



COOPERATIVE EXTENSION

UNIVERSITY OF HAWAII AT MĀNOA
COLLEGE OF TROPICAL AGRICULTURE AND HUMAN RESOURCES

Spraying for Coffee Leaf Rust and Coffee Berry Borer Management

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AND HUMAN RESOURCES



Topics

- Basics of CLR and CBB
- Spraying for CLR and CBB
- When, what and how to spray
- Calculating rates and sprayer calibration
- Q&A



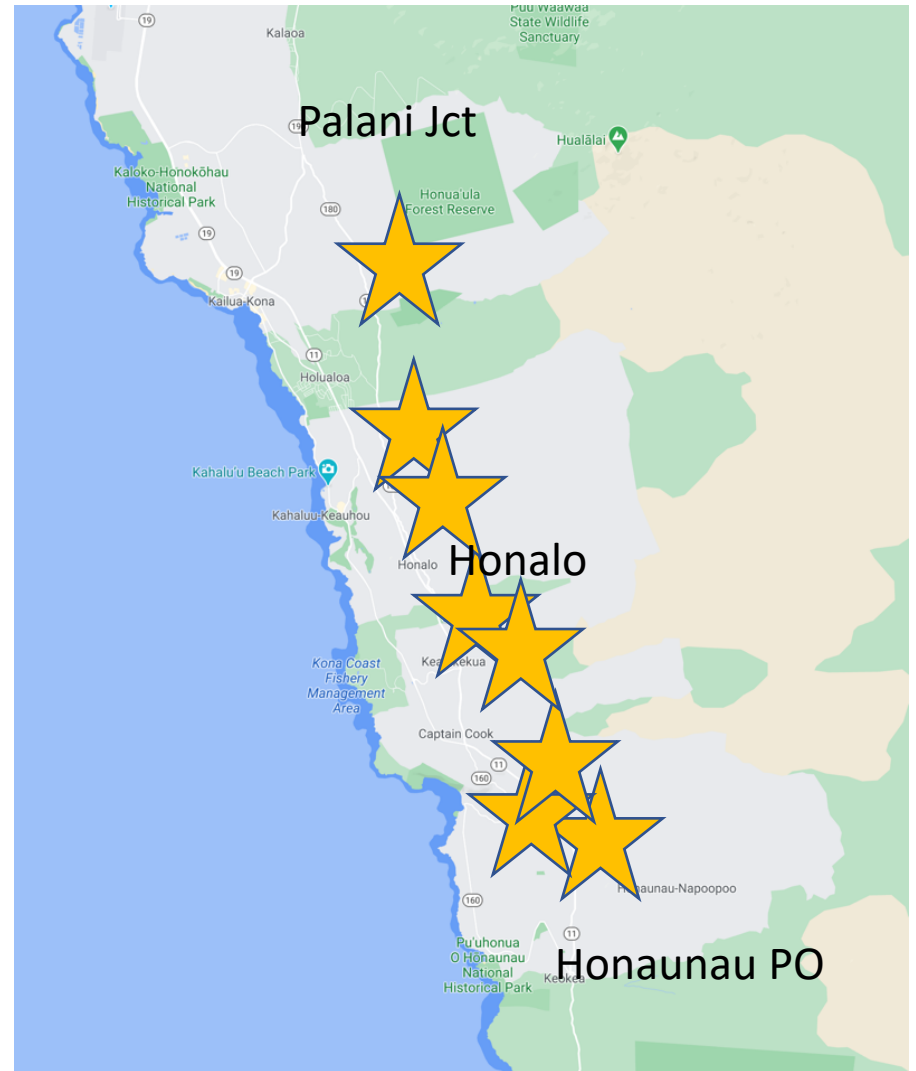
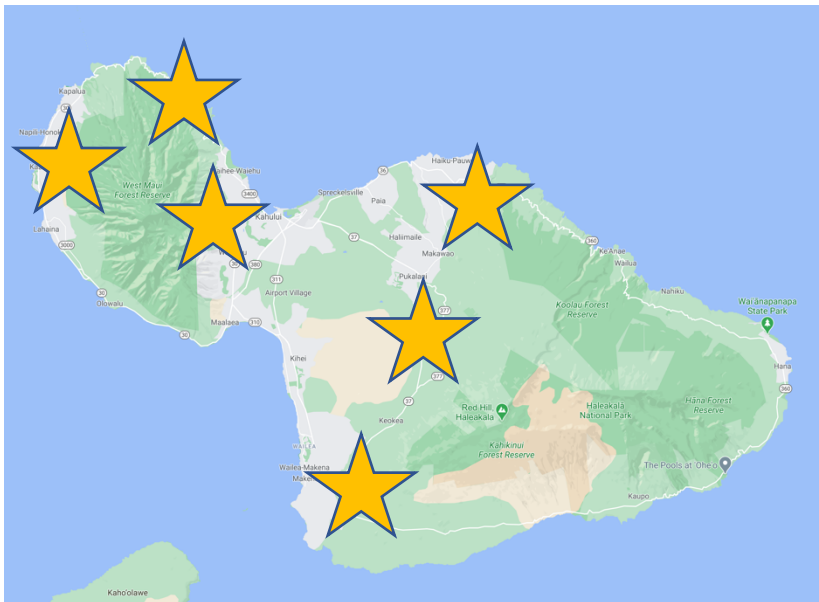


