Diseases and Pests of Cassava

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Virus diseases

- African cassava mosaic virus
- Cassava mosaic virus

Healthy and Virus-infected cassava plants
African Cassava Mosaic Disease and Cassava mosaic Disease

• The most serious cassava disease in Africa
• Major constraint in cassava production.
• Destroyed 150,000 hectares of cassava - a loss estimated at $US 60 million per annum
• It is spread through infected cuttings and by whiteflies (*Bemisia tabaci*).
Symptoms of virus diseases of Cassava

- Light green, yellow or white patches on the leaves
- Wrinkling of leaves
- Shrinking of leaves
- Stunted plants
Virus infected cassava plants
Cassava leaves with ACMV
Below ground symptoms of virus infection
Control

• Use disease-free cuttings.
• Select cuttings from stem branches instead of from the main stem.
• Early planting to avoid peak of whitefly vectors
• Regular field inspection (2-3 times) to rogue out infected plant in low disease incidence
• Use resistant/tolerant varieties
• Control insect vectors
Cassava brown streak virus disease

- It is serious in East Africa and is a threat to the whole of sub-Saharan Africa.
- The virus is vectored by whiteflies (*Bemisia* spp.) and also transmitted through infected cuttings.
- Symptoms
  - include yellowing (leaf chlorosis) and
  - streaks in the stem bark (cortex).
  - Infected tubers have brown streaks (root necrosis) It's a stealth virus, which destroys everything in the field. The leaves may appear healthy even when the roots have rotted away.
Symptoms of Cassava Brown Streak Virus Disease

Symptoms of Cassava brown streak virus disease on lower leaves of a susceptible cassava variety, Kibabulage (Kenya). Characteristics are an irregular yellow-blotchy chlorosis that is most pronounced on lower leaves. Chlorosis is often also associated with secondary veins. In severe cases, there may be leaf drying and shoot die-back.

Symptoms of Cassava brown streak virus disease in the roots of a susceptible cassava variety, TME 204 (Namulonge, Uganda). Root constrictions and malformation are a common feature of severe CBSD.

Symptoms of Cassava brown streak virus disease leaf symptoms in TME 14 (Namulonge, Uganda). This image clearly demonstrates the association of chlorosis with secondary veins.
Figure 18: Cassava leaves with chlorotic (pale) patches of cassava brown streak disease

Figure 19: Cassava stem with “streaks” of cassava brown streak disease

Figure 20: Cassava storage roots discolored by cassava brown streak disease
Control

• Use diseased-free cuttings.
• Use tolerant/resistant varieties
• Remove diseased plants from the field
• Control vectors
Bacterial Disease

• Cassava Bacterial Blight (CBB) is a major bacterial disease
• The disease is **systemic**,  
• Favoured by wet conditions.  
• Yield loss is from 20 to 100% depending on variety, bacterial strain and environmental conditions.
How CBB Spreads

– infected cuttings.
– raindrops,
– use of contaminated farm tools (e.g. knives when cutting stems),
– chewing insects (e.g. grasshoppers) and
– movement of man and animals through plantations, especially during or after rain.
Symptoms of CBB

• **Symptoms on leaves:**
  – Angular leaf spots on cassava
  – droplets of exudates on the spots
  – Wilting of young leaves followed by shoot die back
  – Leaf spots, blights

• **Symptoms on stem:**
  – Brown/black lesions on a cassava stem
  – formation of gummy exudate and
  – Stem die back
  – Complete defoliation resulting in ‘candle stick’ effect
Symptoms of CBB

• Symptoms on leaves:
  – Angular leaf spots on cassava
  – Droplets of exudates on the spots
Water-soaked lesions on leaves with bacterial exudates

Blight symptoms on leaves
Symptoms of CBB

• Symptoms on stem:
  – Brown/black lesions on a cassava stem
  – formation of gummy exudates and
  – sudden wilt of the leaves
Bacterial exudates on stem

Brown/black necrosis on stem
More symptoms of CBB

• Under severe disease attack heavy defoliation occurs, leaving bare stems, referred to as "candlesticks".

• Infected stems and roots show brownish discoloration.

