

FALSE PANAMA DISORDER ON BANANA

Zaag de Beer¹, Julio M. Hernández² and Sonia Sabadel²
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The fungus *Fusarium oxysporum* f.sp. *cubense* (*Foc*) causes Fusarium wilt, in the banana industry commonly referred to as Panama disease. This disease is currently considered as one of the most destructive diseases in certain banana growing areas of the world. False Panama disorder, which can easily be confused with Fusarium wilt, was first described by Deacon *et al.* in 1985. Although the name False Panama disorder was given by Deacon in 1985, a few earlier reports, possibly describing the same disorder, were made by Prescott, Dunlap, Permar, Barnes and Da Costa. Prescott (1917) reported the disorder as “Colorado” disease because of its presence in the Colorado district of Honduras. Dunlap (1923) and Permar (1925) also reported the disorder in the Changinola area of Panama. Barnes (1962) described similar symptoms for cultivars of the subgroup ‘Cavendish’ in Grenada. The name “Yellow mat” or “Mata amarilla” in Spanish was given because of the pronounced yellowing of the foliage. More recent records are those of Da Costa (1982) of Surinam. Since the late 1980’s an increasing incidence of False Panama disorder has been detected in Tenerife, Canary Islands.

External symptoms

External symptoms of False Panama disorder can easily be confused with those of Fusarium wilt. In most cases yellowing of leaves starts with the lower or older leaves. The margin of each leaf turns pale green to yellow, necrotic strips surrounded by a yellow margin occur and eventually the leaf dies off (Figure 1). The lower leaves die completely and hang down the pseudostem as a skirt (Figure 2). In some instances the base

Figure 1.
Symptoms
of False
Panama
disorder.
Note the
yellow leaf
margins and
necrotic strips,
surrounded
by yellow
margins.



Z. De Beer



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Figure 2.
Skirt of dead
leaves hanging
down the
pseudostem of
a plant affected
by False
Panama
disorder.

¹Institute for Tropical and Subtropical Crops,
Private Bag X11208, Nelspruit 1200, South Africa.

²Departamento de Protección Vegetal, Instituto
Canario de Investigaciones Agrarias, Apdo. 60,
La Laguna 3820, Tenerife, Spain.





Z. De Beer

Figure 3. Strelitzia-like growth of a banana plant affected by False Panama disorder.

of the leaf remains green and healthy, whilst the distal part dies off. Often the upper 1-4 leaves remain green but are small and stunted (Figure 2). Re-growth can take place but bunches are found to be small with short and thin fingers. Choked and strelitzia-like growth characteristics, related to stress, are often found (Figure 3).

In the case of Fusarium wilt, the leaves show uniform and pronounced yellowing of the leaf margin, along the entire length of the leaf (Figure 4). The yellowing then progresses inwards towards the leaf midrib and the leaf margins turn brown and then grey. The external symptom differences between False Panama disorder and Fusarium wilt, can be clearly seen in Figures 1-4.

Internal symptoms

When a cross-section through the pseudostem of a plant showing False Panama disorder is made, approximately 50 cm above soil level, wine-red discolored vascular strands are often visible (Figure 5). In Fusarium wilt brown to purple blotchy areas, the so-called gum pockets (Figure 6), are always present. The pseudostem at 50-100 cm above ground level contains many wine-red discolored vascular strands in both False Panama disorder and Fusarium wilt. In Fusarium wilt the discoloration is more or less continuous and can be traced back down the pseudostem. In the case of False Panama disorder the discolored vascular strands are usually discontinuous, occurring in short regions about 10 cm long separated by wide gaps. When the rhizome is split open, False Panama disorder shows brown spots and white strands, whereas *Fusarium*-infected plants show yellow patches and yellow strands (Figures 7 and 8).



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Figure 4. External symptoms of a Fusarium wilt infected plant. Note the uniform and pronounced yellowing of the leaf.



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Figure 5. Wine-red discolored vascular strands in a cross-section of a pseudostem affected by False Panama disorder. No gum pockets are visible.