Coffee leaf rust (*Hemileia vastatrix*)
Coffee berry borer (*Hypothenemus hampei*)

- Found world-wide
- Only host is coffee
- Spores are airborne and easily spread
- CBB spread with movement
- CBB reduces yield and quality; CLR can cause yield reduction, decline of tree health, and tree death

Known areas with CLR and CBB

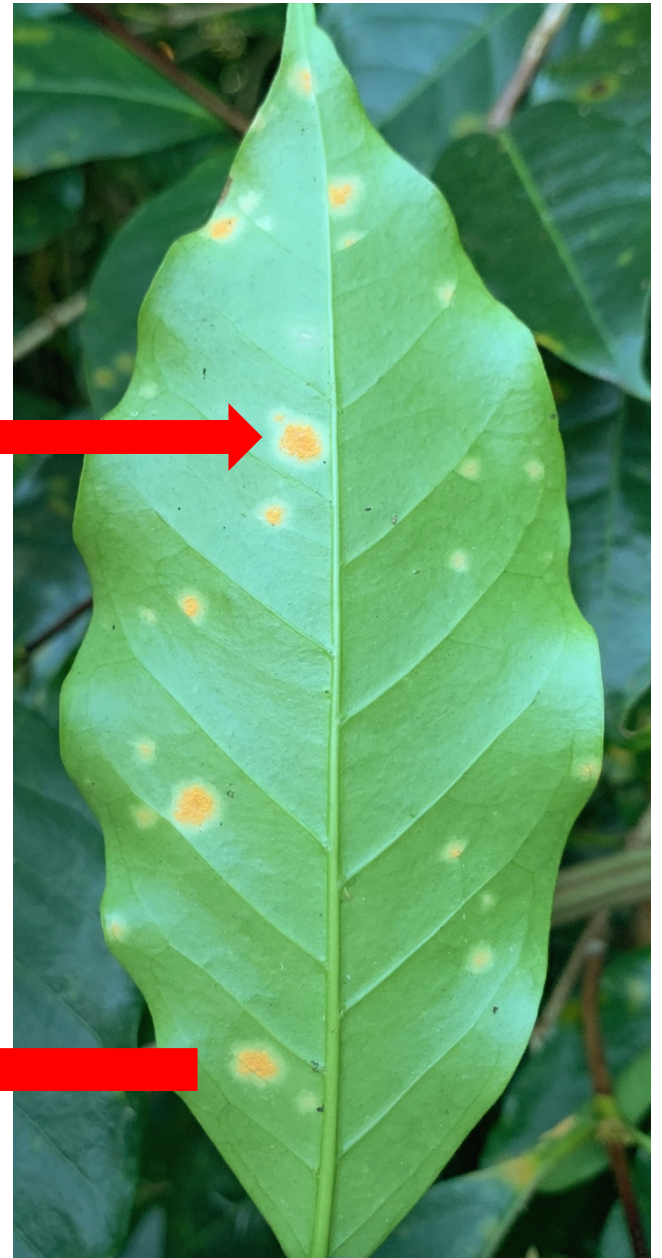
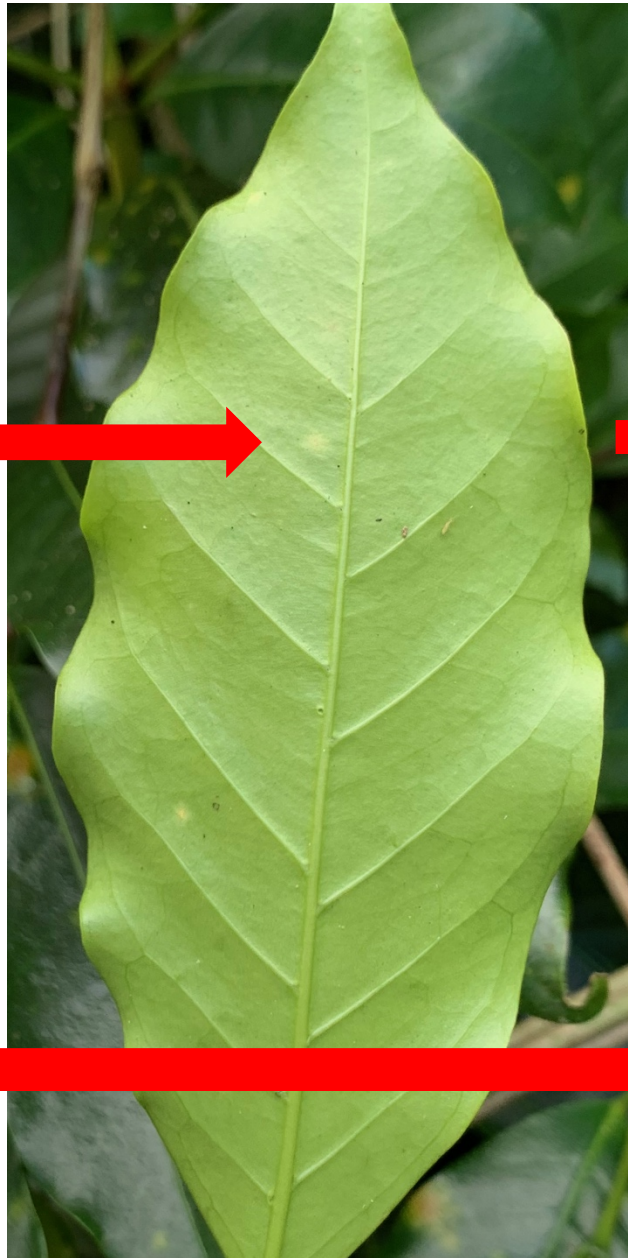
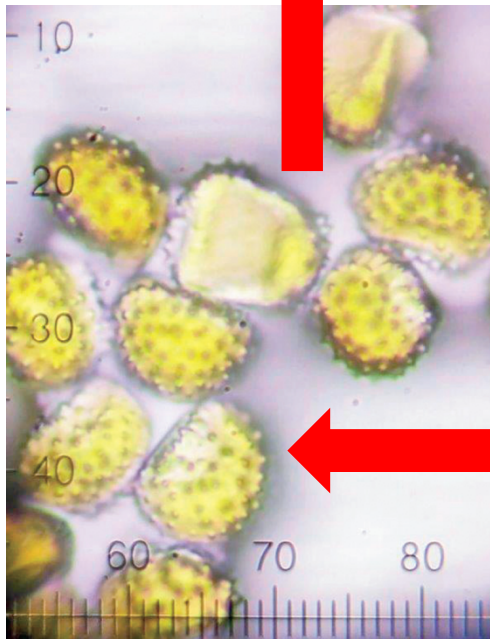
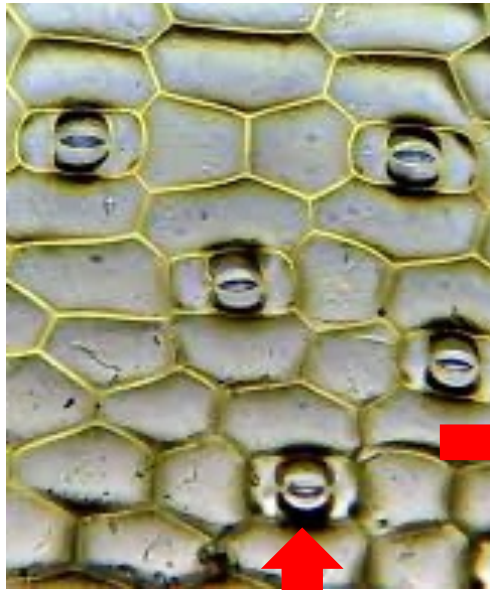
- CBB widespread
- CLR - West to Upcountry Maui
- CLR - North Holualoa through Honaunau





