

Pruning Methods for the Management of Coffee Leaf Rust and Coffee Berry Borer in Hawai'i



Figure 1. Defoliation caused by coffee leaf rust can affect future coffee production over many years. Note the leafless, bare branches with very few berries remaining toward the tip of lateral branches.

Coffee Leaf Rust (CLR), *Hemileia vastatrix*, and the Coffee Berry Borer (CBB), *Hypothenemus hampei*, the world's most devastating (fungal) disease and insect pest of coffee, were identified in Hawai'i in October 2020 and August 2010, respectively. Integrated pest management (IPM) recommendations for CBB mitigation [15] have been established and are widely adopted, but CLR management tactics are still being developed for Hawai'i's producers. Without effective management practices in place, CBB and CLR infestations and infections can cause reductions in coffee yield, due to defoliation and berry loss (Fig. 1) and quality. Severe defoliation can lead to tree decline and death [1].

Combined use of cultural practices, systemic and contact fungicides, and planting of resistant varieties are utilized in other coffee-producing countries to combat CLR [7,19,21]. Pruning and fertilization are common cultural practices employed on coffee farms in Hawai'i, but producers presently do not have access to systemic fungicides or poten-

tially resistant plant varieties. While contact fungicides are registered and available for use in Hawai'i, spraying these fungicides is ineffective when CLR incidence is higher than 5% [6], so the pathogen will continue to spread. It is therefore critical to identify and manage CLR early in infection.

The publications "[Surveying, Sampling, and Monitoring of Coffee Leaf Rust for Early Disease Control of Coffee Leaf Rust \(*Hemileia vastatrix*\) in Hawai'i](#)" and "[Spraying to Suppress Coffee Leaf Rust \(*Hemileia vastatrix*\) in Hawai'i](#)" [10-14] explain how to identify early CLR infections and properly spray. They also provide a list of approved contact fungicides. When transporting, storing, handling, applying, and disposing of pesticides, following all label instructions is a legal requirement.

Pruning methods described in this publication are recommended for the management of CLR, as well as CBB, and are based on the best information currently available. This information is likely to evolve as further research is conducted in Hawai'i. Additional CLR and CBB information can be found at www.HawaiiCoffeeEd.com.

While CBB and CLR are found on all of the major Hawaiian Islands, not all farms are infested and infected. To reduce the further spread of CBB and CLR, follow all recommended sanitation practices [15,18], such as wearing clean clothing when entering a farm and decontaminating shoes, supplies, and tools with 70% or greater alcohol when exiting a farm.

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Brackets e.g. [2], correspond to literature citations found in the Literature Cited section. This publication is expected to evolve as more is learned about coffee leaf rust in Hawai'i.

Pruning Coffee Trees

The main reasons for pruning are to generate new vegetative growth, increase light and airflow through the canopy, manipulate shade, and stabilize or increase yield with the removal of excessive and non-productive vertical and lateral branches.

Depending on the pruning style, there are positive and negative effects when pruning for the management of CLR [2,19]. The immediate benefits are the reduction of foliage that could potentially become infected by fungal spores, as well as the elimination of already infected leaves that would otherwise serve as a source of inoculum (spores) for additional infection. Therefore, periodic pruning of main branches and desuckering of new growth will reduce the number of spores present in the environment. Pruning and desuckering can also facilitate other cultural practices, such as spraying, harvesting, weed control, and fertilization.

All pruning methods should be followed-up with fertilization, desuckering of stumps, vertical and lateral branches, and monitoring and spraying (as needed) for CLR and CBB. Pruning encourages new growth as a result of increased sunlight to the branches and stump, and the loss of apical dominance. Apical dominance is a phenomenon where new growth is concentrated in the main vertical or branch instead of other growing points on the plant. Bending of a vertical, topping, and hedging can reduce apical dominance and encourage these additional growing points to sprout.

Desuckering of new and excess shoots is necessary to open up the canopy for good airflow, circulation, spray coverage, ease of harvesting, and to reduce the amount of new growth. Depending on tree spacing, health, age, stump size, and whether trees are hand or machine

harvested, the total number of vertical branches, once desuckered, can range from 1 to 6 per tree [3,5]. See the "[Growing Coffee in Hawai'i](#)" booklet for additional coffee production information.

