



Speedy Review of Common Banana Pests & Diseases

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Integrated Pest Management

- IPM involves the use of **all possible pest control methods** in a well organized and harmonious way in order to achieve long term pest control.
 - Pest ID
 - Habitat modification
 - Cultural & Physical Control
 - Biotechnology
 - Biological Control
 - Chemical Control
- The primary goal of IPM is to retain or improve production without negatively impacting the environment and human safety.

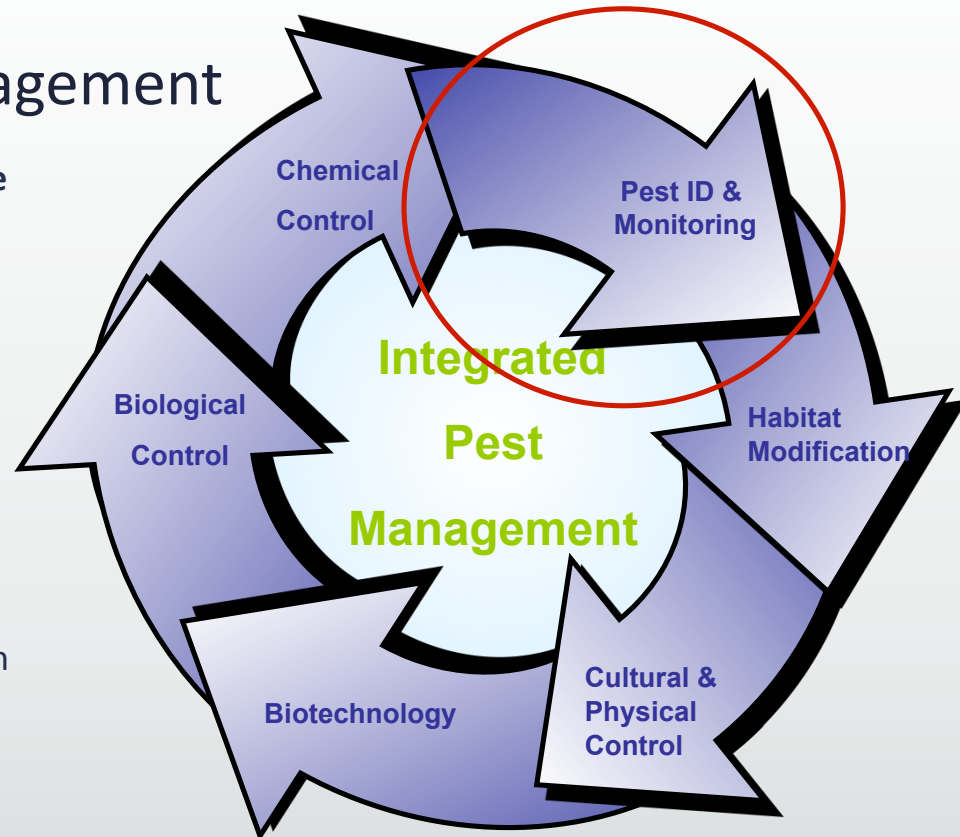
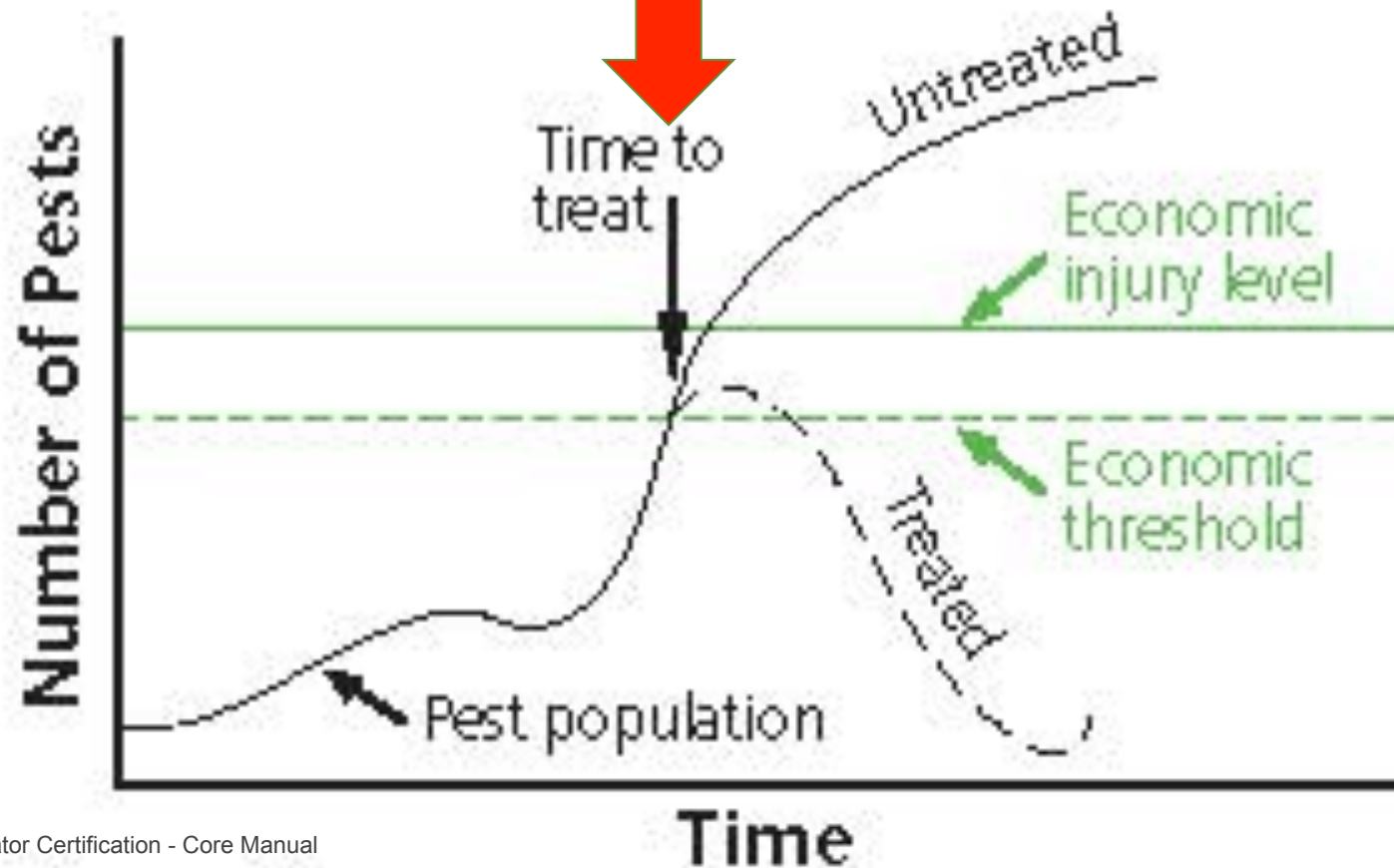


