

Confirm diagnosis with laboratory assay

To confirm the presence of the Kona coffee root-knot nematode, collect a soil and root sample and send it for nematode assay and identification to CTAHR's Agricultural Diagnostic Service Center (ADSC) via the CTAHR Cooperative Extension Service (CES) office in your area.

Taking a soil and root sample for assay

With a shovel, pick, 'ō'ō, or soil-coring device, sample the zone of soil where the coffee roots are found. To diagnose a suspected infection, sample two or three spots at the leaf canopy drip line of each of several trees that are showing symptoms, preferably early symptoms (yellow leaves, stunted trees). To assay infestation of nematodes in a field, take samples from about 20 spots. The samples should include roots.

Mix the subsamples together, and take about a pint of this mixture for the assay. Quickly put this sample in a plastic bag and keep it in an insulated cooler. Label the sample with your name, field identification number, date, and any other information that will be useful. Check with your local CES office to find out the best time to bring in a sample for prompt shipping to ADSC.



Healthy coffee plants (*Coffea arabica*). Coffee production is expanding rapidly throughout Hawaii.

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Sanitize. Remove all volunteer coffee seedlings (*pulapula*) and weed hosts of the nematode.

Nematicides. No nematicide is currently registered for use in coffee. Research indicates that nematicides are relatively ineffective in older coffee plantings. Because nematicides are expensive and highly toxic, other options for nematode management are preferable. Also, registration is an expensive process, and agricultural companies are not likely to see much profit potential in pursuing approval of a product for use in coffee in Hawaii.

Seek expert advice. Contact your nearest CTAHR Cooperative Extension Service office.

Prevention and avoidance

- Don't transplant volunteer coffee seedlings.
- Don't plant coffee seeds in untreated soil; use only sterilized soil for potting.
- Remove *pulapula* from around coffee trees (they harbor many nematodes in their roots).
- Avoid moving farm machinery from infested to noninfested fields.
- Don't irrigate indiscriminately. Excess soil moisture favors root rot in nematode-infected roots. Time irrigation according to the crop's needs.
- Eliminate other host plants of the Kona coffee root-knot nematode, such as hilograss and amaranth (*pakai*).
- Minimize soil erosion and runoff.

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Coffee Decline

Caused by the Kona Coffee Root-Knot Nematode

Coffee growers in Hawaii are able to grow their crop free from many of the world's most serious coffee diseases because our islands are isolated from other coffee-growing areas and the diseases have yet to be introduced here. However, during the past several years a serious disease has been observed in the Kona region of the island of Hawaii. This disease has been referred to in Kona as "transplanting decline," "replant problem," "nutritional stress," and "Kona wilt." It is characterized in coffee plantations by the occurrence of individual or clustered poorly growing or stunted coffee trees.

Why would coffee trees grow poorly or be discolored? The reason in this case is attack by small, plant-parasitic roundworms known as nematodes, which enter the plant's roots and cause serious plant damage and crop loss. Other factors that can worsen decline include nutritional deficiency or toxicity, moisture stress, herbicide damage, and attack by insect pests or plant diseases caused by bacteria, fungi, or viruses.

Nematode entry and feeding within roots disrupts plant growth processes and causes growth decline, so infection by them is considered a plant disease. Their damage also can allow secondary infection when other disease-causing organisms enter. Coffee trees with nematode-damaged roots grow weakly and slowly, suffer moisture stress more readily, often turn yellow, and eventually die.

The nematode causing the coffee plant decline in Kona has been named *Meloidogyne konaensis*, the Kona coffee root-knot nematode.

Coffee decline caused by the Kona coffee root-knot nematode



Drooping leaves, thin foliage

This stunted 3-year-old plant with a poor crop also shows leaf yellowing (chlorosis).



Yellow leaves

Nematode-infected coffee trees with good crops can decline rapidly (2–3 months). A heavy crop makes demands on the tree, causing stress that may hasten the decline.



Dead tree

The Kona coffee root-knot nematode is a microscopic roundworm that lives, feeds, and reproduces in plant roots. It infects coffee, many vegetables, and some weeds. It has been detected on coffee at 600–1800 ft elevation and to our knowledge is restricted to the Kona region at present.



Swollen taproot

oversized with corkiness



Swollen roots

with corky texture, few feeder roots

How to diagnose coffee decline

The only sure method is lab assay of the soil, but you can look for these symptoms in the field:

Above ground

Early symptoms

- leaves drooping and yellowed
- trees small, stunted, with thin trunks

Later symptoms

- wilting despite adequate nutrition and irrigation
- leaf loss (defoliation)
- wobbly trees, easily uprooted

Below ground

- root system small
- roots rotting or dead
- feeder roots scarce
- taproot and root tips with slight to large swellings (galls)
- root texture corky



Infected roots

Healthy roots

A healthy root system has many fine, white feeder roots.

If your farm has root-knot nematodes...

Combined strategies are needed for nematode management. Following are recommendations from CTAHR researchers for managing coffee decline.

Control and recovery

Fallow. Fallowing means maintaining a field entirely free of any plants. A 6–9-month fallow period will reduce nematode numbers greatly; however, some will survive.

Replanting. Some farms may require extensive replanting, which should be done after a fallow or a rotation with a crop that is a confirmed non-host of the Kona coffee root-knot nematode. When replanting coffee, use only vigorous, nematode-free transplants at least one year old.

Replant with trees grafted onto tolerant rootstock. Graft coffee scions onto a nematode-tolerant rootstock known as *Coffea dewevrei*.

Organic soil amendments. Adding large quantities of organic amendments such as animal manure to the soil has been found to stimulate growth of soil organisms that may compete with and suppress nematodes. This technique has not yet been verified on coffee in Hawaii. Use of coffee cherry pulp as a soil amendment is being evaluated.

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