# AmericanHort HRI Boxwood Blight Workshop Aurora, OR

4 February 2020

Karen Suslow, Program Manager and PI
National Ornamental Research Site at Dominican University CA (NORS-DUC)

# National Ornamental Research Site at Dominican University CA (NORS-DUC) 2009 - 2020

# NORS-DUC Mission

To identify, prioritize, facilitate and conduct research related to pests and diseases of nursery stock while safeguarding plant health and the environment

# NORS-DUC: What we do

Conduct collaborative research on quarantine pests and pathogens* in an open nursery-like environment with Universities, private companies and research centers

- **Phytophthora ramorum*
- **Phytophthora tentaculata*
- **Calonectria pseudonaviculata (Boxwood Blight)*
- Plum Bud Gall Mite

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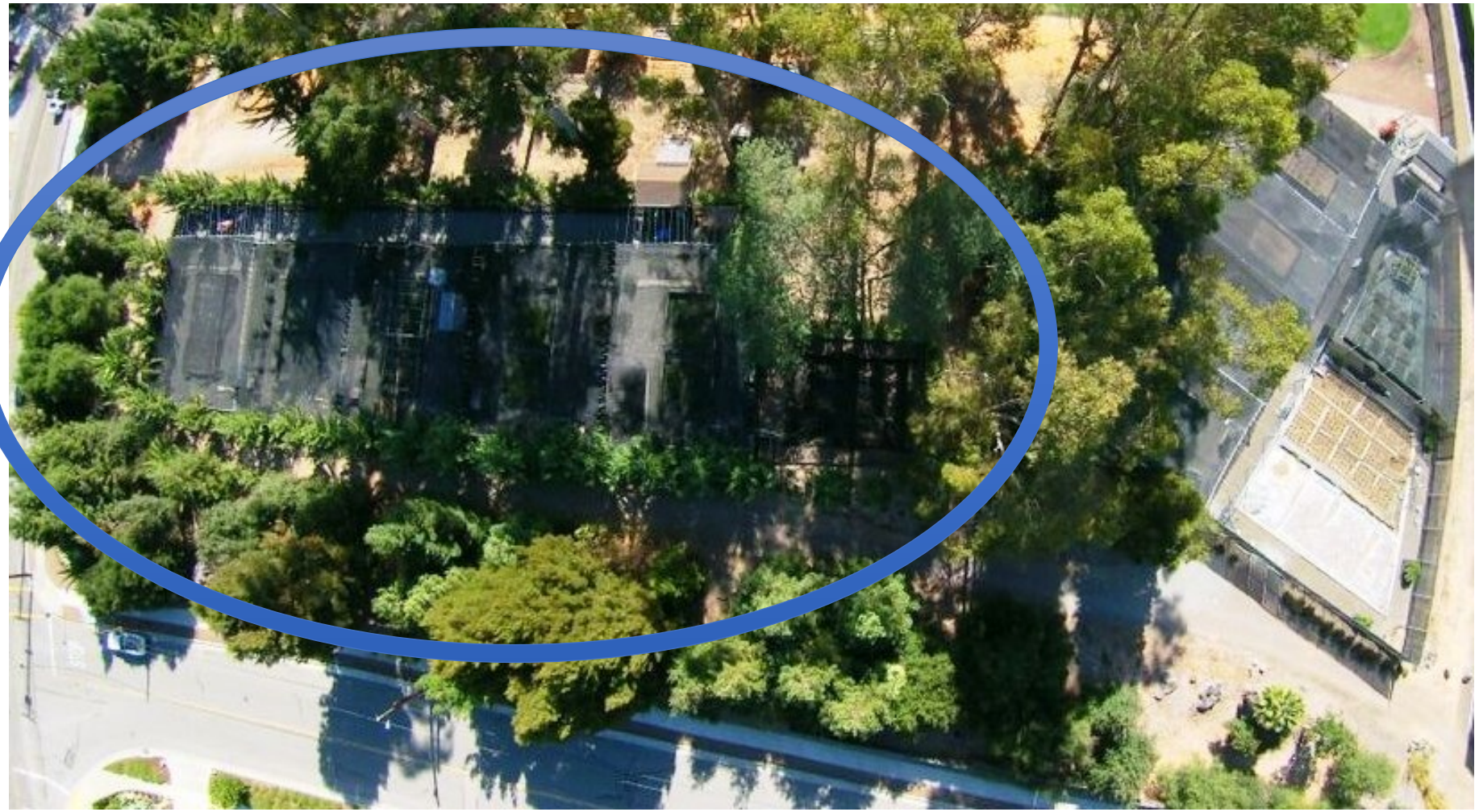
# NORS-DUC (north site)