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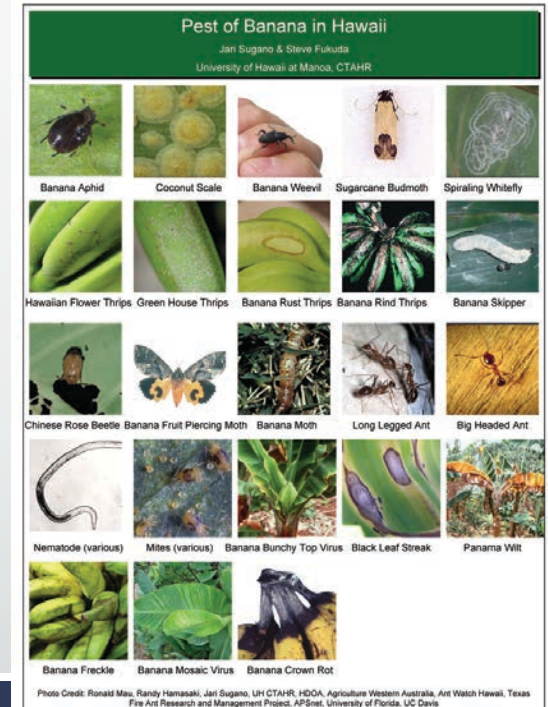
Implementation of Pest Management Treatments



Major (Minor) Pests of Banana in Hawaii

- Banana Bunchy Top Virus
- Banana aphid
- Banana rust thrips
- Hawaiian flower thrips
- Banded greenhouse thrips
- Panama wilt
- Ants
- Nematodes
- Freckle
- Black leaf streak
- Coconut scale
- Banana root borer
- Banana skipper
- Chinese rose beetle
- Banana moth
- Spiraling whitefly
- Banana fruit piercing moth
- Mites
- Mealybugs
- Banana mosaic virus

