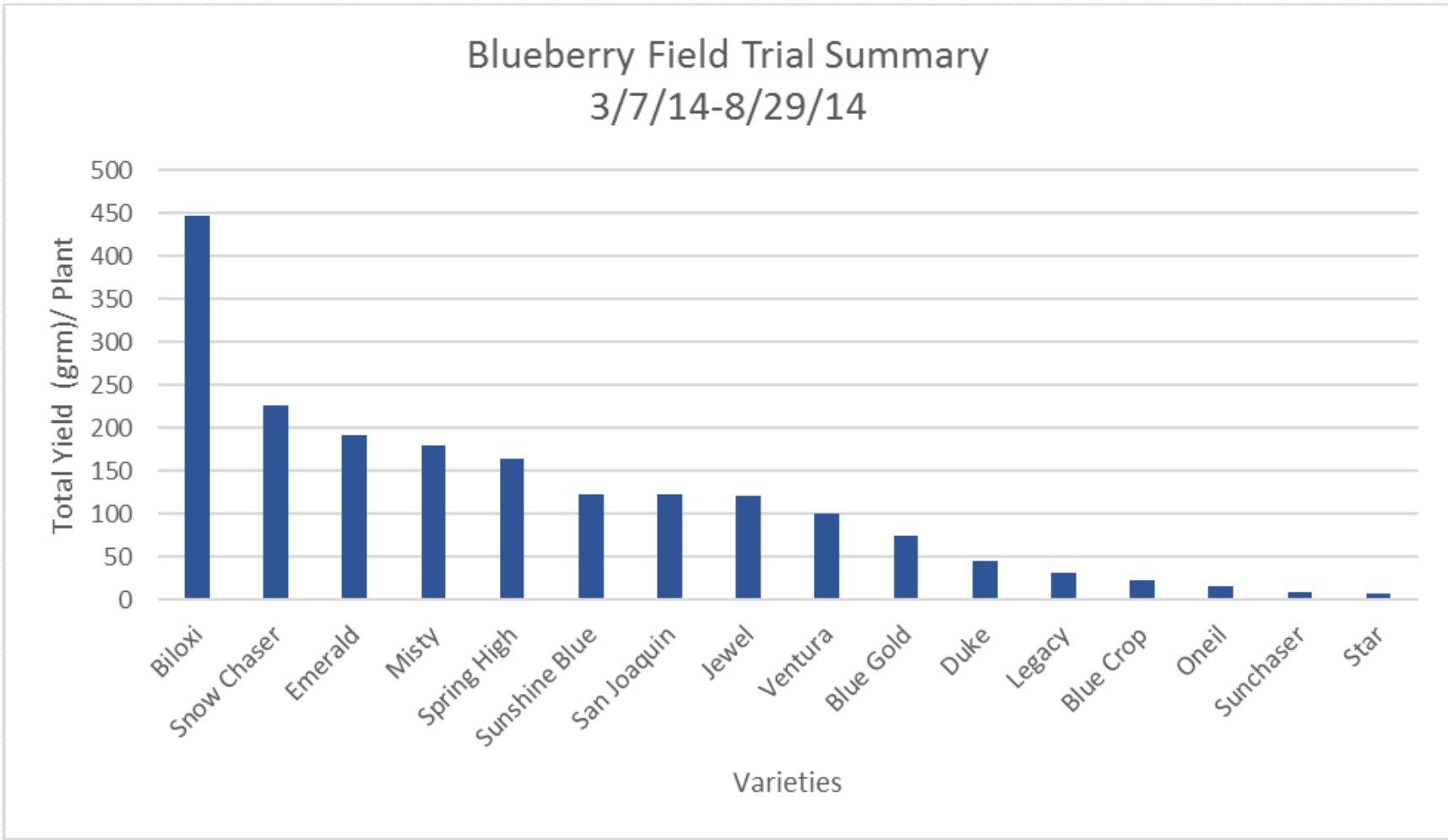


New Crop Evaluations

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

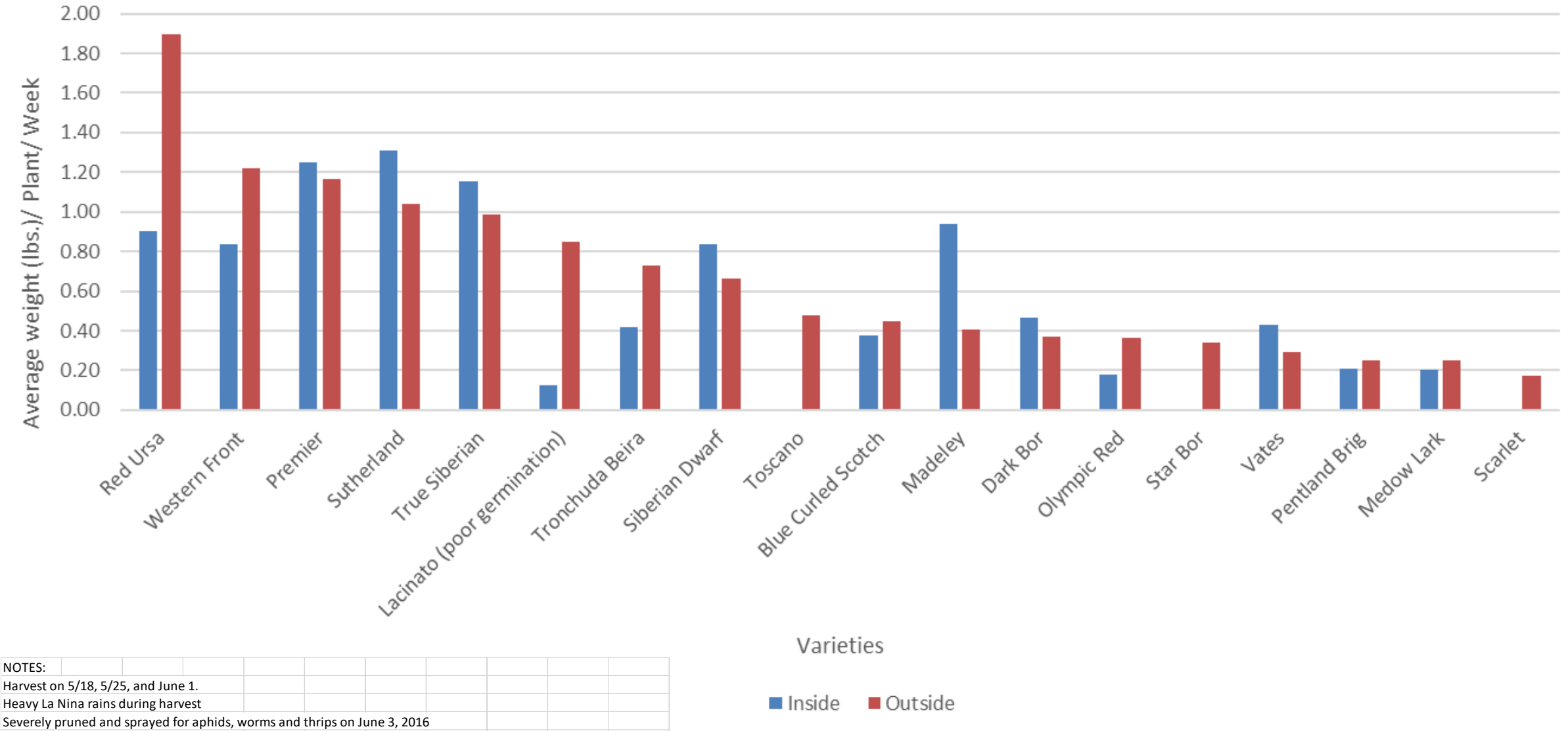




2016: Kale Variety Trial

2016: DBM & Caterpillars: Kale (18)

Overall Kale Production:Inside vs Outside Screen



NOTES:
Harvest on 5/18, 5/25, and June 1.
Heavy La Nina rains during harvest
Severely pruned and sprayed for aphids, worms and thrips on June 3, 2016
Postpone harvest until July 6, 206
Heavy pest pressure, for screen house pest assessment. Lots of white flies, aphids and stickiness on the leaves
Treated with Crymax, Wetcit and Pyrenone prior to initial harvest and data collection
No crop protection applications during data collection period.

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

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