

CHARCOAL ROT DISEASE

in soya beans

Soya bean plants
showing signs
of charcoal
rot disease.
(Photograph: US
Soya bean Research
Information
Initiative)



Charcoal rot is a disease caused by a fungus that is widely present in soil and has been reported to cause yield losses of 30 to 50% in the United States of America. It is also known as summer wilt or dry-weather wilt.

The disease occurs in many fields, sometimes scattered, infecting plants in small patches or parts of rows, and at times in larger patches.

The most seriously affected areas are often in the drier parts of fields. The disease is usually detected after midsummer and is considered as a disease of the mature plant. However, seedlings and young plants are also affected. Under favourable conditions, it causes seedling-wilt disease. Charcoal rot occurs primarily when warm, dry weather causes stress in soya beans.

The fungus

Charcoal rot is caused by *Macrophomina phaseolina*. This pathogen has a host range of more than 500 plant species worldwide. Under hot, dry environmental conditions, many economically significant crops, including soya bean, suffer considerable yield

losses due to this disease. The fungus has been reported to affect soya bean plants throughout the growing season, and causing root and stem rot in soya beans throughout the world. *Macrophomina phaseolina* hibernates in dry soil and in the residue of host tissues, and it can be spread by contaminated seed.

Some reports suggest the fungus to be a weak pathogen and that it can cause only minimal damage when plants are not placed under stress, but that it can severely damage soya beans subjected to stress through factors such as drought. During a recent survey conducted in the major soya bean production areas of South Africa (Bethlehem, Bothaville, Brits, Cedara, Clocolan, Delmas, Dundee, Groblersdal, Kinross, Middelburg, Potchefstroom, Rustenburg and Vaalharts), *Macrophomina phaseolina* was found in all the areas surveyed, with the exception of Cedara.



A close-up view of a soya bean stem infected with charcoal rot, showing minute, black, dusty microsclerotia. (Photograph: www.mississippi-crops.com)



Charcoal rot on a soya bean stem. (Photograph: www.aganytime.com)

Symptoms

Symptoms of charcoal rot are first observed in the driest areas of a field (such as in sandy or compacted areas, or the tops of terraces). Usually the symptoms occur after midseason in dry, warm conditions, but seedlings may also be influenced in hot and dry soil conditions.

- Brown lesions may form on the hypocotyl of emerging seedlings. However, symptoms typically occur during or after flowering in mature plants.
- Infected plants wilt in the midday heat, recovering at night until the permanent wilting point is eventually reached.
- Leaves of severely infected plants turn yellow and brown, then wilt and remain attached to the plant to then drop prematurely, something which is usually mistaken for normal maturity.



Soya bean pith with dark-grey central discoloration, due to microsclerotia caused by the charcoal rot fungus. (Photograph: ARC Plant Protection Research Institute)

A more solid diagnosis of the disease is based on the appearance of the root and lower stem:

- Starting at the flowering stage, a light grey discoloration develops on the epidermal and sub-epidermal tissues of both tap and secondary roots and lower stems. The distinctive characteristic of the disease can be revealed by scraping off the surface layer (epidermis) of the root and lower stem.
- Plants infected with charcoal rot will have minute, black, dusty microsclerotia under the epidermis, giving the stems and roots a charcoal-sprinkled appearance. These microsclerotia are difficult to see without the use of a magnifying glass.
- Cutting the root and lower stem often reveals the distinctive grey-to-black discoloration inside.

Management

- Charcoal rot is a difficult disease to manage. No resistant cultivars are available, but some have been reported to be less affected by the disease than others.
- Manage fields in an attempt to avoid drought stress. Implement practices such as early planting, to avoiding the worst drought conditions. Plan an irrigation schedule that promotes good

root growth and reduces plant populations, in order to diminish competition for water.

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- Practise conservation tillage (minimum and no tillage), as decreased infection has been reported with this practice. This could be due to cooler soils and stubble retention, resulting in decreased moisture stress.
- Crop rotation, especially with cereal grains (that are not hosts) or crops that lead to relatively reduced contamination of the soil, is recommended for a period of one to three years.

Contact the ARC Plant Protection Research Institute at Private Bag X5017, Stellenbosch, 7599, for more information.

References available on request. 