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# NORS-DUC (south site)

## offers in-ground research opportunities

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# NORS-DUC Team

## as of summer 2019

Tomas Pastalka, Kathy Kosta, Vernon Huffman*, Karen Suslow (PI), Wolfgang Schweigkofler*, Supriya Sharma*

Three full-time staff* and one part-time plant pathologist, half-time PI and CDFA/USDA Liaison

# Our main focus:

- Applied research, such as validation and development of BMPs, development of remediation options for soil, water and infested plants, development of monitoring and control strategies

- Our research results are shared with our key stakeholders through a variety of out-reach programs through scientific and technical publications, presentations, tours and Field days plus we provide one-on-one nursery pest risk assessments (PRAs) for native plant nurseries and, in collaboration with CDFA, PRAs for interstate shipping nurseries

2009 Creation of NORS-DUC; Second site built in 2010

Entire site is covered with a pond liner in order to capture all water (including rain water) which is then processed through UV filters before releasing

Water tanks installed in each plot allow researchers the opportunity to recycle infested water

Beds in each individual field plot are 12’ x 29’ and also covered with a pond liner; there are 11 plots and one unheated GH


Each plot is equipped with a sink

In each plot, water can be captured, recycled or sent directly to UV filters for disinfesting


FM 2

# NORS-DUC Safeguards

**In addition to the lined plots/beds and the UV water treatment, we bait the water runoff with rhododendron leaves to confirm containment of *P. ramorum***

**Research plots are fenced with barbed wire, graveled, with foot baths at the egress and inside the plots**

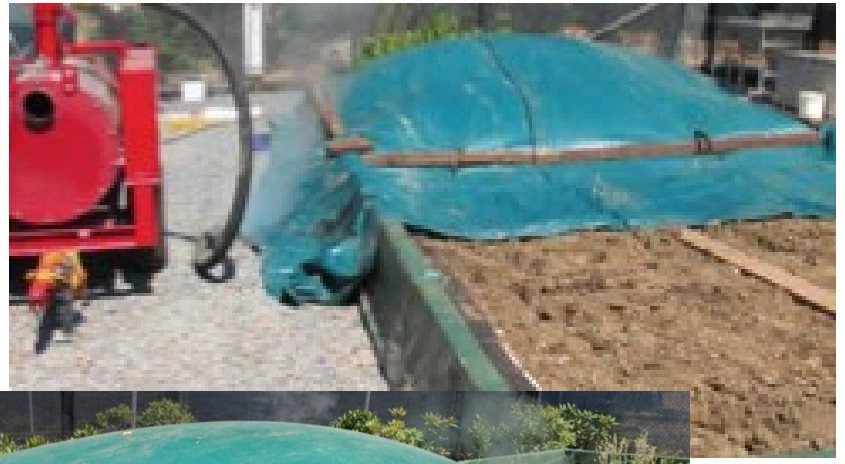
# NORS-DUC Safeguards

**Sentinel plants (potted rhododendrons) are located inside the plots to detect if *P. ramorum* has escaped an experiment. Outside the fence is a wind barrier (Prunus caroliniana) and a row of sentinel plants (in-ground rhododendrons) to detect if *P. ramorum* is blowing into the research plots.**

