

# Cassava seed production certification and quality assurance



**UNIVERSITY OF NAIROBI**  
**SEED ENTERPRISE MANAGEMENT INSTITUTE (SEMIs)**  
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# Presentation outline

- Introduction
- Importance of cassava
- Cassava seed production
- Cassava pests and diseases
- Seed certification procedures

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# Introduction

- Cassava (*Manihot Esculenta* Crantz) is a diploid plant (2n=36)
- Belongs to Genus *Manihot* has >100 spp, only *E.* Crantz is cultivated
- Cassava is adapted within latitudes 30° North and South
- Grown in elevations of not more than 2000 m asl
- Temperatures ranging from 18 to 25 °C
- Rainfall of 50 to 5000 mm annually
- Poor soils with a pH from 4 to 9 (Kamau, *et al.*, 2016).
- In Kenya, grown 50% western, 40% eastern and coastal and 10% central

# Introduction cont'd

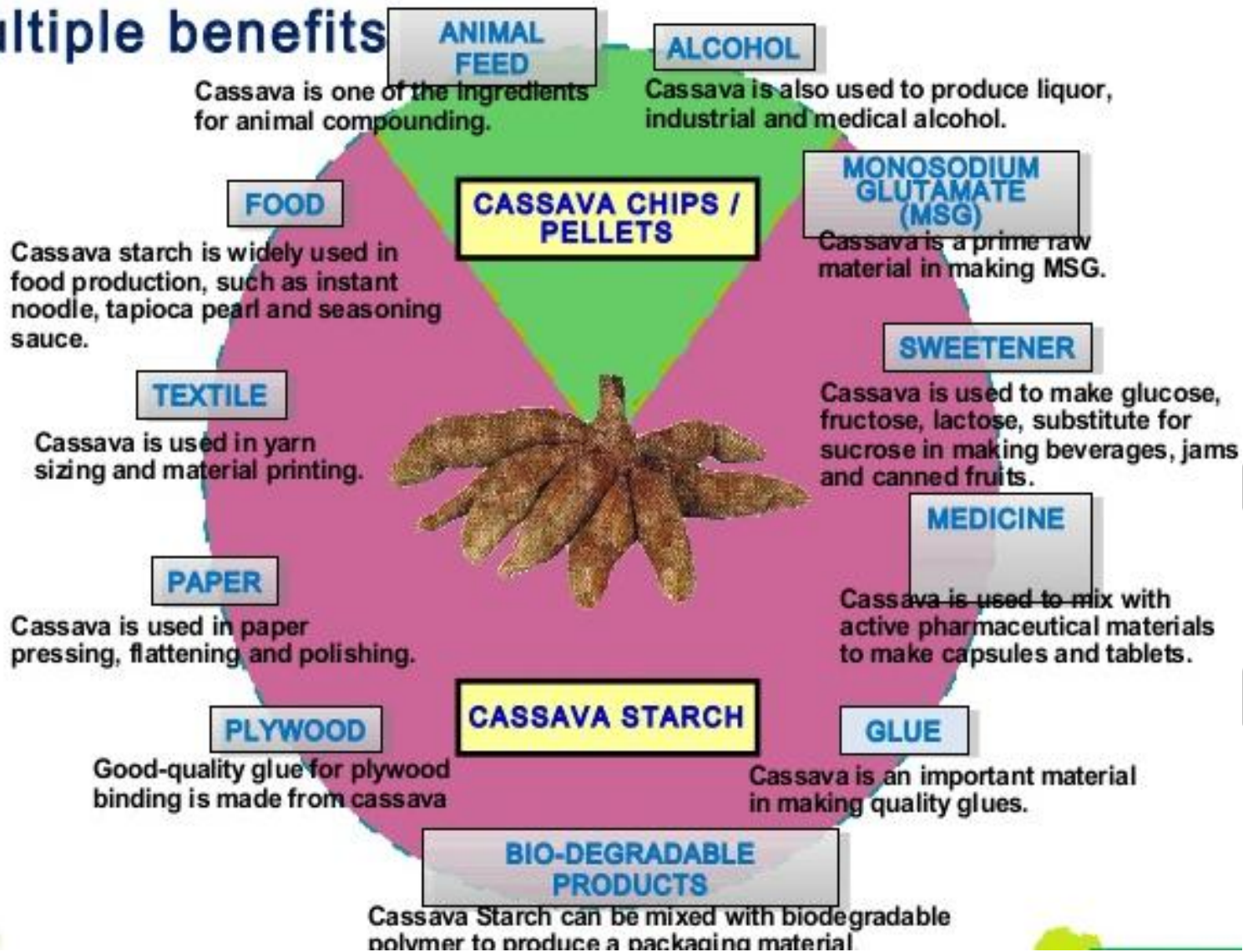
- Cassava is monoecious, perennial shrub originated from S. America
- Is propagated sexually (botanical seeds) & asexually (stem cuttings)
- It is naturally open pollinated mainly by insects
- Cassava seed system in sub Saharan Africa (SSA ) is about 85% informal
- Un-availability of clean seed is a major hindrance to cassava production in SSA
- Hence need to develop an effective seed system in (SSA)

