

### Varieties with partial resistance:

Plantain: FHIA-21, FHIA-20, Topocho, Maqueño.

Banana: Fougamou, Sedita, Pisang Mas, Pisang Ceylan, FHIA-02, FHIA-03, FHIA-17, FHIA-23 (Figure 3).

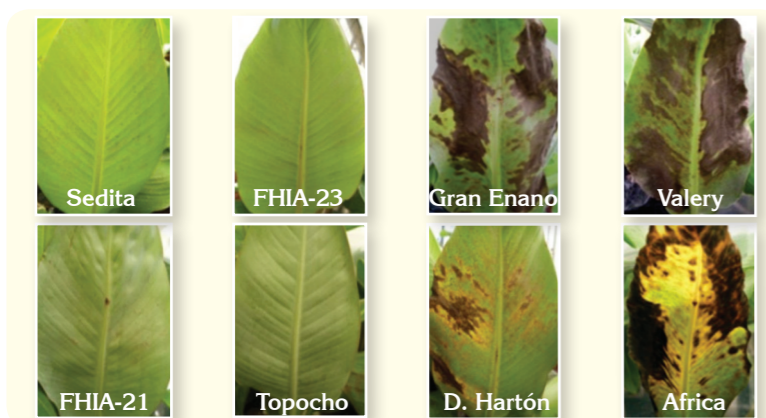


Figure 3. The reactions of different banana and plantain materials to black sigatoka.

Although plantain variety Africa is susceptible to black sigatoka, its production is precocious, enabling it to tolerate disease attack and attain harvest with a higher number of functional leaves.

**Chemical control.** Applications of chemical fungicides can reduce damage caused by black sigatoka, but its use must be justified and supervised to prevent cost overruns, harm to human health, and damage to the environment. Recommendations are to:

- Apply fungicides only under conditions of high inoculum pressure (e.g., susceptible variety, or rainy season with temperatures at  $\geq 23$  °C).
- Consult an agronomist for recommendations on chemical control.
- Before applying, remove leaves or conduct leaf surgery.
- Alternate the fungicides' mode of action (e.g., systemic  $\rightarrow$  contact  $\rightarrow$  systemic  $\rightarrow$  contact) to prevent the appearance of fungal populations resistant to fungicide applications.
- Use dispersants and additives to improve the effectiveness of applications.
- Carry out applications either in the mornings or evenings, and use protective equipment.

### Additional reading

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Photos: Neil Palmer (CIAT) and Alejandra Cuéllar

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# Black Sigatoka in Plantain and Banana

A guide for recognizing and managing the disease in family agriculture



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## Importance

Black sigatoka, also known as black leaf streak disease or BLSD, is caused by the fungus *Mycosphaerella fijiensis*. This leaf disease represents the principal limitation to the production of musaceas, that is, plantains and bananas, worldwide. The disease affects leaves and thus the plant's ability to photosynthesize, resulting in bunches and fruits that weigh less than those from healthy plants. Severe infections of black sigatoka can also cause premature ripening of fruit.

## Symptoms

According to Fouré's scale, symptoms of black sigatoka pass through six stages of development (Figure 1):

- Stage 1.** Small (< 1 mm) lesions or spots, yellowish-white to brown in color, that are barely visible on the lower surfaces of leaves.
- Stage 2.** Chlorotic brown streaks, 3–4 x 1 mm in size.
- Stage 3.** The streaks lengthen by as much as 2 cm and also widen, giving the impression of having been painted on by brush. Edges are brown but not well-defined.
- Stage 4.** Oval-shaped blotches, coffee-colored on the lower surfaces and black on the upper surfaces of leaves.
- Stage 5.** Black blotches, each surrounded by a black ring and sometimes a yellowish halo; centers are dry and semi-sunken.
- Stage 6.** Light brown blotches surrounded by chlorotic tissue; centers are dry and sunken.

## Epidemiology

Disease development is directly influenced by climatic conditions, varietal susceptibility, and crop management. Geographical areas most affected by black sigatoka typically have rainfall of more than 1400 mm per year, relative humidity of more than 80%, and temperatures averaging between 23 and 28 °C. The disease is most aggressive during rainy seasons because of the continuous presence of water films on leaves, thus favoring the release and infestation of spores. How black sigatoka develops on a *Musa* plant is shown in Figure 2.

