Cassava brown streak disease: control measures, Uganda

This practice describes the Cassava Brown Streak Disease (CBSD), its main symptoms on cassava leaves, stems, and storage roots, and how it spreads. Additionally, it is explained how to manage CBSD.

Description

1. How does cassava brown streak disease affect cassava?

Cassava brown streak disease (CBSD) is a devastating disease that causes loss of cassava root (tuber) production and quality. It can render susceptible varieties unusable if cassava roots are left in the ground for over nine months. CBSD is now occurring in areas that were believed to be unsuitable for the disease such as high altitude areas away from the Indian coastal belt in Kenya, Tanzania and Mozambique. Cassava brown streak disease causes substantial root yield loss of up to 100 percent particularly in worst affected areas. This is worsened by the fact that the symptoms are elusive, i.e. cannot be recognized easily by untrained or inexperienced people, and may not appear until the cassava plant has stayed longer than 9 months. Worse still, some farmers even confuse the symptoms with those caused by the more familiar Cassava mosaic disease (CMD). The gravity of the situation is that almost all varieties bred or selected for resistance to CMD are susceptible to the “new strain” of CBSD occurring in Uganda, inland areas of Tanzania and Western Kenya. Additionally, the disease causes loss in both quality and quantity of storage roots (tubers). Storage roots showing CBSD symptoms are not fit for human and animal consumption.

2. Main symptoms caused by cassava brown streak disease

Symptoms of Cassava brown streak disease can be observed on leaves, stems and cassava roots as described below. However, some cassava plants or varieties do not show symptoms on leaves nor tubers; other varieties may only express symptoms on leaves and not on roots; while others do not show symptoms on leaves but on roots only. However, the typical response of cassava plants is the one in which plants reveal symptoms on leaves, stems, and roots. The symptoms may appear and disappear in young plants, but appear again in cassava plants at a later stage.

2.1 Symptoms of cassava brown streak disease on leaves

1. Symptoms of cassava brown streak disease appear as patches of yellow areas mixed with
normal green colour (see Figure 1). This phenomenon is commonly referred to as chlorosis.

2. It produces characteristic yellow or necrotic vein banding on leaves which may enlarge and join to form comparatively large yellow or necrotic patches.

3. The yellow patches are more prominent on mature (bottom) leaves than younger ones.

4. Chlorosis is often also associated with secondary veins; veinal chlorosis is on mature cassava leaves.

5. The infected leaves do not become distorted in shape as occurs with leaves infected by Cassava mosaic disease.

6. Advanced symptoms on the leaves become an irregular yellow blotchy chlorosis that is most pronounced in the periphery (margins or edge) of lower leaves.

2.2 Symptoms of cassava brown streak disease on stems

1. The disease appears as dark brown “streaks” and “spots” (see pictures below) on stems, with dead spots on leaf scars.

2. These streaks are most prominent on upper, green portions of the stem.

3. “Streaks” may appear as scratch-like wounds on stems.

4. The diseased plants may show shoot tip death, which may progress into cassava stem die-back.

5. In severe cases there may be leaf drying and shoot die-back.
2.3. Symptoms on storage roots
1. The disease may cause cracks and discoloration in the storage roots.
2. It often causes root constriction and malformation (see pictures below).
3. The harvested roots have corky, yellow-brown necrotic spots.
4. Root rot becomes evident (roots start rotting).
5. In the roots of a susceptible variety, the disease causes a dry, hard rot which is irregular, yellow blotchy chlorosis (see pictures below).
6. Necrosis is most pronounced in the edges of the root when the root/tuber is cut across with a knife.

2.4 Notes
1. Cassava brown streak disease symptoms vary from variety to variety, and from one geographical location to another.
2. Some varieties show more symptoms on above ground parts (foliar) while others show symptoms only on below ground parts (roots).
3. Not all symptoms have been shown in these resource material.
4. Careful inspection of cassava plants and consulting agricultural extension and research officers is necessary to confirm presence of CBSD.
3. How Cassava brown streak disease spread?

Planting cassava cuttings from infected cassava plants is the major way CBSD spreads. This also explains the rapid spread of the disease in areas where it is re-emerging, such as Uganda. Additionally, sharing and distribution of infected planting materials is responsible for rapid spread of the disease. It is also believed to be spread by insects called white flies and by infested farm implements such as knives used for cutting cassava stems but research is still on-going in this area. Below is a detailed outline of how CBSD is spread:

1. The disease is spread through planting of stem cuttings from CBSD infected plants
2. The virus also spreads from plant to plant by white flies (Figure 8)
3. Planting of susceptible varieties helps build up CBSD in the affected countries
4. Cassava brown streak disease also spreads through multiplication centres if the original source of cassava materials were infested or if the planting materials being distributed are not checked for the presence of CBSD
5. Farm implements such as knives used in cutting cassava sticks into cuttings can spread CBSD to healthy planting materials when the infested knife is used on them

4. Management of CBSD

Planting of clean (symptomless) cassava cuttings is the main way of controlling CBSD. Use of resistant varieties is the most sustainable way of controlling CBSD, however, research in developing or selecting resistant varieties is currently on-going in several countries, with some promising results in Tanzania, Uganda and Mozambique. At the moment planting tolerant varieties is being encouraged in most cassava growing countries. Integrated management of CBSD is the best way forward. Management options for integrated management of CBSD are discussed in detail below; these include:

4.1 Field hygiene

Field hygiene is one of the most important ways of managing CBSD and other diseases which are spread through cassava cuttings and insects. Field hygiene involves uprooting and destroying all cassava plants which are showing disease symptoms, and this helps in reducing the source of the disease. However, this approach is not practical in farmers’ fields. It should be practised in cassava multiplication plots or blocks.