Photo Credit: S. Nelson, J. Sugano, A. Hara, R. Mau & HDOA



Banana Bunchy Top Virus

- Most significant disease of banana
- Symptoms: Stacked leaves, Morse coding, erect narrow leaves, marginal chlorosis, distorted fruits
- Insect vector: Banana aphid
- *Control: Aphid management, rouging, ant management, weed control, eradication of infected plants*



Help Control Banana Bunchy Top Virus

SYMPTOMS

Healthy	Infected
 Labels normal	 Labels bunched up
 Healthy pistole	 Pistole with mottling
 No Morse code	 Morse code
 No rosetting	 Wide fan green leaves
 Healthy fruit	 Distorted fruit

Host Vector


Winged banana aphid


Aphid feeding on banana plant

Best Management Practices

- Monitor often for BBTV symptoms
- Flag BBTV-infected plants for removal
- Control the banana aphid with an approved insecticide
- Destroy all BBTV-infected plants with an approved herbicide
- Control aphids on alternate host plants near banana plants
- Prevent BBTV spread by not transporting infected plants
- Start new plantings with BBTV-free planting materials

www.ctahr.hawaii.edu/banana

PLEASE REMEMBER!
Do not transport banana plants into or between the islands of Hawaii.

<http://www.ctahr.hawaii.edu/oc/freepubs/pdf/PD-12.pdf>

Photo Credit: S. Nelson, J. Sugano, A. Hara, R. Mau & HDOA

Banana Aphid

Pentalonia nigromervosa

- Vector of BBTV
- Live birth (all females)
 - Aphid takes time to acquire virus (hours)
 - Virus circulates inside the insect
 - Virus is phloem limited
 - Transmit clean plants in minutes of feeding
 - Does not transmit virus to offspring
 - Alates (winged)
- Protected by ants
- Peak season: dry, warm conditions, February to April.
- Host range includes: ginger, heliconia, taro, etc.
- Control: Insecticides, oils, soapy water, ant control



Photo Credit: S. Nelson, J. Sugano, A. Hara, R. Mau & HDOA

Banana rust thrips (*Chaetanophothrips signipennis*)

- Piercing and sucking mouthparts
- Feed on the pseudostem and fruit.
- Peak season: dry periods or in low rainfall areas.
- Symptoms: dark, v-shaped marks on the outer surfaces of leaf petioles
- Fruit damage: water-soaked appearance, oval shaped reddish “stains” where fingers touch
- Control: Insecticides, bagging, oils, soapy water

<http://www.ctahr.hawaii.edu/oc/freepubs/pdf/IP-10.pdf>

Photo Credit: S. Nelson, J. Sugano, A. Hara, R. Mau & HDOA



Banded greenhouse thrips (*Hercinothrips femoralis*)

- Symptoms: Silver and bronze scars, reddish discoloration on fruit
- Control: Insecticides, bagging with bell removal, oils, soapy water, etc.



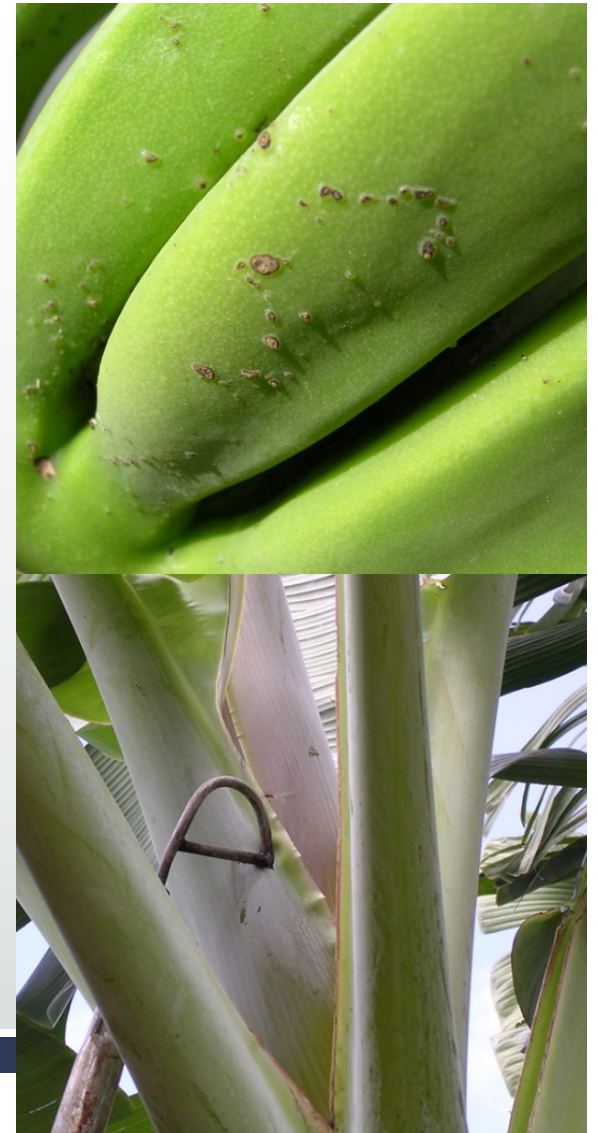
Photo Credit: S. Nelson, J. Sugano, A. Hara, R. Mau & HDOA