(unfortunately)
Hawaii is perfect for CLR and CBB

- Lots of shade and cloud-cover, no frost
- Warm temperatures (70-77°F)
- Adequate moisture and rain (at least 6 hours)



~30 days



Initial effects:

- Spots and spores become evident
- Start of defoliation
- Yield not typically affected



Advanced effects:

- Defoliation
- Slowed growth, berry development
- Branch dieback
- Lower yield
- Tree dieback
- Tree death

Info on CLR and CBB

- Introduction to Coffee Leaf Rust Webinar
<https://www.youtube.com/watch?v=UzSaocVIT9k>
- Identifying and Mitigating Damage from Coffee Leaf Rust Webinar
<https://youtu.be/A6dnEh0VrTc>
- Short term CLR Strategies and Research, Resources and Regulation Webinar
<https://hawaiicoffeeassoc.org/page-1771697>
- Update on CLR Webinar
https://www.youtube.com/watch?v=BAZlOf0RzkU&feature=emb_logo
- CLR website
<https://www.hawaiicoffeeed.com/clr.html>
- CBB website
<https://www.hawaiicoffeeed.com/cbb.html>
- Multiagency Coffee Leaf Rust Meetings
<https://hawaiicoffeeassoc.org/News>



Managing CBB

- 2020 CBB IPM Recommendations
 - <https://www.ctahr.hawaii.edu/oc/freepubs/pdf/IP-47.pdf>
- Strip-pick ALL green, ripe, over-ripe, and raisin coffee at the end of harvest and prior to pruning.
- Monitor and spray with *Beauveria bassiana* (BotaniGard or Mycotrol) products