# Some Cassava varieties in Kenya

Cassava variety	Attributes
KME-1	Maturity-6 months, yield 20-28 t/ha, sweet, less fibrous, low cyanide content, production altitude 25-1500 masl.
KME-61	Maturity-14 months, yield 20-30 t/ha, bitter and more fibrous than KME-1, tolerant to cassava mosaic virus and scales
Muchericheri	Maturity -16 to 18 months, yield 20-28 t/ha, sweet, has deep red leaf stalks, tolerant to cassava mosaic and scales, low cyanide, production altitude 25-1750 masl.
EX-Ndovu	Green stem turning purple green, yield 40t/ha, tolerant to mosaic and scales

# Importance of cassava

## Multiple benefits



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# THE PROCEDURES FOR SEED CERTIFICATION

- Many countries have legislation that control seed production and movement of various crops.
- In Kenya: Seed certification under Seeds and Plant Varieties Act (Chapter 326) of the Laws of Kenya ensures that only high quality seed of crop varieties are available for use by the farmers.

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# Cassava Seed production system

There are two main seed production systems :

- (a) Formal or legally recognized – seed is certified following laid down legal procedures and involves public and private organizations such as research institutes, certified seed growers and regulatory bodies.
- (b) Informal or not legally recognized – Seed produced outside the formal seed certification system. This includes positive selected seed; farm saved seed
  - The two seed production systems (formal and informal) result in three different types of seed :
  - 1) Certified seed – these are used by less than 2 % of farmers; the quality is assured according to the seed law by an independent regulatory organization.
  - 2) So called “Clean seed” – used by about 4 % of farmers; it is produced using Good Agricultural Practices (GAPs) and quality is assured by area extension officers.
  - 3) Farm saved seed – used by over 85% of farmers; it has no quality standards and is generally of poor quality; the seed is blamed for endemic spread of diseases especially CMD, CBSD, and bacterial diseases.



# Cassava Seed production system cont'd

- **Positive selected seed:** Under Positive Selected Seed (PSS) farmers plant their cassava and during active growth, they stick pegs next to healthy looking plants which will be harvested separately and retained for the next crop planting. This may reduce the disease load in the subsequent crop.
- **Negative selected seed:** In Negative Selected Seed (NSS), the farmer establishes a crop from certified seed. As the crop is growing, the farmer goes through the field and removes any plant that does not look healthy, leaving only healthy plants which will be harvested and used as seed in the next cropping cycle.
- **Formal Seed System:** This includes all legally recognized seed supply systems carried out by public and private bodies. It includes research, breeding, seed certification, multiplication, distribution and marketing. The public bodies involved include KALRO, Universities, KEPHIS, and MoALF ; while private entities include Agrico East Africa Ltd, Kisima Farm Ltd, Syngenta East Africa Ltd and Suera Flowers Farm.