Hawaiian flower thrips (*Thrips hawaiiensis*)

- Feeds only on flowers.
- Prefers wet and shady areas.
- Symptoms: Flecked, spotted, or deformed flowers, pimple like bumps on fruit
- Difficult to control, damage done inside flower bell
- Control: Bunch injections with insecticides, oils, soapy water, improved sanitation

Photo Credit: S. Nelson, J. Sugano, A. Hara, R. Mau & HDOA



Banana weevil (*Cosmopolites sordidus*)

- Bore through the corm, suckers and roots of living and decaying planting material.
- Symptoms: root destruction, slowed plant growth, reduced fruit production, and toppled plants
- Young banana plants at risk
- Feeds and breeds at night.
- Controls: Hot water, trapping, sanitation, minimizing root exposure

Photo Credit: S. Nelson, J. Sugano, A. Hara, R. Mau & HDOA



Coconut scale (*Aspidiotus destructor*)

- Quarantine pest
- Armored scale
- Found on under side of leaves, petioles, peduncles, and fruits
- Piercing and sucking mouthparts
- Symptoms: Discoloration and yellowing of plant tissue.
- Peak season: February through April
- Control: Fungicides, oils, hot water treatments

Photo Credit: S. Nelson, J. Sugano, A. Hara, R. Mau & HDOA



Banana skipper (*Erionota thrax*)

- Symptoms: Rolled leaves originating from the midrib of plants
- Control: Natural enemies, Bt, Mechanical control



Photo Credit: S. Nelson, J. Sugano, A. Hara, R. Mau & HDOA

Black leaf streak (*Mycosphaerella fijiensis*)

- Fungal disease of banana
- Conditions: warm, wet and humid conditions
- Symptoms: Necrotic lesions / streaks, defoliation of leaves,
- Control: Fungicides, oils, canopy management, de-trashing, improve air movement, variety selection

<http://www.ctahr.hawaii.edu/oc/freepubs/pdf/PD-50.pdf>

Photo Credit: S. Nelson, J. Sugano, A. Hara, R. Mau & HDOA



UH-CTAHR Black Leaf Streak of Banana PD-50 - Sept. 2008



Stagnant air and high relative humidity in the banana canopy favor the development of black leaf streak disease. A recommended periodic IPM practice for managing the disease ("de-trashing") is to cut off severely diseased leaves with more than 50 percent of the leaf area damaged; therefore, the leaf in this photo should be cut off.

In areas with high rainfall, necrotic banana leaves turn very dark in color as the dead tissues become waterlogged. Hundreds of smaller black leaf streak lesions coalesce to form large, lighted areas on banana leaves.

least 10 disease-free leaves are usually needed to realize very good bunch yields in Hawaii. Therefore, some farmers manage the crop with the primary goal of getting x number of healthy leaves at the flowering stage.

Cultural practices for black leaf streak management

Avoid planting bananas in bowl-like depressions in the landscape, and avoid planting in areas with poor drainage or heavy clay soils. Good water drainage in fields will reduce disease levels greatly by minimizing the relative humidity in the canopy and the leaf wetness duration.

Some banana cultivars can resist black leaf streak. But resistance is poor among many commercially important types of bananas, including export dessert AAA, AAB plantain, highland AAA and AAB dessert cultivars. And, clones with resistance to BLS may be intolerant of other banana pests such as burrowing nematodes (*Raiglyphorus simia*) or Fusarium (Panama) wilt disease. Of the two most commonly planted commercial banana varieties in Hawaii's (Cavendish types and Dwarf Brazilian, locally called "apple banana"), the Dwarf Brazilian is more tolerant of (or less affected by) black leaf streak disease. In some locations there exist naturalized populations of bananas that are relatively tolerant of BLS. These "gudch bananas" bananas are often not common commercial cultivars.