***Plants are monitored weekly and no P. ramorum has been detected; however, other Phytophthoras spp. have been found***

# NORS-DUC Safeguards cont.

**Upon completion of projects, research beds, along with soil and containers are steamed**



# NORS-DUC

## Soil Remediation Successes:

- **Use of Steam Sterilization to remediate contaminated soil** (NORS Staff)
- **Use of *Trichoderma asperellum (BC)* in potting mixes to kill *P. ramorum*** (Tim Widmer, USDA ARS)
- **Use of Solarization to eliminate *P. ramorum* from nursery beds** (Jennifer Parke, OSU)

# NORS-DUC

## Soil remediation successes:

Use of Steam Sterilization to remediate a contaminated soil substrate at a Commercial retail nursery

# NORS-DUC

## Soil remediation successes:

Use of Steam Sterilization to remediate a contaminated soil substrate at an Interstate Shipping nursery –
Part of a multistate project
(CA, OR, WA)

# NORS-DUC

## Soil remediation successes:

Use of *Trichoderma asperellum (BC)* in soil substrate and potting mixes to kill *P. ramorum*

# NORS-DUC

## Soil remediation successes:

Use of Solarization to eliminate *P. ramorum* from nursery beds


Construction of soil solarization beds at NORS-DUC

# NORS-DUC Internal projects

- NORS-DUC staff internal research projects
  - *Phytophthora* Nursery pathway survey of interstate wholesale and native plant nurseries to determine if *Phytophthoras* are moving between the nurseries and into the nursery supply chain
  - Transmission Experiment: Natural spread of *P. ramorum* from Bay trees to healthy Rhododendrons
  - Pot and soil solarization
  - Steaming
  - Host range studies *Phytophthora tentaculata* (newly introduced pathogen found in native plant nurseries)
  - Boxwood blight
  - Multiple undergraduate research projects presented by students at NCUR (National Collegiate Undergrad Res) Conf
  - Plum Bud Gall Mite (found in residential areas NorCal)

P. tentaculata host range studies

# Current collaborator projects

- **Immunoassay for *Phytophthora ramorum* in nursery water samples *detection assays of real nursery samples, focusing on detection in irrigation water, surface water, and irrigation samples*** *(for rapid detection P. ramorum in nursery runoff water vs. Bottle of Bait)*
  - Doug Luster, USDA ARS Ft. Detrick, MD

- ***Determining the minimum treatment area and importance of soil moisture for effective soil solarization in nurseries*** *(for remediation of infested plants in habitat restoration projects)*
  - Jennifer Parke, Oregon State University

- **Movement of *Phytophthora ramorum* inoculum in the soil profile** (to aid in future steaming work)
  - Gary Chastagner and Marianne Elliott, WA State University

- **Interaction of irrigation and potting mixes on the infection of *Mimulus aurantiacus* by *P. tentaculata*** *(BC)*
  - Tim Widmer, USDA ARS, Ft. Detrick, MD

- **Detection of asymptomatic root infections by *Phytophthora* species in nursery ornamentals**
  - Rick Bostock and Tatiana Roubtsova, UC Davis

# Technology Transfer and Outreach

(on an annual basis)

**Outreach (Stakeholders and Students) annual average**

- **Presentations (Oral and Poster) (7)**
- **Tours (4) including a Field Day at NORS**
- **Trainings NPB SANC (2-3)**
- **Horticultural Tradeshows (3)**
- **Grant Reviewer (2) SCBG and CANERS**
- **Articles published (1-2)**
- **Native plant nursery pest risk assessment (reducing the risk of introducing *Phytophthoras* into habitat restoration areas) (25)**
- **Tribal nation engagement 1-2**
- **Student engagement (lab and field work)**