A



B



C

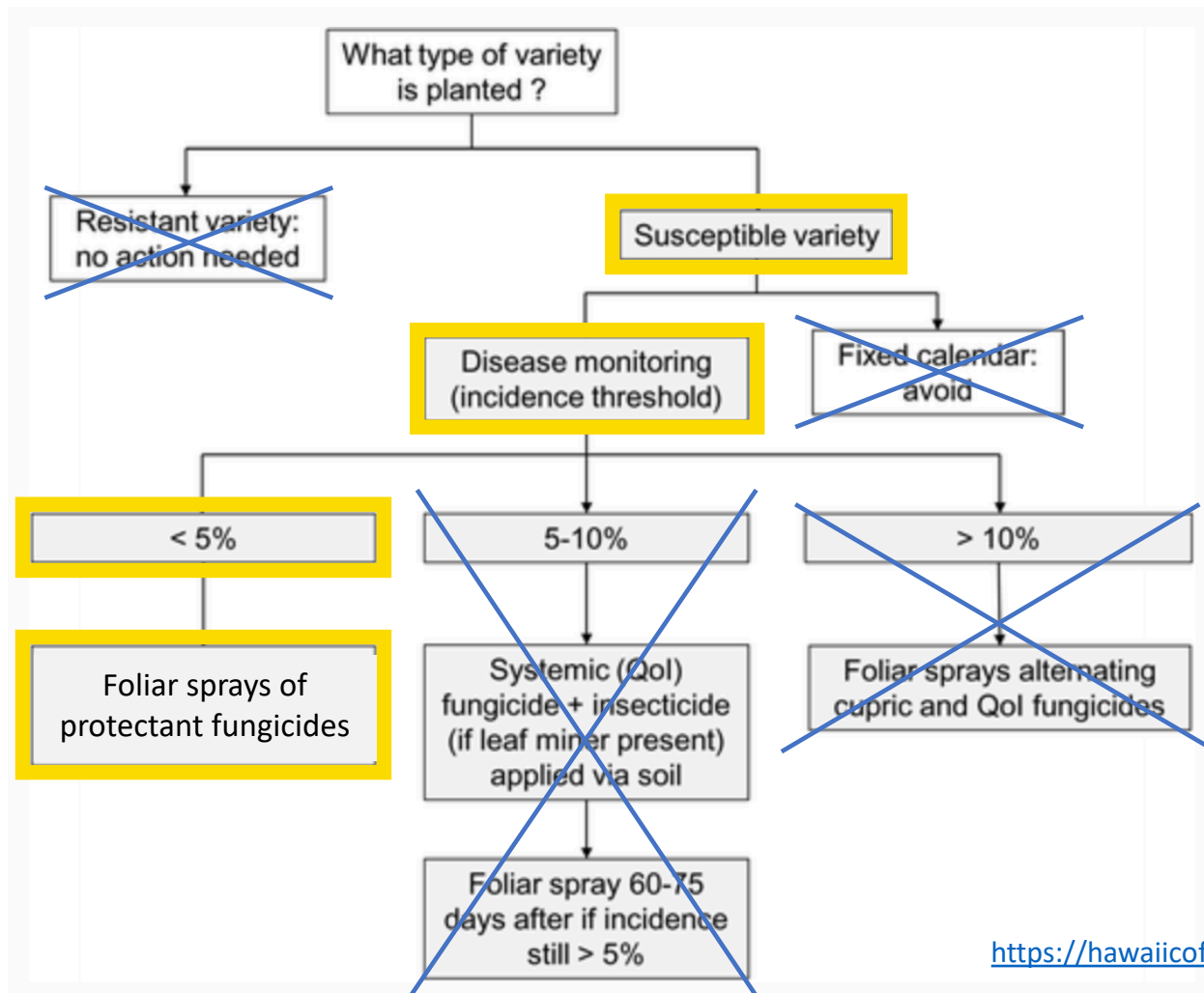


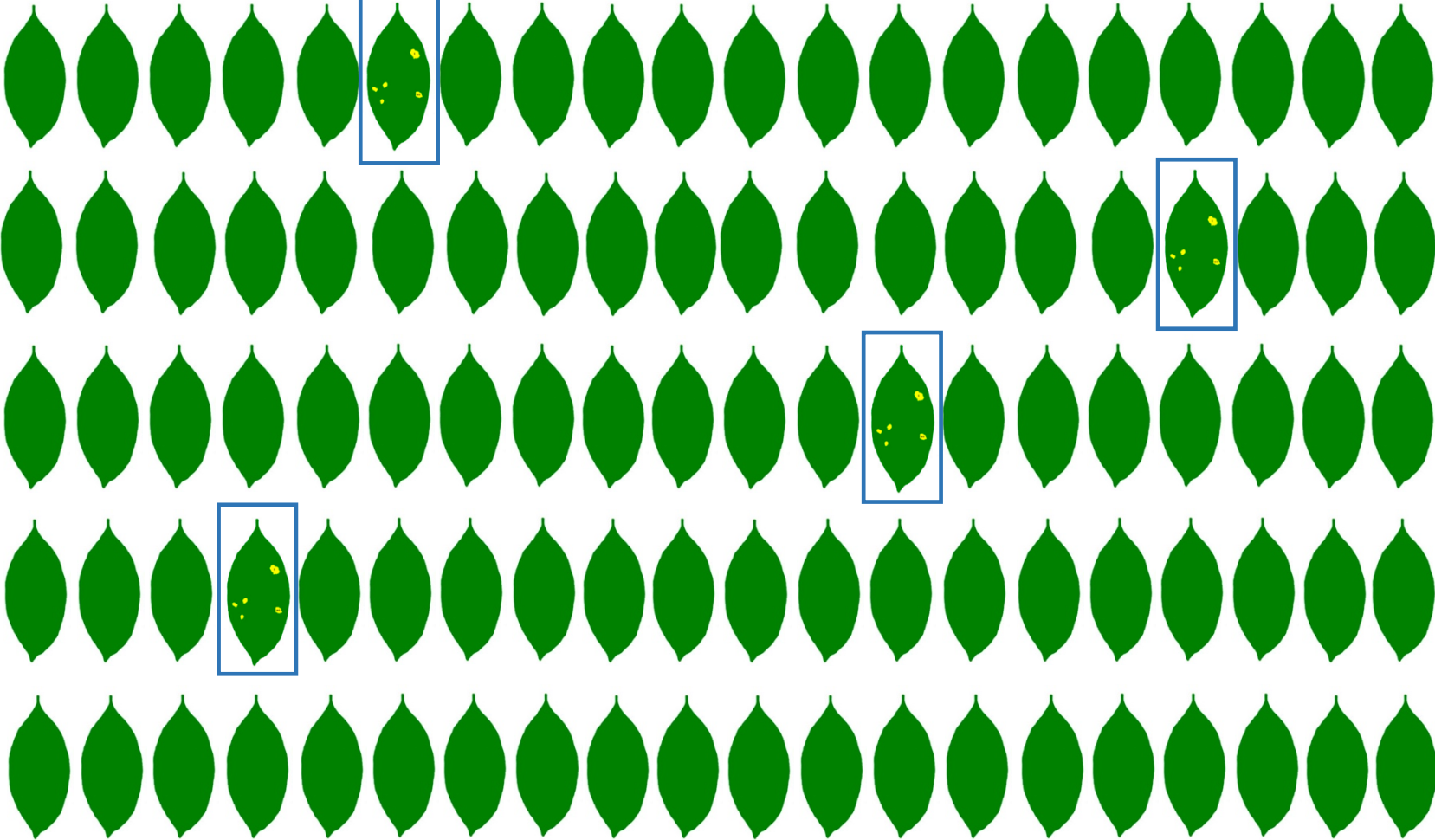
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Spraying can kill CBB and help prevent bean damage

Spraying will not kill CBB. Bean damage will continue and new CBB will be produced.

Early CLR detection is critical for management







You need to look!

- All trees
- Bottom third of canopy
- Shaded areas
- Along roadsides
- Areas where pigs or other animals frequent
- Human movement
- Hold the leaf up against sunlight to see spots





Day 0



1 week



4 weeks



Managing CLR

- No resistant varieties yet
- No systemic fungicides yet
- Healthy trees
- Approved contact fungicides
 - Contact fungicides will not effectively control CLR inside the leaves
 - <5% CLR incidence rate
 - Avoid pesticide resistance

Table 1. List of fungicides currently licensed by the Hawaii Department of Agriculture with directions for use on coffee grown in Hawaii. Licensed products and label changes happen frequently. Refer to http://npirpublic.ceris.purdue.edu/state/state_menu.aspx?state=HI or <https://opendata.hawaii.gov/> for currently licensed products and their approval labels (1/5/21).