Disease assessment

Some farmers take disease management actions, such as making fungicide applications, on the basis of the intensity of BLS disease observed on plants in the field. These farmers have scouts that record plant growth and disease levels weekly on plants of similar age groups (i.e., just before flowering). An estimate of disease intensity is obtained and recorded, such as "the youngest leaf with spots" or "the number of leaves between the first leaf with a streak and the first leaf with a spot." Some farmers use a disease assessment scale to estimate visually the percentage of leaf area diseased. It is also useful to count the number of leaves on a plant without disease. At

Panama wilt (*Fusarium oxysporum*)

- Symptoms include internal stem necrosis, root and rhizome rot, discolored leaves, plant wilting, plant death
- Disease can survive almost indefinitely in soils
- The fungus then penetrates into the vascular system of the pseudostem, causing
- Control: Fumigation, water management, residue management, eradication of infected plants

Photo Credit: S. Nelson, J. Sugano, A. Hara, R. Mau & HDOA



Formic Acid Type Ants (*Anoplolepis longipes* (long legged) *A. gracilipes* (crazy ant)

- Moves and protects aphids
- Releases a toxic chemical causing dry necrotic lesions on the fruit surface, formic acid
- Prefers wet, high rainfall areas
- Long-legged ants are sugar lovers
 - Peak season: June through October
- Control: Boric acid mixture, Terro, biocontrol using the big headed ant (*Pheidole megacephala*) (Taniguchi)

<http://www.ctahr.hawaii.edu/oc/freepubs/pdf/IP-29.pdf>

Photo Credit: S. Nelson, J. Sugano, A. Hara, R. Mau & HDOA



Ants that produce formic acid are attracted to flower nectaries and to sap-feeding insects that secrete honeydew. They climb the plants to feed and, when startled, eject formic acid from their abdomens, causing blackened spots and trails.



Entire bunches may be damaged by formic acid injury.



Startled and disturbed ants scatter over the banana fingers, spraying formic acid and leaving burnt, sunken trails.



Severe formic acid injury to a hand of bananas in East Hawai'i caused by *Anoplolepis gracilipes*.



Nematodes

- Attack the root system of plants and impair water and nutrient uptake
 - Rootknot (*Meloidogyne* spp.)
 - Burrowing (*Radopholus similis*)
 - Reniform (*Rotylenchulus reniformis*)
 - Etc.
- Symptoms: stunting, poor plant growth, narrow and weak stems, foliar chlorosis, root rotting and galling, and plant toppling.
- Apple bananas slightly more tolerant than Cavendish
- Control: Hot water, fallow, nematicides, drainage, crop rotation

<http://www.ctahr.hawaii.edu/oc/freepubs/pdf/PD-69.pdf>

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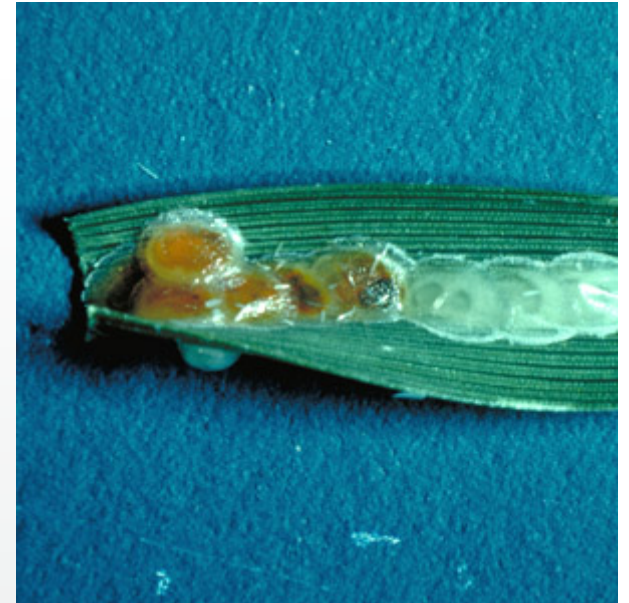


Banana moth (*Opogona sacchari*)

- Lays eggs on senescing flowers, decaying leaves, pseudostems or fruit.
- Feed on decaying plant material
- Control: Removal of flowers, application of insecticides prior to bagging, Bt



Photo Credit: S. Nelson, J. Sugano, A. Hara, R. Mau & HDOA



Chinese rose beetle (*Adoretus sinicus*) often confused with Oriental Flower Beetle