• During periods of high humidity, bacterial exudates (appears as gum) can be seen on the lower leaf surfaces, petioles and stems.
Cassava Bacterial Blight
Candlestick symptom in severe cases
Snapping of stem due to CBB

Severe stem rot
Control

• Use clean planting material. This reduces disease incidence in areas where cassava bacterial blight is widespread.
• Collect cuttings from healthy plants & from lignified portion of the stem, up to 1 m from the base; Check visually for vascular browning.
• Disinfect tools regularly (between cuttings)
• Intercrop cassava with maize or melon.
• Practice crop rotation and fallowing.
• Remove and burn all infected plant debris and weeds.
• Alternatively plough them into the soil.
Control con’d

• Dry heat (hot air) treatment at 50-52 degrees for 20-30 min
• Timely weeding
• Foliar spray with Agromycin, Copper sulphate or Bordeaux mixture
• Resistant cultivars
Fungal diseases

Brown leaf spot (*Cercosporidium henningsii*)

- Symptoms are mostly on older leaves.
- Brownish round spots with definite borders appear on the upper leaf surface.
- On the lower leaf surface, they are brownish-grey in colour.
- Infected leaves later become yellow and eventually drop.
- Disease causes yield reduction of up to 20%.
Cassava brown leaf spot
Severe symptoms on lower leaves
Control

• Adequate plant spacing to reduce rain splash
• Farm sanitation eg removal of weeds & debris
• In severe conditions fungicides such as Mancozeb can be used at the rate of 70 g in 10 L of water
Cassava white leaf Spot

• Caused by *Cercospora caribaeae*
• Less severe
• Yield loss in minimal
• Symptoms are whitish spots on leaves
• Leaf spots with a reddish border around them
• Severe cases, can be controlled with fungicide
Cassava white leaf spot

Initial symptoms

Advanced symptoms
Cassava fungal blight

- Caused by *Cercospora vicosae*
- Occurs in the rainy season
- May be severe, causing up to 50% yield loss
- Large spreading brown leaf spots mainly on leaf tips and margins
- Differentiated from CBB by the lack of exudates on leaves and no leaf wilt
- No symptoms on stems
Symptoms of cassava fungal Blight
**Anthracnose** *(Colletotrichum gloeosporioides)*

- Initial symptoms of the disease are oval lesions ("sores") on young stems.
- On older stems, raised fibrous lesions develop that eventually become sunken.
- In severe cases, the stem may die off.
- Yield loss is between 20 to 50%.
Anthracnose symptoms on cassava stems
Lesions on stem at initial stage

Stem canker in more advanced stage
Control

• Hot air treatment of cuttings @ 50 – 52 C for 20 min

• Spaying of plant with Bordeaux mixture, Zineb

• Pruning of infected plant parts followed by burning

• Destruction of plant debris after harvest

• 2- 3 weedings from planting

• Use resistant cv
Root Rot Diseases

Causes of root rot diseases

- Root rots are common in flooded soils
- Root rot outbreaks can also occur in well drained soils with no history of flooding.
- These rots are caused by fungi
Common symptoms of cassava root rot diseases

- Leaves become brown and wilt (lose water) even in the wet season.
- Defoliation (loss of leaves) often follows the wilting stage.
- Storage roots of affected plants may be swollen and are often coloured when cut open.
- Rotten roots may be soft and give out offensive odour particularly in infections involving bacteria.
- Shoot or stem dieback may be observed.
- Stems may become weak at the base and lodge.
- Affected plants finally die.
Armilleria root rot
Wet Root rot

Pythium/Phytophthora
Wet Rot Complex
Sclerotium tuber rot
Spread of root rot diseases

• Root rot agents require water to spread.
• Infective units of disease causing fungi use water to get to a new host.
• Plant debris left on fields after harvest are often contaminated with disease causing fungi and are good sources of spores for infecting new plants.
• Diseases are also transmitted through wounds by using contaminated farm tools such as cutlasses and hoes.
Control of Root rot Diseases

• *Site and land selection* - not prone to flooding or is not water logged
• *Use disease resistant or tolerant variety*
• *Use healthy planting materials*
• *Practice good farm sanitation*
Nematode root galls

- Root galls are caused by root knot nematodes *Meloidogyne* spp.
- The roots swell and do not function normally
- Affected pants do not yield well
- Galls are also formed on tubers
- Tubers therefore are of low quality and yield less starch
Root & Tuber gall symptoms on Cassava
Control

- Use of Resistant cultivars
- Avoid intercropping with nematode susceptible crops
- In severe cases apply carbofuran nematicide
Cassava mealybug