# Publications in collaboration with our research partners

- 2019. Rapid recovery and detection of *Phytophthora* ramorum propagules in nursery water. Proceedings of the SOD 7 Science symposium
- 2018. Inactivation of plant pathogens in irrigation water runoff using a novel UV disinfection system. European Journal of Plant Pathology
- 2018. *Remediation of P. ramorum-infested soil with Trichoderma asperellum isolate 04-22 under ornamental nursery conditions*. Bio Control
- 2018. Thermal inactivation of inoculum of two Phytophthora species by intermittent vs. constant heat Phytopath
- 2017. *Monitoring using a sentinel plant system reveals very limited aerial spread of Phytophthora ramorum from infected ornamental plants in a quarantine research nursery*. Plant Health Progress
- 2016. *Research on the Quarantine Pathogen Phytophthora ramorum at the National Ornamentals Research Site at Dominican University of California*· Proceedings of the Sudden Oak Death Sixth Science Symposium, San Francisco, CA
- 2016. *Effects of Soil Solarization and Trichoderma asperellum on Soilborne Inoculum of Phytophthora ramorum and Phytophthora pini in Container Nurseries.* Plant Disease
- 2016. *Host-induced aneuploidy and phenotypic diversification in the Sudden Oak Death pathogen Phytophthora ramorum.* BMC Genomics
- 2016. *Solarization – A simple and low-cost method for disinfesting horticultural containers.* Ecesis SERCAL (California Society for Ecological Restoration) Summer newsletter.
- 2015. *A new method to apply Phytophthora ramorum inoculum to hosts that simulates overhead irrigation.* Plant Health Progress
- 2014. *Steaming inactivates Phytophthora ramorum, causal agent of Sudden Oak Death and ramorum blight, from infested nursery soils in California*. Plant Health Progress
- 2012. *Disease Management of Phytophthora ramorum in a Research Quarantine Nursery at NORS-DUC. Phytophthora* in Forests and Natural Ecosystems, International Union of Forest Research Organizations (IUFRO) Working Party
- 2011. *Phytophthora ramorum research at the National Ornamentals Research Site at the Dominican University of California.*New Zealand Journal of Forestry Research

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# The National Ornamentals Research Site at Dominican University of California