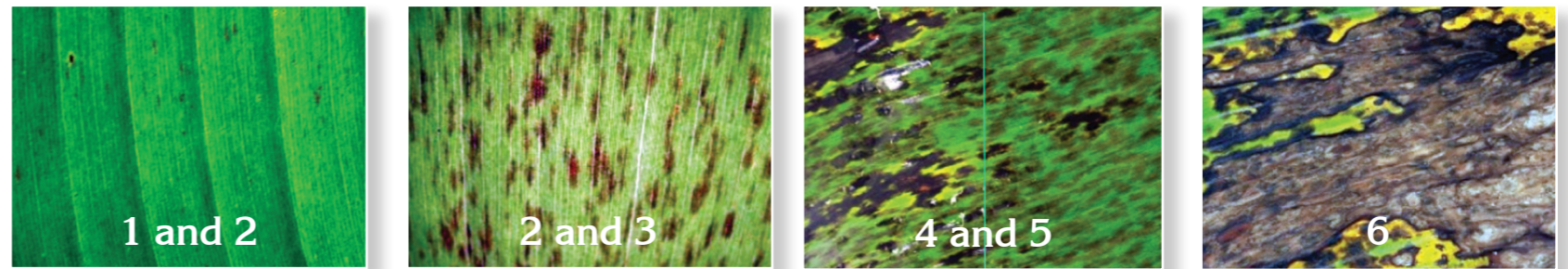


Figure 1. Six stages of symptomatology of black sigatoka.

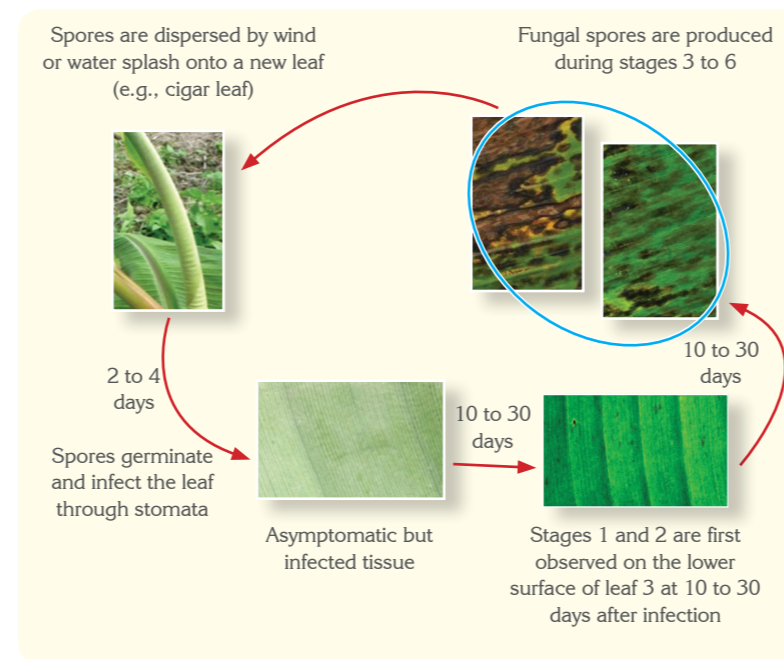


Figure 2. Disease cycle of black sigatoka.

## Management

Black sigatoka can be controlled through integrated disease management (IDM), an approach that offers farmers effective, safe, and sustainable solutions. Success depends on skill in combining different practices that are compatible and applicable to the agroecosystem according to ecological, economic, and technical principles. The main methods for managing the disease are described below.

**Cultural Control.** Seeks to reduce pathogen inoculum sources and improve growing conditions for plantain or banana plants to minimize impact from the disease. The following practices are used:

- Use of healthy or **certified planting materials**.
- Construction of **drains** to prevent water-saturated soil.
- Planting of **associated crops** such as maize and coffee.
- Applications of mineral **fertilizer** that contribute, in particular, phosphorus (P), potassium (K), and calcium (Ca), together with supplements of organic matter, plantain rachis lixivates, and biofertilizers.
- **Deleafing** is recommended where leaves are more than 50% affected. Otherwise, **surgery** is performed, where fragments of affected leaves (stages 3 to 6) are removed every 15 days during rainy seasons and every 20 to 30 days during dry seasons. The leaves must then be chopped up to accelerate their degradation in soil.
- **Management of weeds and pests**, including phytoparasitic nematodes and crop diseases.
- Suckers and male buds **pruned**, dried plant materials **trimmed**, and bunches **dehanded** and **covered** with translucent plastic bags.

**Genetic resistance.** Some varieties of musaceas have shown partial resistance to black sigatoka, that is, the plant may be affected by the disease, but lesion areas and sporulation capacity are reduced, and the time of symptom evolution is slower than in more susceptible varieties.

Institutions such as the Honduras Foundation for Agricultural Research (FHIA) have developed plantain and banana cultivars with partial resistance to black sigatoka.

It should be remembered that known resistant varieties differ in characteristics such as appearance, size, flavor, texture, and post-harvest maturation.