Pruned and desuckered material should be disposed of properly and not left in the field where live spores could be transferred back to the trees via wind, splashing water, rain, or by physical transport. See the methods of disposal section for details.

Research has shown that during a high production year, CLR incidence and severity increases, leading to a reduction in yield the following season [21]. Additionally, a higher CBB infestation level at the beginning of a coffee season is typically related to a higher level of CBB damage in green coffee beans, as well as lower profit margins at harvest [20]. CBB and CLR management starts with strip-picking (Fig. 2) after the harvest and before pruning to remove all remaining coffee. Multiple rounds of strip-picking may be needed for effective field sanitation. If CLR is present on-farm, at least one application of an approved fungicide is recommended to reduce the number of live CLR spores and to prevent the spread of CLR throughout the farm as branches are pruned, mowed, chipped, and/or piled.

Prior to Pruning

1. Spray the coffee orchard with an approved fungicide(s) to kill CLR spores and reduce further spread.
2. Strip-pick ALL (green, ripe, over-ripe, and raisin) coffee BEFORE pruning to kill CBB and to remove berries that could harbor CBB from one season to the next.
3. Process or destroy all coffee berries and raisins from strip-picking.

Be sure to minimize the transport of infected materials through uninfested areas of the farm. Several methods to dispose of plant materials infected by CLR and CBB are described below. In addition, sanitize tools and equipment as necessary and always follow pesticide product label directions.

Some level of CLR and CBB presence is likely to persist from one season to the next in infested farms. Therefore, growers should strive to manage both pests to the lowest level feasible.

Pruning Styles for CLR and CBB Control

There are various pruning systems (Appendix 1) used in Hawai'i. These include stump, Beaumont-Fukunaga, Kona-style or selective, and hedge pruning. Pruning alone will not provide total control of CLR or CBB and should be incorporated with other management practices, including field sanitation, monitoring, and spraying.



Figure 2. At the end of the coffee season, remaining green and ripe berries and raisins tend to have a high level of infestation of CBB and bean damage. Strip-picking these remaining berries from the field prior to pruning, can greatly reduce CBB populations and the number of borers harbored from one season to the next.



Figure 3. A mechanically harvested coffee field that was recently stump pruned. Leaves, branches, and dropped raisins (old coffee berries) were thoroughly removed from the field as part of CBB IPM. CBB and CLR would still need to be actively managed in adjacent fields that are still in production.

Stump pruning in blocks

Stump pruning by block or large sections (plots) is currently the only pruning method for maintaining a sizeable area without food or shelter for CBB, or live foliage for CLR (Fig. 3). Typically, only one strip-picking is needed prior to pruning and labor costs are usually lower when compared to other styles of pruning. Stumping can also help growers to regain control of CBB and CLR where infestation and infection is extensive and where management with approved pesticides is ineffective.

While CLR monitoring and spraying is necessary after regrowth, CBB monitoring and spraying is not required until coffee berries develop the following season. Stump pruning by rows, such as the Beaumont-Fukunaga style of pruning, will not help control CBB or CLR.

While there are positives to stumping, there are also challenges, especially if trees are aged, grown in dry locations or higher elevations, or unhealthy. Avoid stump pruning during drought, as trees need rainfall or irrigation and proper nutrition to recover. If you must stump prune during a drought, or have older or frail trees, retaining a “nurse vertical” (Appendix 1B) can help reduce tree shock and losses from stumping. However, a “nurse vertical” with leaves will continue to be a potential source of CLR spores in the field. Therefore, nurse verticals should be removed after new shoots emerge.

Kona-style or selective vertical pruning

If maintaining a Kona-style pruning system, the lateral and vertical branches are selectively removed to assist with harvest, spray coverage, and ease of spraying and other cultural practices. Normally, the oldest vertical(s) is removed to make room for new growth. Since there is persistent berry and foliage production each season, the Kona-style of pruning does not help control CBB or CLR.