## *Thank you to our partners.*

California Oak Mortality Task Force

fera The Food and Environment Research Agency

defra Department for Environment Food and Rural Affairs

USDA APHIS

SNA

USDA ARS

ANLA American Nursery & Landscape Association

NATIONAL PARK SERVICE

CFIA·ACIA

cdfa CALIFORNIA DEPARTMENT OF FOOD & AGRICULTURE

HRI Horticultural Research Institute

WASHINGTON STATE NURSERY & LANDSCAPE ASSOCIATION WSNLA

OREGON ASSOCIATION OF NURSERIES

The Nature Conservancy SAVING THE LAST GREAT PLACES ON EARTH

FOREST SERVICE US DEPARTMENT OF AGRICULTURE

Pacific Southwest Research Station

Hines Nurseries

SAF SOCIETY of AMERICAN FLORISTS

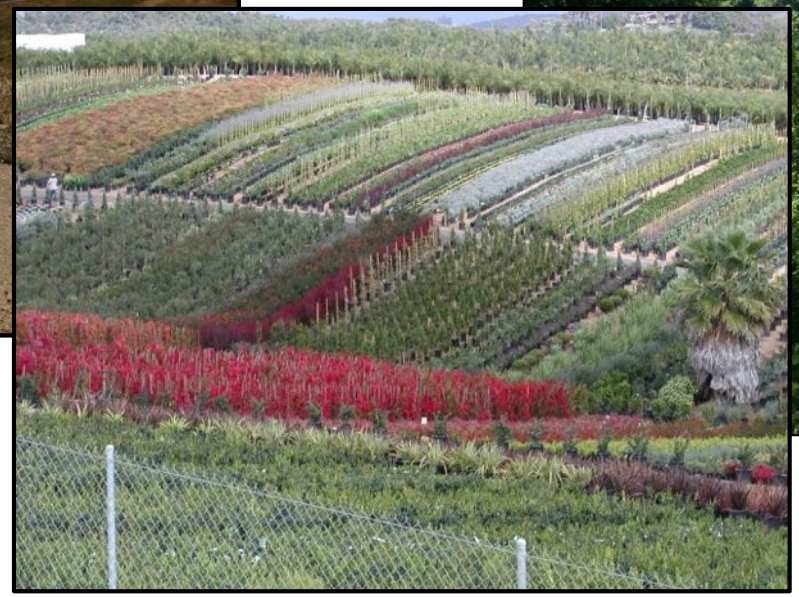
cangc

CALIFORNIA CONGRESSIONAL DELEGATION

NPB national plant board

CALIFORNIA DEPARTMENT of FORESTRY and FIRE PROTECTION CDF

# Safeguarding the Environment




Karen Suslow, NORS-DUC Program Manager
Wolfgang Schweigkofler, Sr. Researcher
Nilwala Abeysekara, Lab Manager

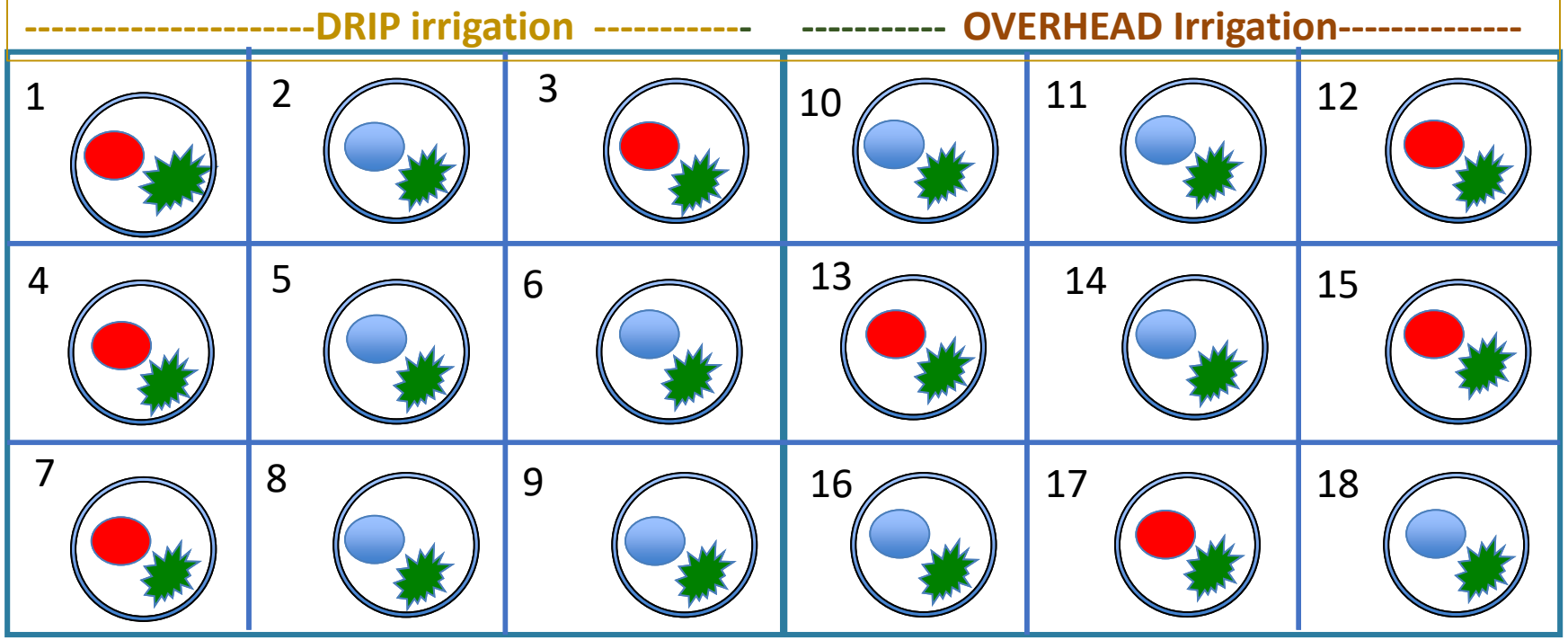
Vernon Huffman, Nursery Manager
Tomas Pastalka, Plant pathologist
Suzanne Rooney-Latham, Liaison

# Boxwood Blight trial at NORS in collaboration with Chuan Hong

Will adding a mulch layer on top of the soil, after infested plants defoliate, lower the risk of new infestations?