The following need to be done in order for field hygiene to be effective:

1. Cassava plants in multiplication plots/blocks should be regularly checked for presence of CBSD.
2. Checking for CBSD should involve checking mature (lower) leaves, stems and storage roots for CBSD symptoms as shown above.
3. All infected cassava plants should be uprooted and destroyed to avoid disease build up and spreading CBSD from the multiplication blocks.
4. All farm implements need to be sterilised over fire, especially when cutting cassava stems into planting materials (cuttings) in multiplication blocks.

4.2 Use of disease free planting materials

This strategy is interlinked to the field hygiene strategy/option. Since CBSD spread mostly through planting cuttings from diseased cassava plants, it is important that farmers should select cuttings from healthy cassava plants. Therefore:
1. Farmers should use clean planting materials.
2. Farmers should only plant cassava from reliable multiplication sources.
3. Farmers should plant resistant/tolerant varieties when available.
4. Farmers involved in community multiplication of cassava planting materials, and all those involved in such exercises should be trained in proper identification, how to reduce spread, how to manage and avoid spreading CBSD through cuttings.

4.3 Use of Cassava brown streak disease resistant/tolerant cassava varieties

Tolerant cassava varieties exist in some countries even though some of them have not been consistent in showing tolerance to CBSD. Unfortunately all improved cassava varieties which were bred or selected for resistance to CMD are susceptible to CBSD, that’s reversing most of the gains made in breeding cassava in the Eastern and Southern Africa Region. Farmers were even used to the improved varieties. In order to win farmers’ acceptance of any new improved varieties resistant/tolerant to CBSD, CMD and other diseases, deliberate efforts will need to be made. These include creating awareness on CBSD, and the fact that all previous improved varieties are susceptible, and to involve farmers in breeding/selecting new improved and disease resistant varieties in order to make sure that the varieties meet farmers’ preferences.

Participatory breeding/varietal selection will need to be employed. However, some tolerant varieties exist. In Uganda two varieties are showing tolerance, these are MH97-2961 and 00061 (AKENA). Resistance to CBSD is also reported in Tanzania, Malawi and Mozambique. Tolerant cassava varieties in the region (Kenya): Kaleso, Shibe, Nzalauka, Siri, Tajirika and Karibuni. The following should be followed in order to manage CBSD using resistant/tolerant varieties:

1. Farmers should only plant resistant/tolerant cassava varieties where present
2. Distribution of CBSD-tolerant varieties should be accompanied by information for raising farmers’ awareness about CBSD, and where farmers can get tolerant varieties in each country
3. Arrangements should be made to share and test new CBSD resistant/tolerant varieties against CBSD in areas of new outbreaks

This will need to be overseen by a reputable organisation such as ASARECA. Quarantine regulations should be followed when sharing resistant varieties across countries to avoid introducing of new strains of CBSD.

5. Propagation of clean materials

Vegetative propagation of cassava planting materials is a crucial component of cassava improvement in all cassava growing regions. A number of organisations and individuals are involved in propagating cassava planting materials, vegetatively. In most cases this is done as a food security measure. However, due to the high demand for planting materials, some organisations or individuals may take short cuts, thus increasing the risk of spreading CBSD and other diseases which are spread through cuttings. Planting infected cuttings is the major avenue for spreading CBSD to a wider area and even across countries. Propagators of cassava planting materials should therefore:

1. Be trained in proper identification of symptoms of CBSD and other diseases which are spread through cuttings.
2. Where possible, particularly where international organisations are involved in propagation of cassava planting materials, molecular techniques such as PCR should be used in testing elite cassava materials for propagation. This however raises the question of sustainability due to the high costs involved in running PCR based tests. One would be compelled to investigate development of easy to use field kits for detecting CBSD. However, more research will be required to develop these even though some kits are in existence for other diseases.

3. Only resistant/tolerant cassava varieties should be propagated and distributed when confirmed healthy by trained inspectors.

4. Multiplication of varieties known to be tolerant to CBSD should be fast tracked with proper backing on rigorous inspections by trained inspectors for CBSD.

6. Quarantine and legislation
- Farmers living along borders between countries should be targeted for awareness raising on importance of avoiding moving cassava plant materials across borders without following quarantine procedures.
- Restrict the movement of cassava cuttings from CBSD infested areas in the country.
- Movement of cassava germplasm between countries should only be done through virus-indexed tissue culture form. In other words, only virus-tested tissue culture materials should be used for inter-country germplasm movements.
- Countries neighbouring CBSD infested countries should:
  - Create awareness of CBSD through print, radio and TV media channels, in particular through distribution of leaflets and posters on CBSD symptoms. This should also be carried out in countries with CBSD already.
  - Survey all introduced cassava materials being grown in the country to determine whether or not CBSD is present.
- Assess the health status, with respect to CBSD, of all cassava multiplication blocks (even in countries with CBSD).
- Governments should tighten surveillance of border points to prevent illegal crossing of cassava materials.

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8. Agro-ecological zones
- Tropics, warm

9. Objectives fulfilled by the project
9.1 Women-friendly
- This practice benefits women farmers in saving their cassava harvest

9.2 Resource use efficiency
- Mitigating Cassava diseases saves the harvest, which can be sold and rescue the farmers’ income

9.3 Pro-poor efficiency
- Being aware of CBSD and its symptoms helps poor farmers in identifying the affected plants and taking the appropriate action to manage and mitigate the disease.