SIL Field Guide to African Soybean Pests and Diseases

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An electronic copy of this guide is available at: http://soybeaninnovationlab.illinois.edu/soybean-disease-diagnostic-guide

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Importance of soybean
Importance of Soybean
Soybean production in Africa

Soybean production in Africa 2004-2013

FAOSTAT, 2015

6.6 Million households- 28.6 Million people- SSA Abate et al., 2012
Disease Triangle

Host

Pathogen

Environment
Leaf Diseases

Leaf diseases can be caused by a large number of pathogens, some of which cause diseases on roots, stems, pods, and seeds. Some only occur, or primarily occur, on leaves.

Many of the common leaf disease symptoms are well defined especially leaf spots and lesions caused by bacteria and fungi.

Symptoms caused by viruses include leaf mosaic, brittleness of leaves and stems, leaf turning yellow or red or brown and necrotic. The entire plant may be stunted while still green, and seeds may become misshapen and discolored.

Identifying virus and virus-like diseases using symptoms alone is unreliable. Other leaf diseases that are often said to be virus-like are caused by certain groups of bacteria, including those referred to as phytoplasmas, which are mostly transmitted by leaf hoppers. Symptoms of phytoplasmas infection include yellowing, dwarfing, proliferation of axillary shoots, green stems, and sterility.
The first symptoms may appear as small yellow, tan to dark-brown, or reddish-brown lesions.

Later, one to many erupting volcano-like fungal structures called uredinia are just barely visible with the naked eye.

On occasion, lesions occur on petioles, but not typically on stems or pods.

Severe infection causes premature defoliation and maturation.

Early symptoms of soybean rust can be confused with bacterial pustule.
RED-LEAF BLOTCH

- Lesions occur on leaves, petioles, pods, and stems.
- Lesions are dark red on the upper surfaces of leaves and reddish brown on the lower surfaces.
- Lesions grow to form necrotic blotches up to 2 cm in diameter.
- Within older lesions, diagnostic fungal structures may be found. These include fungal structures called sclerotia (a resting structure) and pycnidia (a structure to produce spores).
- Severe infection causes premature defoliation and early maturation.
**Stem Diseases**

Diseases in the section are those that have the most characteristic symptoms for identification occurring on stems. However, the majority of pathogens producing symptoms on stems, also produce symptoms on other tissues.

For example, a fungal disease known as charcoal rot may be noticeable on stems, but it initiates infection in roots and for this guide is covered under root diseases.

Symptoms of green stem disorder (left), pod and stem blight (top right), and Sclerotinia stem rot mostly occur on stem but will sometime colonized pods (bottom right).
ANTHRACNOSE

- Irregularly shaped brown areas appear on stems and petioles.
- In the advanced stages of anthracnose (usually, the late reproductive stages), infected tissues are covered with black fruiting bodies (acervuli) that can be seen with the unaided eye.
- The fungus causing this disease also attacks pods and seeds (see pods and seeds).
- When the disease is severe, premature defoliation occurs and plants senesce earlier than usual.
**SCLEROTINIA STEM ROT**

- Infection occurs by spores produced in a fingernail sized cup shaped fungal structure that land and germinate on matured flower petals.

- The fungus grows into stems often times and may cause the plant to wilt, and also may infect the pods and seeds.

- Under moist conditions, white fungal growth forms on and around the stem and or pods.

- The fungus produced spores (ascospores) from disc shaped structures (bottom) that when airborne, infect and colonize flowers (top left) that have matured. The fungus continues to grow and colonize stems and pods (top right).
Soybean seed health is affected by many factors, including abiotic and biotic stresses. Plants stressed by too much or too little water or by nutrient imbalances often produce seeds that are abnormal. Biotic factors including bacteria, fungi, and viruses often affect seed health.

Disease symptoms on seeds may include mottling, shriveling, discoloration of part of or all of the seed coat, and decreased seed weight. Seed mottling often is caused by viral infection of the plant and viral symptoms especially on leaves also may be evident. Fungal infection of seed can be diagnosed somewhat by color; however, seed infection can also be symptomless.

Pod and Seed Diseases

Pod (top) and seed discoloration (bottom) caused by fungal infections. Seed image courtesy of John MacRobert.
ANTHRACNOSE

➤ Necrotic lesions are first observed on pods. Seeds may be shriveled and discolored or symptomless.

➤ This fungal pathogen also infects other plant organs and is often associated with leaf and stem anthracnose causing vein and stem necrosis (see anthracnose on stems).

➤ Pre-emergence and post-emergence damping off may occur when infected seeds are planted. Dark-brown, sunken cankers often develop on stems and cotyledons killing the plant.
PURPLE SEED STAIN

➤ Seed discoloration varies from pink to dark purple, and discolored areas range from specks to the entire seed coat.

➤ This infection of seeds by this fungus can be important when seeds are used for seed stock (perpetuating the disease) and for human consumption where it may affect the quality of edible soy products.
Root Diseases

There are many root diseases that occur widely including charcoal rot, Pythium root rot, Rhizoctonia root rot, and diseases caused by nematodes. Distribution of root disease in Africa based on surveys is lacking.

Many of these root diseases cannot be diagnosed by symptoms alone, although a few produce symptoms or life structures of the pathogen that are diagnostic.

Root pathogens often kill the roots of infected plants (left), but can also infect the plant and cause vascular browning (right).
This fungal pathogen may cause premature death of the plant often times with leaves left dried on the plant.

Symptoms include wilting and/or yellowing due to vascular plugging.

Roots and stems of diseased plants will have a charcoal or grayish colored appearance due to the aggregated appearance of tiny fungal structures called microsclerotia.

The pathogen also infects seeds producing microsclerotia often in seed coats.
SUDDEN DEATH SYNDROME

➤ The most prominent symptoms occur on foliage and include interveinal chlorosis, necrosis, and premature death of the plant.

➤ Severely affected leaves detach from the petioles, which often remain attached to the stem.

➤ Although infection may occur earlier, visual symptoms become most noticeable on leaves when the plant reaches the full-pod stage.

➤ The root mass of affected plants is reduced and roots appear discolored, often preceding foliar symptoms. Severely infected plants can be easily pulled from the ground.

*Image credit, bottom center: Carrie Miranda*
Not all abiotic and biotic stresses have been identified in Africa. However, it is known that drought and flooding can be problematic, and either condition can exacerbate occurrence of certain diseases. Additionally, macro and micronutrient imbalances can produce various symptoms.

Nitrogen deficiency, when inoculant is not used or is ineffective under certain environments, results in leaf yellowing especially of lower leaves. Other deficiencies like phosphorous or potassium may also be common with each causing their own specific symptoms.

Micronutrient deficiencies for toxicities may not so obvious, but soil tests in general show that certain nutrients like boron and zinc may be limiting in some areas.
Best Practices for Management

General principles of good management often help to reduce or alleviate problems related to abiotic and biotic stresses. Practices like crop rotation, planting healthy, vigorous seeds, and selection of soybean varieties may all be important.

Pesticides like fungicides and insecticides may be needed on occasion, but are generally not recommended except under certain conditions where an expert has provided guidance or product application.

Research in many countries in Africa is ongoing and includes breeding and selection for varieties that are locally adapted and that include resistance to some of the common diseases in the region. Disease resistance is known to be effective for bacterial pustule and soybean rust.
Future Goals

• Printed copies and online version
• Mobile app developed
• Suggestions for other diseases to include
• Dissemination suggestions