# Original Boxwood Blight trial at NORS in collaboration with Chuan Hong

- Project focus:  Adapt mulching as a disease mitigation tool Adding a mulch layer on top of the soil after infested plants defoliate might be a good option to lower the risk of new infestations
- Treatment:  mulch vs no mulch
- Inoculate Buxus, once they defoliate, prune all Buxus heavily (to 4” in height)
- Place 4” of mulch around base of each plant in 9 of the cylinders, leaving the other 9 unmulched
- Insert detector plants next to each of the 18 Buxus, within the cylinder
- Replace detector plants twice a month thru end of April and monitor them for disease development
- Goal:  The mulch would protect the detector plants from becoming infected




**BOXWOOD BLIGHT TRIAL**

AUGUST 2018 plant 18 5G boxwoods equally spaced in plot and enclose each in a cylinder ◯

4 MARCH 2019 Inoculate all 18 boxwoods with *Calonectria pseudonaviculata* Strain 582

Once defoliated (MARCH), leave infested leaves on top of the soil and carefully cut plants off at the base (ground level) and carefully bag them in place for autoclaving. Place Mulch (redwood, small chip) in ● mini-plot 4" deep

● NM NoMulch ● M Mulch

Once defoliated and infected plant removed, insert detector plant (1G boxwood) ✸ in each mini-plot, 'pot in pot' and sunk so top of can is 1" above soil line and as close to stump of inoculated/defoliated plant as possible. Label with mini-plot number and the date of detector plant installation.

Replace detector plants every two weeks (thru April) and monitor for symptom development

*Version 3-4-19*

August 2018 planting of 5G *Buxus sempervirens ‘Suffructicosa’*

November 2018 inserted cylinder around each 5G in-ground boxwood

December 2018 created a pot-in-pot hole for a detector plant. Empty pot currently has a lid.

4 March 2019 inoculated each 5G boxwood plant by spraying with 50 ml suspension (2200 conidia/ml) and then covered each cylinder for 48 hours to increase humidity