Trade Name	Active Ingredients	FRAC Group	EPA Reg. No.	Labels	Notes	Compatibility with BotaniGard® ¹	<i>H. vastatrix</i> Rate (per acre)	Est. Cost ³ per Application/Acre	
								Low Rate	High Rate
Serenade ASO	QST 713 strain of <i>Bacillus subtilis</i>	44	264-1152	Label	OMRI	Yes, but NOT at 8 qts per 100 gal (see chart)	2.0-4.0 qts	\$23.50	\$47.00
Badge SC	Copper Oxychloride + Copper Hydroxide	M1	80289-3-10163	Label		Yes ²	1.0-3.0 pints	\$5.88	\$17.63
Badge X2	Copper Oxychloride + Copper Hydroxide	M1	80289-12-10163	Label	OMRI	Yes ² , but tested at 2.5 lbs/A per 100 gal water	1.0-3.0 lbs	\$12.00	\$36.00
Champ Formula 2 Flowable Agricultural Fungicide / Bactericide	Copper Hydroxide	M1	55146-64	Label		Yes ²	1.33-2.66 pints	\$7.48	\$9.84
Champ WG Agricultural Fungicide	Copper Hydroxide	M1	55146-1	Label		Pending	2.0-4.0 lbs	\$17.00	\$34.00
Cueva Fungicide Conc.	Copper Octanoate	M1	67702-2-70051	Label	OMRI	Pending	0.5-2.0 gals	\$30.00	\$120.00
Kocide 3000	Copper Hydroxide	M1	91411-2-70051	Label		Yes (see chart)	0.75-1.75 lbs	\$9.00	\$21.00
Kocide 3000-O	Copper Hydroxide	M1	91411-11-70051	Label	Organic	Yes ²	0.75-1.75 lbs	\$9.00	\$21.00
Nu-Cop HB	Copper Hydroxide	M1	42750-132	Label		Pending	1.0-2.0 lbs	\$12.00	\$24.00
Nu-Cop 30HB	Copper Hydroxide	M1	42750-281	Label		Yes ²	0.75-1.75 lbs	\$9.00	\$21.00
DoubleNickel LC Biofungicide	<i>Bacillus amyloliquefaciens</i> strain D747	BM 02	70051-107	Label	OMRI	Yes ²	0.5-6.0 qts	\$7.50	\$90.00
DoubleNickel 55 Biofungicide	<i>Bacillus amyloliquefaciens</i> strain D747	BM 02	70051-108	Label	OMRI	Yes ²	0.25-3.0 lbs	\$9.63	\$115.50
OxiDate 2.0	Hydrogen Dioxide + Peroxyacetic Acid	Not classified	70299-12	Label	OMRI	No	0.25% to 1.0%	Gals. water needed/A \$58.00/gal	

¹ See the BioWorks BotaniGard® Compatibility Chart [here](#). “Pending” means that the exact product was not listed as tested by BioWorks. Per email from BioWorks dated 11/2/20, these products still need to be tested for compatibility with *Beauverria bassiana*. Results will be forthcoming.

² Per email from BioWorks dated 11/2/20 and 1/14/21, these products have been determined compatible with BotaniGard®.

³ Estimated costs are based on local retail prices and are for the fungicide only.

Mention of a trademark or proprietary name does not constitute an endorsement, guarantee, or warranty by Ms. Shriner, the University of Hawaii Cooperative Extension Service, United States Department of Agriculture, Hawaii State Department of Agriculture, or its employees and does not imply recommendations to the exclusion of other suitable products.

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Spray tips

- Read and follow the label
- Use proper PPE
- Calibrate your sprayer to determine amount of water per acre and rate of product per gallon
- Low pressure sprayer for initial spray
- Direct the spray to the underside of leaves





- Tank mixing
- Controlling anthracnose and cercospora
- Other considerations
 - REI
 - Solution pH
 - Min and max rates per appl.
 - Max appl. per year or season
- Rotate to avoid pesticide resistance
- Pesticide recordkeeping

<https://hdoa.hawaii.gov/pi/files/2018/11/SAM-PLWPS-Application-record.pdf>

Product label variability

- Serenade

- REI 4 hours
- Do not allow spray mixture to stand overnight or for prolonged periods.
- Maintain a spray solution pH between 4.5 and 8.5.
- No spray interval stated

- Kocide 3000

- REI 48 hours
- Avoid contact with metal surfaces.
- Phytotoxicity may occur with a spray solution having a pH of less than 6.5.
- 14 to 21-day spray interval

Calculating rates per gallon or acre

- How many gallons of water need to spray an acre of coffee
 - [Sprayer calibration for mist blower](#)
 - [Sprayer calibration for motorized pump sprayer](#)
- Amount of product per acre according to the label
 - Depends on the pest or disease
 - High or low rate
- How many gallons of water to fill tank

Example: Badge X2

- Spray for Anthracnose, CLR and Cercospora
- Label rate is 1 lb per acre for CLR and Cercospora, but 2.5 lbs per acre for Anthracnose
- 50 gallons of water per acre for good coverage
- 3-gallon spray tank