# Types of formal seed systems

- (a) Public formal seed system – the public sector undertakes all** activities involved in seed development to marketing. For example research institutes carries out breeding of new varieties and also the seed production, multiplication and distribution under the supervision of regulatory bodies.
- (b) Public-private formal seed system – participation of the public and** private sector from variety development to marketing. In such a scenario KALRO does the research/breeding while private sector multiplies the seed under the supervision of KEPHIS and distributes the seed to farmers.
- (c) Fully private formal seed system– Systems:** that are entirely controlled by the private sector from breeding and variety development to seed multiplication and distribution. There is minimal government involvement except in seed quality control and certification . This system is applied by private companies.

# SEED CASSAVA PRODUCTION REGULATION GUIDELINES

- **Sources of basic seed cassava:** The basic seed production begins at tissue culture where meristem tissues are multiplied in controlled environment to produce *in vitro* plantlets. These plantlets are transferred to the glass house for hardening. Afterwards, they are then planted in the field for multiplication, to produce pre- basic seed and multiplied to produce basic seed. The basic seed is sold to authorized seed multipliers for production of further classes of certified seed.
- **Sources of certified seed:** Sources of certified seed are the authorized multipliers that plant the basic seed to produce certified first generation class. They obtain basic seed of the Kenyan varieties from KALRO and Universities.
- **Breeder Seed:** From breeding work, the seed derived is called breeder seed. This seed is of the highest status but of very limited quantity. In order to multiply to large quantities, the breeder often hands over to institution or specialized farms.

## SEED CASSAVA PRODUCTION REGULATION GUIDELINES CONT'D

- **Pre-basic and basic seed class:** The breeder's seed is then passed on to specialized farmers or farms to grow and register for certification. The first generation from the breeder's seed after fulfilling the certification standards is labeled as Prebasic.seed . Further multiplication is done following similar procedures to produce basic seed .
- **Basic seed** cassava is further multiplied to produce **certified first generation seed class** (C1). This can be done two more times (C2 and C3) to raise sufficient quantities .
- It is important to note that the higher the classes of seed the higher are the standards. Those that fail to meet the standards of the specific class are downgraded to a lower class . Those which fail to meet any class standards are rejected and may be disposed of.

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## 4.3 Requirements of seed production

- Site selection and appropriate seed bed preparation
- Crop rotation
- Appropriate Soil properties and crop nutrition
- Agronomic practices (*Choice of variety, correct seed selection, correct planting, Crop management ( weed control, Soil moisture - Essential during establishment, tuber / stem growth and expansion stages, Crop protection - Timely spraying and correct choice of crop ), Earthing up, Rogueing diseased and off types*)
- Plant population, spacing and seed rates for seed cassava
- Harvesting and postharvest handling
- Storage requirements and distribution

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# Seed production



Plantlets



Established plant lets



Mature seed crop



Harvested and packaged seed

# Cassava diseases and pests

## Diseases

- Cassava mosaic disease (CMD) caused by a *Begomovirus*,
- Cassava brown streak virus disease (CBSD) caused by *Ipomovirus*,
- Bacterial blight caused by *Xanthomonas campestris* pv. *Manihotis*
- Anthracnose are the most important in EAC

## Pests

- Mites,
  - Mealy bugs,
  - Thrips
  - White flies
- Effects of Mites, Mealy bugs and Thrips are severe during dry period
  - White flies are important as vectors of CMD and CBSD

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CMD



CBB



CBSD on leaves and roots





Mealy bugs

CMS

➤ Disease vectors  
(CMD & CBSD)

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# Pests and Diseases/ management

- The pests are managed through spraying with insecticides and biological control methods.
- The diseases are largely controlled through use of clean planting materials.
- Cassava mosaic disease is mainly spread through cuttings (81%) and by white fly (19%).
- Cassava brown streak disease (CBSD) is preferent at coastal regions. Effect of diseases and pests combined can lead to 50% reduction in tuber yield if they are unchecked.

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# Pests and Disease Management:

- Using healthy, certified seed, Removing sources of infection by destroying remnants of plants from the previous crop by collecting all plant remains and disposing them in a deep pit, cover and burn them or burying them in a pit.; Destroying or covering heaps of discarded tubers (cull piles) with black plastic
- Rogueing volunteer plants as soon as possible after emergence.
- Crop rotation with non-manihot crop such as Maize, beans, cabbages and napier grass in a 1 to 5 year rotation program.
- Maintaining field and store clean.
- Correct spacing that is recommended should be observed during planting. Too close spacing will create humid conditions under the foliage which is suitable for disease development.