- Damage due to feeding by the adult beetle
- Nocturnal feeder of leaf and interveinal tissue
- Peak season: May through November (dry)



Oriental Flower Beetle: Pollen feeder, often found with
compost. Confused with Rhinoceros beetle

Photo Credit: S. Nelson, J. Sugano, A. Hara, R. Mau & HDOA

Spiraling whitefly (*Aleurodicus disperses*)

- Sap-sucking insects that damage and discolor plant leaves and tissue.
- Excrete honeydew that may lead to black sooty mold.
- Protected by ants
- Control: Natural enemies, oils



Photo Credit: S. Nelson, J. Sugano, A. Hara, R. Mau & HDOA

Banana fruit piercing moth (*Othreis fullonia*)

- Adult moth punctures and feeds on ripening fruit (not larvae stage)
- Symptoms: Premature ripening and fruit drop, secondary infections due to fungal and bacterial infections
- Control: Natural enemies, removal of alternative host such as willi willi



Photo Credit: S. Nelson, J. Sugano, A. Hara, R. Mau & HDOA

Mites (Various species)

- Minor pests of banana
- Piercing and sucking mouthparts of mites damage plant tissue and fruit
- Control: Sulfur, natural enemies

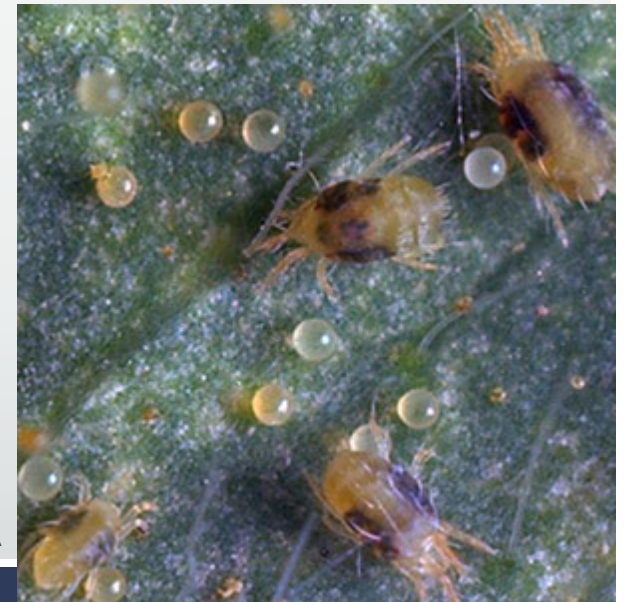


Photo Credit: S. Nelson, J. Sugano, A. Hara, R. Mau & HDOA

Crown rot & other post harvest rots (*Colletotrichum musae*, *Fusarium*, *Anthraco*se, etc)

- Post-harvest disease problem of banana
- Fungal disease enters wounded tissue after harvest
- Symptoms: Dark discoloration to fruit skin and pulp, brown soft rot
- Control: Minimize bruising, increase air movement, minimize humidity, fungicides

<http://www.ctahr.hawaii.edu/oc/freepubs/pdf/PD-54.pdf>

Photo Credit: S. Nelson, J. Sugano, A. Hara, R. Mau & HDOA



UH-CTAHR Postharvest Rots of Banana PD-54 — Oct. 2008



Anthracose: Symptoms occur as peel blemishes, as black or brown, sunken spots of various sizes on fruits that may bear masses of salmon-colored sporula with their associated conidia. Spots may have triangular-shaped or angular edges. The pathogen may cause symptoms on green fruit and may also enter the crowns after fruits are severed from stalks. As with crown rot, fruits may ripen prematurely. Photo: S. Nelson (left) and W. Neelap

leaf streak disease.

Bunch management. Remove leaves that rub against bunches to reduce fruit injury. Spray bunches with approved fungicides before bagging them with perforated polyethylene sleeves. The sleeves protect bunches from detrimental factors that cause injury and disease. Deflower the bunch stalk and finger tips before bagging.

Preharvest fungicides. Some growers apply copper fungicide spray to banana fruits after deflowering fingers and before bagging.

Harvesting. Harvest bunches when fruits are still green and measure 3/4 of the mature width of fruit. Avoid bruising fruit during harvest and transport to the packinghouse by handling them carefully. Allow harvested bunches to cool overnight before processing by hanging them under cover from direct sunlight.