$2.5 \text{ lbs} * 16 \text{ oz} = 40 \text{ oz}$ of Badge X2 per acre

$50 \text{ gal} / 3 \text{ gal} = 16.67$ tankfuls for an acre of coffee

$40 \text{ oz} / 16.67 \text{ tankfuls} = 2.4 \text{ oz}$ of Badge X2 per 3 gal of water

Fill the tank half full, add 2.4 oz of Badge X2 and then fill to 3 gallons

OxiDate 2.0

- Strong oxidizing agent.
- Handlers must wear coveralls over long-sleeved shirt and long pants, rubber gloves, chemical resistant footwear plus socks, and protective eyewear (goggles or face shield).
- Stay out of treated areas until sprays have dried.
- Dilute with water containing low levels of organic or inorganic materials and having a neutral pH (pH value of 7.0)
- To increase the effectiveness of OxiDate 2.0, additional non-ionic surfactant may be added. Only non-ionic surfactants are compatible with OxiDate 2.0.





- Toxic to bees so avoid bloom.
- Do not tank mix with copper or metallic-based products
- Do not tank mix with *Beauveria bassiana*
- Wait at least 24 hours after spraying a copper-based fungicide to apply
- Apply 1 day before or 4 days after spraying Beauveria
- Test new combinations for physical compatibility and phytotoxicity

- Use 1% curative rate at first sign/symptom of infection
- Do not use repetitively
- Rotate with other fungicides

- Mixing a 1% OxiDate 2.0 solution in 50-gallon tank
 - Fill half of tank with water
 - Add 64 fluid ounces of OxiDate 2.0 to water
 - Fill remainder of tank so there is 50 gallons of solution

- Mixing a 1% OxiDate 2.0 solution in 3-gallon tank
 - Fill half of tank with water
 - Add 3.84 fluid ounces of OxiDate 2.0 to water
 - Fill remainder of tank so there is 3 gallons of solution

Sanitation



Tips:

- Consider your farm contaminated
- Sanitize before and after entering your farm and other farms
- Clean clothing, footwear, tools, supplies, etc.
- $\geq 70\%$ alcohol
- Newly made 10% bleach solution
- Detergent and heat for washable material



Pruning

- Strip-pick before pruning
- Spray fungicide before pruning
- Thin out canopy and reduce verticals
- Block stump pruning for CBB and CLR
- Keep tree materials on-farm



Disposal of materials with CLR and CBB

Burning

- Apply for and abide by the regulations of your approved agricultural burning permit from the [Department of Health's Clean Air Branch](#); (808) 586-4359 or cab@doh.hawaii.gov.

Composting

- Pile infected leaves and branches and securely cover the pile to prevent live spores from being transferred back into the field.
- Manual cutting or using a flail mower will help to reduce the size of branches and increase the rate of decomposition. A chipper might be used, but chipping will blow material into the air and could disperse CLR spores.
- Since branches may poke holes in the covering, use a thick, non-porous material without holes or openings.
- Bury infested berries and raisins under at least 6 inches of compact soil.
- Keep the pile covered for at least 6 weeks.

Solar heating

- Collect infected leaves, berries, and other tree materials and enclose them in a non-porous bag, bucket or bin with a secured lid. Do not reuse any container that previously contained pesticides, as this is a federal violation.
- If adding branches, use a thick, non-porous material to prevent branches from poking holes in the bag.
- Leave the bag or container in direct sun for at least 6 weeks.



Overview

- Catch CLR and CBB early for management
- Spray with the proper fungicides and rates
- Rotate fungicides to avoid pesticide resistance
- Strip-pick for CBB management
- Spray for CLR prior to pruning
- Prune to rejuvenate trees, increase airflow and decrease shade
- Control weeds
- Healthy trees to tolerate CLR





Resources

- [Surveying, sampling, and monitoring of CLR for early disease control](#)
- [Spraying to suppress CLR](#)
 - [Spanish](#)
 - [Ilocano](#)
 - [Tagalog](#)
- [USDA sanitation protocols](#)
- [HDOA field guide and submission form](#)
- [CLR webinars and meetings](#)

Thank you!

- Questions
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