Figure 4. Annual pruning, coffee berry borer and coffee leaf rust management, and harvesting are necessary for trees pruned in the Kona-style.

Hedge pruning

The combination of stumping and hedge pruning with tractor-drawn equipment is commonly practiced on large, mechanically harvested farms. To regenerate a new vertical(s), the trees are stumped and desuckered. Thereafter and until re-stumping, the trees are topped and the laterals along the row are hedged to maintain good tree height and width for harvesting. When mechanically hedged, some berries and foliage often remain on the branches. In an effort to eliminate residual fruit and leaves harboring CBB and CLR, strip-picking and use of a defoliant product can help to drop (abscise) remaining berries and leaves from the trees to where sweepers can then collect them.

Hedge pruning by hand can assist in the control of CBB and CLR, but all berries and raisins must be strip-picked prior to pruning, and any remaining leaves removed and destroyed. While yield can be prolific in the first year of production, a major challenge with hedging is the thickness of (secondary and tertiary) lateral regrowth, which makes spraying and harvest slow and difficult.

Feral and unmanaged coffee

If not actively farming coffee, consider strip-picking and then stump pruning your coffee trees when neighbors are also pruning. This will help nearby farms in their attempts to control CBB and CLR. Furthermore, strip-pick, prune, and then kill feral and unmanaged coffee trees to reduce CBB and CLR reservoirs. If you do not want to continue farming coffee, strip-pick all green, ripe, and raisin coffee and then kill the tree(s).

Disposal of Plant Materials Infected by CLR and CBB [14]:

- **Burning**
 - Apply for and abide by the regulations of your approved agricultural burning permit from the Hawai'i Department of Health's [Clean Air Branch](#).
 - Contact the Clean Air Branch at (808) 586-4359 or cab@doh.hawaii.gov.
- **Composting**
 - Option 1. Bury infested berries, raisins, and infected plant material under at least 6 inches of compact soil or compost. Keep out animals that may dig up the materials prematurely.
 - Option 2. Pile infected leaves and branches and securely cover the pile with a tarp to prevent live spores from being transferred back into the field. Since branches may poke holes in the covering, use a thick, non-porous material without holes or openings.
 - Manual cutting or using a flail mower will help to reduce the size of branches and increase the rate of decomposition. A chipper can be used, but

chipping will blow material into the air and could disperse CLR spores.

- Keep the pile(s) undisturbed and covered for at least 6 weeks.
- **Solar heating/Solarization**
 - 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 the direct sun for at least 6 weeks.

To reduce the spread, DO NOT move or transport CLR-infected or CBB-infested tree materials around the farm, as well as off-farm.

Once germinated, CLR spores require a living host to remain alive [16]; however, a live spore can remain viable for about 6 weeks. Therefore, it is important to keep piles covered and bags or containers enclosed and in direct sun for at least 6 weeks to kill CBB and CLR. All composted plant materials can then be returned to the farm.

If you have questions, contact your [local Cooperative Extension](#) or statewide coffee agent, Andrea Kawabata, at andreak@hawaii.edu or 808-322-4892. Texts and photos can be sent to (415) 604-1511.

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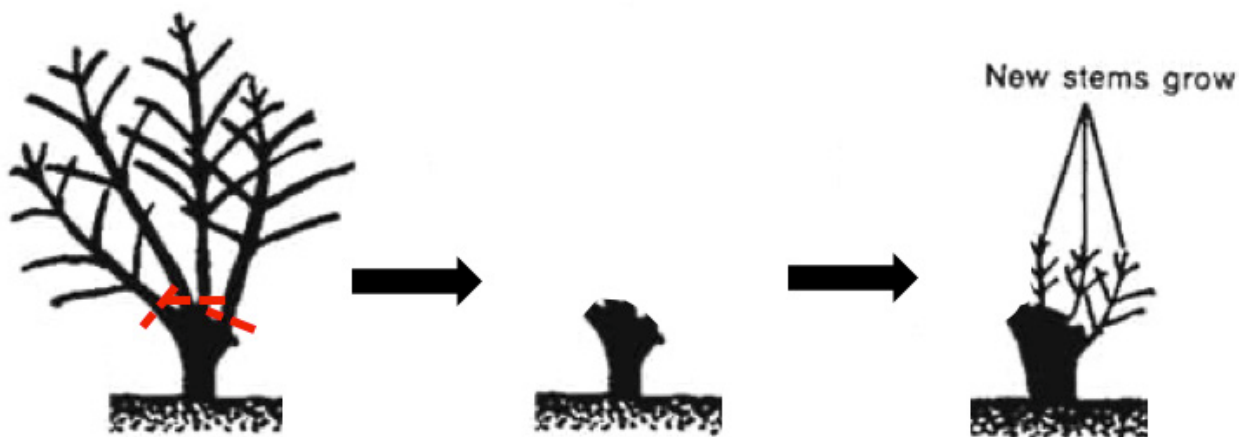
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Appendix 1: Examples of various common pruning systems [2,4] used in Hawai‘i