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Figure 6. Brown to purple blotchy areas, the gum pockets, are always present in a cross-section through a pseudostem infected with *Fusarium* wilt.

Disorder incidence

The incidence of False Panama disorder is usually low, although as much as 60% of a plantation can be affected. Since False Panama disorder can easily be confused with *Fusarium* wilt, it is often not possible for the banana producer to distinguish between the two. In *Fusarium* wilt-affected areas, the occurrence of False Panama disorder can therefore be underestimated.

False Panama disorder usually occurs in the first year after planting. However, in the Canary Islands and in South Africa it has occasionally been observed in older plantations. These affected plants in the older plantations can even produce marketable fruit but can also die off completely. The disorder is generally observed either in plantations planted on virgin soils or on soils where other crops have been previously planted, and seems not to be linked to old banana plantations. Plants affected by False Panama disorder are usually scattered throughout the plantation and affected patches including several plants, are seldom observed as is the case with *Fusarium* wilt. Although only Cavendish bananas in South Africa and the Canary Islands are affected, it seems as though most dessert bananas and plantains (AAA, AAB, ABB) including Abaca, can be affected.

Causes

False Panama disorder seems not to be transmitted from one plant to another. Up to now it has not been possible to isolate any pathogens from affected plants despite several attempts. In the Canary Islands, some *Fusarium* spp., including *F. oxysporum*, *F. proliferatum*, *F. solani* and *F. subglutinans* as well as some bacteria and other common saprophytes were isolated. Pathogenicity tests conducted with some of the fungal isolates gave negative results. Some bacterial isolates gave hypersensitivity reactions when tested in the Canary Islands, suggesting a potential role of these organisms in causing the disease. Although some *Fusarium* spp. including *Fusarium oxysporum*, were isolated in South Africa, the findings were not consistent. Success rates in isolating organisms from individual banana corms range from zero to a maximum of five out of 30. Nevertheless, some bacteria and saprophytic fungi were isolated, even from deep inside the corm. In both the Canary Islands and South Africa, it has been proven that pathogenicity tests with *F. oxysporum* isolated from False Panama disorder plants were negative. Conversely, severe *Fusarium* wilt symptoms occurred with *F. oxysporum* isolated from *Fusarium* wilt-infected plants. It is therefore accepted that a fungal pathogen is not the primary cause of this disorder.



Figure 7. A cross-section through a False Panama affected rhizome showing brown spots and white strands.

False Panama disorder has been observed in South Africa as well as in the Canary Islands to be most prominent in winter. However, besides low temperatures, other stress factors also occur. Some of these factors could include nematodes, drought, nutritional imbalances and waterlogging. A Masters degree conducted by Rabie, (1991), indicated that the root-knot nematode (*Meloidogyne* spp.) alone was not an indication of

False Panama disorder and suggested that additional stress factors were involved. It is therefore suggested that a combination of stress factors such as drought, waterlogging, soil compaction, nutritional imbalance in combination with low temperatures, could be the cause of the disorder. However, the biotic factors should be further investigated.

Recommendations

The incidence of False Panama disorder can be prevented by reducing the incidence of stress to newly planted material. Nematode infestation, soil compaction, waterlogging, insufficient irrigation and insufficient fertilizer application normally cause stress to young plants. Good soil preparation and soil management, to promote strong root vigor, is therefore necessary to prevent the occurrence of False Panama disorder. When early symptoms of False Panama disorder are detected it is important to determine which stress factors are involved. If nematodes are present in the banana roots and in the soil, appropriate treatment should be advised. Leaf and soil analysis can be a helpful tool to rectify any nutrient deficiencies, while waterlogged areas could be drained by digging drainage channels. Irrigation systems, if available, should be in place before planting and checked regularly. Soil compaction cannot be rectified once the banana plantation has been established and deep ripping should be carried out before planting. It is further recommended that banana producers have their infected plant material analyzed for *Foc* if they are not sure about the cause of the symptoms.

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Figure 8. Cross-section through a Fusarium wilt infected rhizome showing yellow patches and yellow strands.