Packinghouse practices. Keep packinghouses clean. Use fresh water every time bananas are processed. Add soap or bleach to the tank water used to remove latex from severed hands. Use a clean, sharp knife to de-hand fruits from stalks. The cuts should be smooth and even, not ragged or jagged. Place severed hands in tanks of clean wash water to stop the flow of latex plant sap. Do not put hands or banana fingers with symptoms of disease in the wash water. After 5 minutes, remove bananas from wash water and place them on cushioned drying tables.

Packing. Pack dried banana hands in fresh, clean

boxes. Wrap sets of fruits within boxes in plastic designed for that purpose in order to maintain high humidity in boxes. Higher humidity in packing boxes is reported to deter the banana postharvest diseases.

Shipping. Cool the bananas to 56°F after packing and deliver them promptly to a ripening facility. Ripen without delay according to accepted protocols.

Marketing. Keep ripe bananas cool and market them as soon as possible.

Fungicides. Banana growers in Hawai'i do not generally use postharvest fungicide on harvested fruits, aside from dilute bleach solutions in packinghouse wash water. However, banana growers in other countries sometimes use dips or sprays of fungicides such as thiabendazole to deter crown rot and anthracnose disease development.

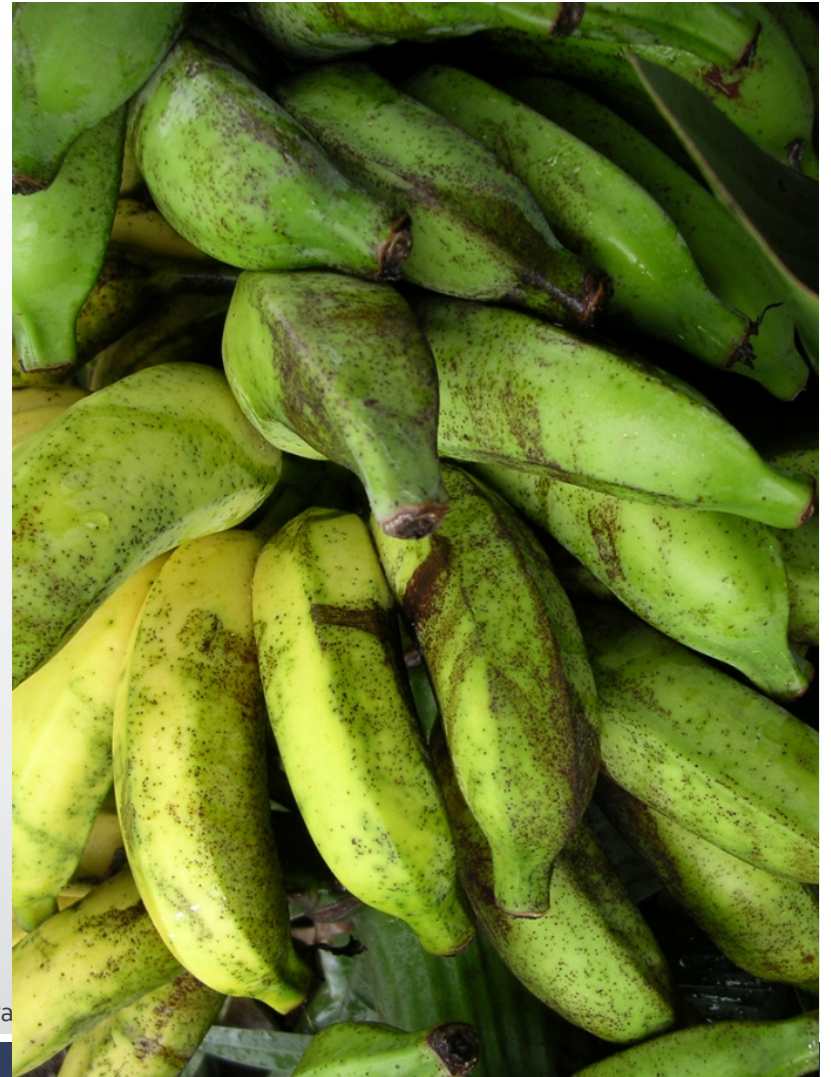
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- Floetz, R.C., A.K. Kepler, J. Daniels, and S.C. Nelson.