See publication [6] for the original drawings depicted in sections A, B, C and D. A red dash line (--) shows where the vertical or lateral branch is cut and pruned.

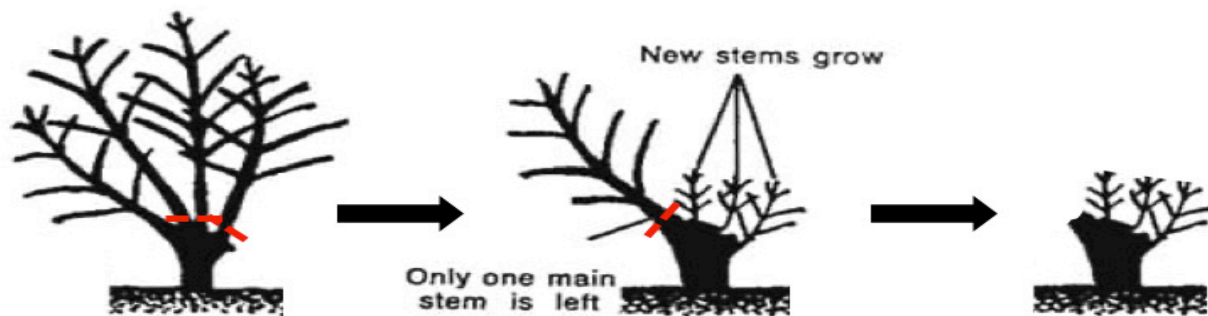
A. Stumping

All verticals (stems) are removed and only the (18-24" high) stump remains with stump pruning. As a result, stumped blocks of large areas and acreage are devoid of coffee berries, raisins (dried berries), and foliage until new growth is generated. The Beaumont-Fukunaga pruning style [2,3] employs stumping by rows so within a field, some rows remain productive while other rows are stumped. Beaumont-Fukunaga row stumping does not help to control coffee berry borer (CBB) or coffee leaf rust (CLR); whereas, stumping in larger sections can. An active replant program may be necessary to replace stumps that do not regrow.



B. Stumping with a nurse vertical

Stumping is a quick but severe method of pruning, and tree death can occur. When stumping older, unhealthy, over-productive, and/or coffee root-knot nematode affected trees, or during drought, retaining a nurse vertical could help reduce tree losses. However, if CLR is present, retaining a nurse vertical will not help to control CLR.



C. Kona-style or selective vertical pruning

This pruning method ensures there is at least one productive vertical remaining on the stump each year. Typically, the oldest vertical(s) is removed following the harvest, and a new vertical(s) is generated and retained for future production. This is the least severe form of pruning. However, Kona-style or selective pruning does not help to control CBB or CLR.



D. Hedging

Hedging is a pruning method commonly used on mechanically harvested farms. There may be more than one vertical per stump. The vertical(s) is topped at least once and the laterals are cut along the row, leaving a small portion of the laterals or sublaterals where new growth can develop. Lateral growth between trees is not normally hedged. Machinery is used to prune; however, hand tools can also be used to hedge trees on small farms. Similar to stumping, hedging in large blocks or areas may help to control CBB and CLR but no berries, raisins, or leaves can remain on the tree immediately following pruning.