# Date of inoculations and symptom development

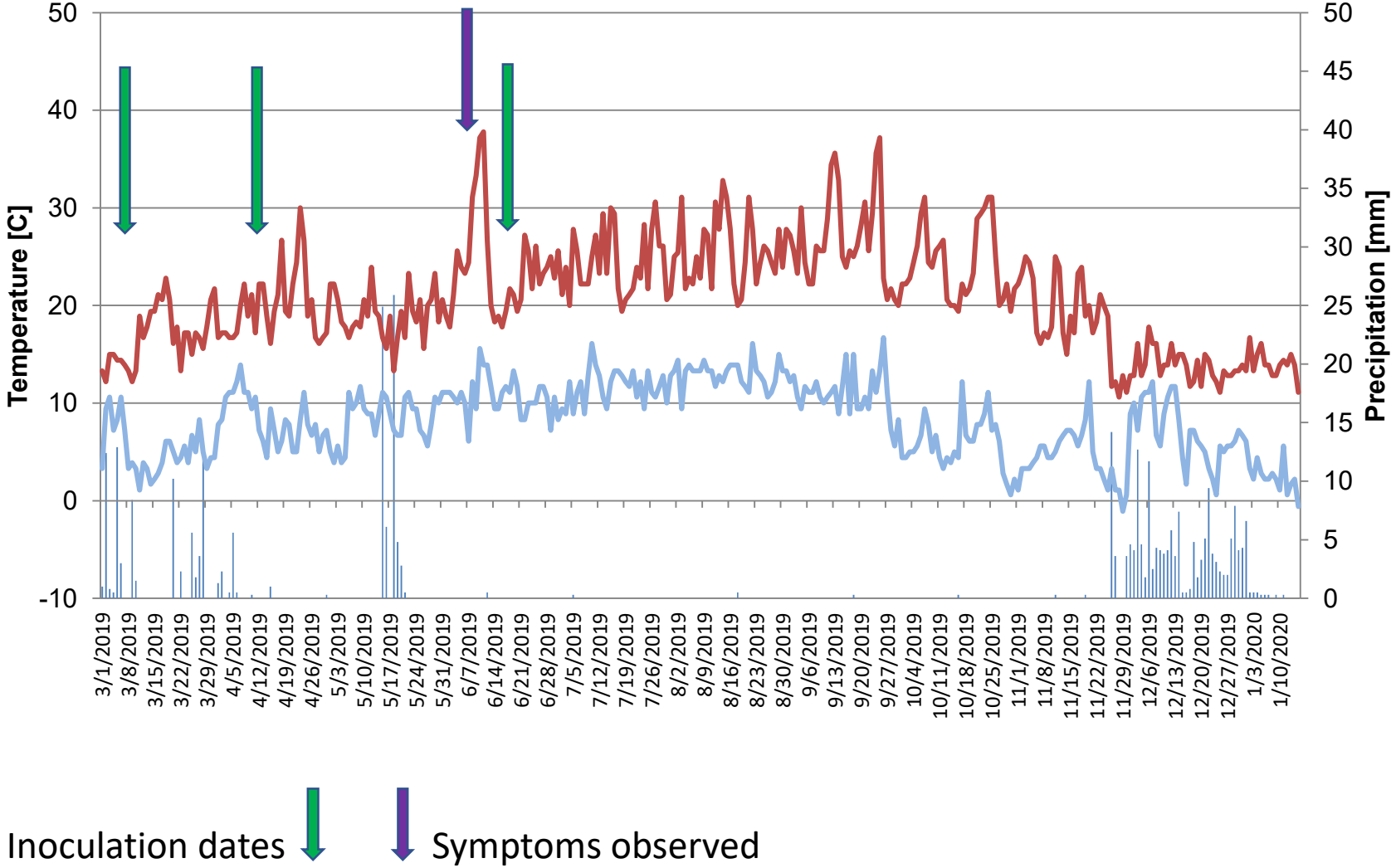
**All plants inoculated on:**

- 4 March 2019 (no symptom development, reinoculated 2 months later)
- 10 April 2019 (no symptom development, reinoculated 2 months later)
- 18 June 2019 (last inoculation)

**First symptoms seen:**

- 4 June 2019 (3 of 18 plants)
- 27 August 2019 (8 of 18 plants)
- 7 October 2019 (9 of 18 plants)
- To date, 2020, 10 of 18 plants are symptomatic

# Temperatures (min/max) and precipitation in San Rafael, CA
# 1 March 2019 – 15 January 2020




Inoculation dates Symptoms observed

# Symptoms as of June 2019

3 of 18 symptomatic plants

(two plants each with 1 leaf symptom, one plant heavily infested, pictured below)