Freckle (*Phyllosticta musarum*)

- Freckle is a fungal disease of bananas that affects fruit quality and appearance
- Symptoms: Spots on fruit
- Control: Fungicides, oils, canopy management, de-trashing, fruit bagging, improve air circulation

Photo Credit: S. Nelson, J. Sugano, A. Hara



Banana Mosaic Virus

- Also known as cucumber mosaic virus
- Numerous alternate hosts for the disease (including weeds)
- Symptoms: Chlorosis of leaves, mosaic symptoms, and heart rot
- Control: Virus free planting material, alternative host management, aphid control, eradication of infected plants

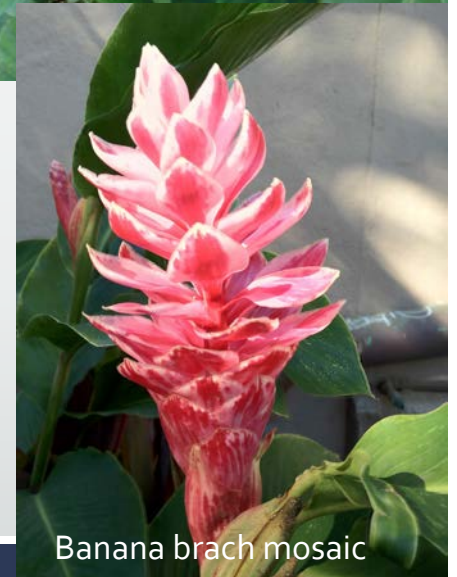


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Banana brach mosaic

Integrated
Pest
Management
=
Emphasis on
PREVENTION
vs **REACTION**

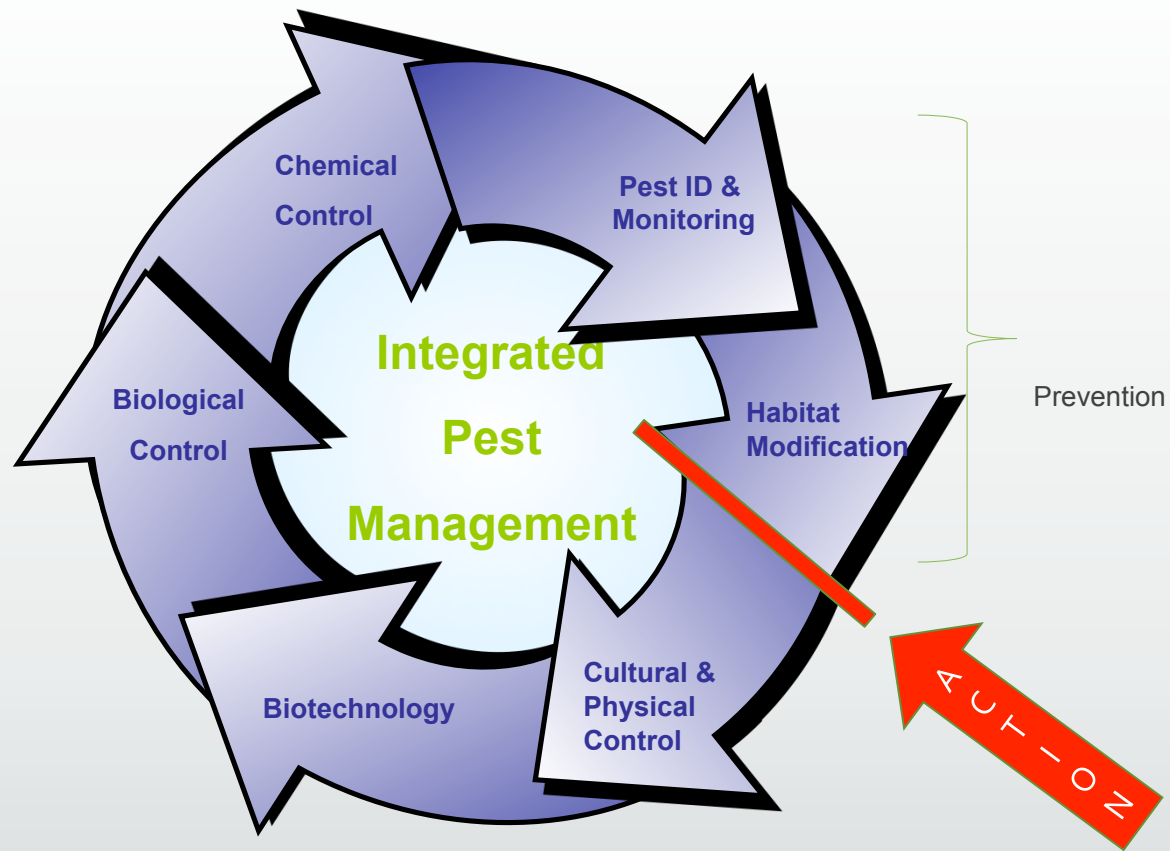


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