- Mealybugs (*Phenacoccus spp.*) cause two types of damage; a mechanical or direct damage caused by their sucking feeding habits, and their indirect damage produced by the build-up of the sooty mold on the leaf surface due to mealybug excrement.
- This fungus reduce leaf photosynthesis. *P. gossypii* causes leaf yellowing, and eventually defoliation beginning with basal leaves. *P. manihoti* start at the apical part of the plant often causing a cabbage-like effect to the growing points. Further symptoms are short internodes, little new leaf growth, and curling of leaves.
- Very young plants may be killed. Environmental conditions, including a prolonged dry season, are favorable for population build-ups. Yield losses due to mealybugs are estimated to be up to 80% under severe attack.
Cassava mealybug (*Phenacoccus manihoti*)
Termites

• Some insects that attack cassava cuttings after planting are found in the soil; they generally destroy the bark of the cuttings and make tunnels that favor the development of microbial rots which cause germination losses and seedling death. Termites belong to this group of insects. To prevent the attack of this group of insects, insecticides like Aldrin, or granulated Carbofuran should be incorporated into soil directly under the cuttings.
Termites
Cassava green mite

- Populations of *Mononychellus tanajoa* develop on the upper part of the plant, growing points, young leaves and green portions of the stem. They are smaller than many spider mites, green in color at a young age turning yellowish as adults.

- Depending on the abundance and duration of attack, the damage initially appears as yellowish (chlorotic) ‘pinpricks’ on surface of developing and newly formed leaves. Symptoms then vary from few chlorotic spots to complete chlorosis. Heavily attacked leaves are stunted and become deformed, severe attacks cause the terminal leaves to die and drop, producing a ‘candlestick’ appearance. Severe mite attacks during the dry season result in 20-80% loss in tuber yield.
Cassava Green spider mite

*(Mononychellus tanajoa)*
Cassava red mite

- There are four major species in Nigeria, *Oligonychus gossypii*, *Tetranychus telarius*, and *T. neocaledonicus*. The mites are visible to the naked eye as red specks. Under magnification, juveniles and adults appear as ovoid bodies with 4 pairs of appendages bristling with hairs. Symptoms initially appear on the under surface of fully mature leaves as yellowish (chlorotic) ‘pinpricks’ along the main vein which may increase to cover the entire leaf, turning the surface reddish, brown or rusty in color. A protective webbing can often be seen. Most damage occurs at the beginning of the dry season but is apparently controlled by local natural enemies.
Cassava red mites
Cassava scale insect

• Cassava scale are not a serious pest, but locally abundant on the stem of plants weakened by previous insect attack and drought.
• The scale covers the lower stem and eventually the leaves, occasionally kills the host.
• Control measure are not usually required since this is typically a secondary pest attacking weak plants.
Cassava scales (*Aonidomytilus albus*)

A typical diaspine scale with elongate silvery white cover, 2-2.5 mm long. The insect under the cover is reddish.
Spiraling whitefly

- The spiraling whitefly (*Aleurodicus dispersus*) suck sap from cassava leaves. As it feeds, it secretes large amounts of honey dew which supports the growth of black mold on the plant. The blackened leaves dry up and drop. The spiraling white fly spreads by active flight and by being transported on stem planting materials. Treatment and selection of planting materials can help control this pest.
White fly: *Bemisia tabaci*
Variegated grasshopper, *Zonocerus variegates*

- The variegated grasshopper, *Zonocerus variegates* L. chews cassava leaves, petioles and green stems. It defoliates the plants and debarks the stems. The leaves are eaten by nymphs and adults. After leaves are gone, green stems are consumed leaving only the white wood.

- The pest damage is more common on older than on younger cassava plants, and is more severe in the dry than in the wet season. The variegated grasshopper spreads by flying from farm to farm. However, the insect does not fly over long distances. It spreads fast in areas where the forest has been cleared than in thick vegetation.

- Control: This pest can be controlled culturally by destroying egg sites of the pest. Control of freshly hatched nymphs is the easiest and most economical way, but requires a communal effort. The bands of freshly hatched nymphs can easily be detected and treated with insecticide.
Variegated grasshopper - *Zonocerus variegatus*
Biological Control

Cassava field devastated by mealybug

Anagyrus lopesi

Phenacoccus manihoti

T. aripo
Predatory mite

Neozygites tanajoae
Not every abnormality is caused by diseases or pests!