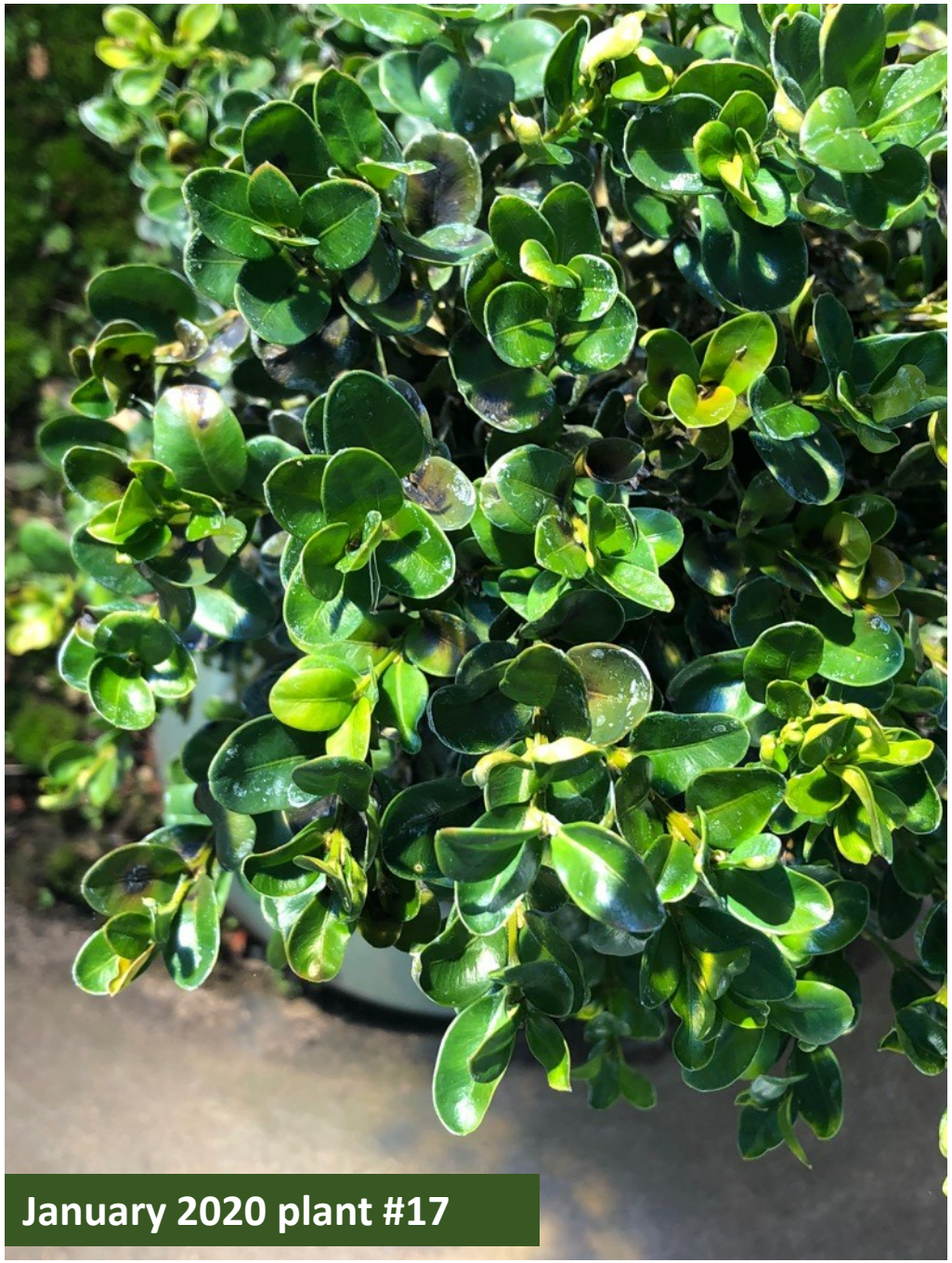

JULY 2019


JULY 2019


July 2019

**August 2019** 10 of 18 plants symptomless; new growth on all 18 plants

January 2020 plant #13



January 2020 plant #17


January 2020 plant #9


January 2020 plant #11


January 2020 plant #11

late January 2020 Plant #11  Heavy defoliation

Late January 2020
heavy defoliation
Seen on the 10
symptomatic plants

late January 2020 Plant #12  Heavy defoliation

**Does the CA arid Mediterranean climate delay Boxwood Blight infection and symptom development?**

Suggestions for Next Steps -
*Do we continue with the original plan?*

In CA, the pathogen has so far only been found in homeowners yards and estates in 2 counties, no nurseries


# Boxwood Hedge

Item #110327

~~Was $1,899.00 - $2,999.00~~ **Sale $1,519.20 - $2,399.20**

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4' - Ships 1/21/20 - $1,519.20

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