• Although cassava is well adapted to grow on poor soils, the crop requires high rates of fertilization to attain maximum yields.
• Because large amounts of potassium are removed in the root harvest, soil potassium reserves may become depleted with continuous production without fertilization.
Nutrient deficiency

- Nitrogen – Reduced growth; leaves are slightly lighter green in color with chlorosis being rather uniform throughout the plant; deficiency starts in the lower leaves, but extend rapidly to all parts of the plant; premature dropping of leaves.
- Phosphorus – Reduced growth of the plant; reduced leaves, thinner stems, under severe conditions, lower leaves turn chlorotic which may turn necrotic and fall off.
- Potassium – Reduced growth of the plant; small leaves; under severe conditions purple spots, chlorosis and necrosis of the apices and borders of the lower or intermediate leaves; necrosis of the petiole, or stem tissues.
- Calcium – Reduced growth of the roots; small and deformed upper leaves
- Magnesium – Interveinal chlorosis in lower leaves and intermediate part of the plant, certain reduction in plant height.
Nutrient deficiency

• Sulphur – Uniform chlorosis of the upper leaves; sometimes similar symptoms are observed in the rest of the plant
• Boron – Reduced plant height, internodes and short petioles; small and deformed young leaves; Completely extensive purple-gray spots in the leaves, reduction of the development of the lateral roots.
• Iron – Uniform chlorosis of the upper leaves and petioles, which could turn white under severe conditions, reduced plant growth and small young leaves without deformation.
• Manganese – Interveinal chlorosis of the upper or intermediate leaves; uniform chlorosis in severe conditions, reduced growth of the plant; small young leaves without deformation.
• Zinc – Interveinal yellow white spots in young leaves, which becomes narrow; development of chlorosis in the shoot tip under severe conditions, necrotic spot of the lower leaves, reduced growth of the plant. Many times confounded with thrips attack.
Soil nutrient deficiency effect
Toxicities

• The principal symptoms of toxicity in the cassava crop are:
• Aluminium – Reduced plant height and growth of roots; chlorosis of the old leaves under severe conditions. Cassava tolerates acidity and 80% Al saturation of the effective exchange capacity.
• Boron – Necrotic spots of the old leaves especially along its border.
• Manganese – Chlorosis of the old leaves with purple –brown or dark spots along the veins; the leaves turn flaccid and drop.
Herbicide damage

Alachlor damage

Atrazine damage

Diuron damage
Paraquat damage

Oxifluorfen damage
CASSAVA PESTS AND DISEASES EVALUATION
LEAF DISEASES

Cassava mosaic disease (CMD)
1. = No visible symptoms (highly resistant)

2. = Mild chlorotic patterns on entire leaflets or mild distortion at base of leaflets, rest of leaflets appearing green and healthy (moderately resistant).

3. = Strong mosaic patterns on entire leaf, and narrowing and distortion of lower one-third of leaflets (tolerant)

4. = Severe mosaic, distortion of two-thirds of leaflets and general reduction of leaf size (susceptible).

5. = Severe mosaic, distortion of four-fifths or more of leaflets, twisted and misshapen leaves (highly susceptible)
CASSAVA BACTARIAL BLIGHT (CBB)
EVALUATING FOR CASSAVA BACTERIAL BLIGHT (CBB)

1 = No visible symptom (Highly resistant)

2 = lesion around one point of inoculation on the leaves (Moderately resistant)

3 = extension and appearance of new lesions on the stem and beginning of first leaves to wilt (Tolerant)

4 = extensive leaf wilt and defoliation and stem die-back (Susceptible).

5 = extensive leaf wilt, defoliation, stunting and die back forming candle stick (Highly susceptible).
Cassava Anthracnose Disease (CAD)
EVALUATING FOR CAD

1  = No visible symptoms (Highly Resistant)

2  = few shallow cankers on woody stems, late in the growing season (Moderately Resistant).

3  = many deep cankers on stems followed by distortion (Tolerant)

4  = many oval lesions on stems (Susceptible)

5  = many lesions on stems and severe necrosis at leaf axils, followed by wilting and severe defoliation (Highly Susceptible)
CASSAVA GREEN SPIDER MITE
EVALUATING FOR CGM

1 = apparently no visible symptoms

2 = slight reduction in leaf size and internode length

3 = serious reduction in leaf size and internode length

4 = severe bunch top symptoms; obvious reduction of internode length and severe reduction in leaf size and leaf area

5 = candlestick appearance; internode length reduced, young portion of shoot curved and completely defoliated
Thank you