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# Pests and Disease Management cont'd:

- Use of fungicides - fungicides reduce infection, limit the formation of spores and thus limit the spread of the infection.
- Use of resistant/tolerant varieties.
- Removing sources of infection by using healthy seed,
- Using good irrigation systems such as drip irrigation to reduce drought stress and to support the uptake of nutrients.
- Balanced use of fertilizer (especially increased level of potassium) to produce healthy plants more resistant to infection from this disease. The recommended rates should be used during planting to give the crop a good start.
- Reduce mechanical damage during harvesting, transportation.

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# Seed certification

- Regulated by CAP 326 i.e. Seed and Plant Varieties Act of 2012, laws of Kenya.
- Certified seed can be recognized by a label attached to the seed cassava bunches.

## Importance of seed certification

- Seed certification assures farmers of trueness to type of the variety and health status of the seed. Any surplus of certified seed may be exported to countries in the region.

## Seed classification system

- Seed cassava are divided into different categories with subdivisions into classes, as follows:
  - **Breeders seed:** in-vitro plants or healthy mother plants
  - **Pre-basic seed:** originating from in-vitro plants or clonal selection
  - **Basic seed:** originating from pre-basic class
  - **Certified seed:** classes C1, C2, C3 (derived from basic and subsequent certified class)
- Every season (after each multiplication) the seed cassava crops are automatically downgraded one class. Depending on inspection results, further downgrading or rejection may occur.
- Pre-basic and basic seed classes are to be further multiplied while the certified seed classes are planted to produce cassava for utilization.

# Classification system of seed cassava

Type of material	Seed class	Generation (Maximum)
Healthy mother plants; in-vitro plants	Breeders seed	G0
Cuttings	Pre- basic	G 1
Cuttings	Basic	G 2
Cuttings	Certified 1	G 3
Cuttings	Certified 2	G 4
Cuttings	Certified 3	G 5

- **Note: - Pre-basic and basic seed is produced by researchers; while Certified seed is produced by seed multipliers.**

# 6.3 Seed certification procedure

- The main certification procedures are:
- Application for certification
- Field inspection
- Post-harvest laboratory testing
- Lot inspection
- Labeling

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# Application for certification

- A registered seed grower fill appropriate form (SR 5) and forwards to regulatory body
- Regulatory body scrutinizes source/origin of seed used, ownership, seed field/ location, history of the field where the seed has been planted, date of planting, estimated date of harvesting.
- If it complies with all the conditions and seed class has been defined, then inspection is effected.
- The seed grower should be knowledgeable in cassava production.

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# Field inspection

- a) isolation distance between the seed crop and other crops, 100 meters for breeders, pre-basic and basic seed; 50 meters for certified seed classes I, II and III
- b) morphological characters for trueness to type of the variety and for off-types,
- c) symptoms and incidence of specified diseases.
- At least two field inspections is made during the active growth stage of the crop; the first being at fowering stage or at canopy close for non-fowering varieties and the second inspection at tuber bulking stage.

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# Field inspection cont'd

- During inspections, inspectors take scores on the number of off-type plants and plants infected by specified seed borne diseases per count. Off-types are plants that do not conform to the variety being grown. They will then compute and compare with the tolerances for off-types and diseases per seed class .
- A seed crop that does not meet the standard of the seed class for which certification was requested in the application form will be downgraded to a lower class, rejected for sale as seed, or approved for own use by the grower.
- The inspector may also reject the seed crop if it is excessively weedy or severely lodged to a degree that it adversely affects the inspection and quality of the seed.
- The results of inspection are communicated to both the grower and the merchant on the same day.

# Tolerance on off-types during field inspection

Seed class	Tolerance ( no. of off types / 100 plants)
Breeder	0
Pre-basic	1
Basic	2
Certified 1	2
Certified 2,3	3

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# Sampling for post-harvest laboratory testing

- Field inspection is normally carried out by visual assessment of the crop. Inspectors may be supported by appropriate tests when confirmation of the cause of a particular disease symptom is required.
- For seed fields less than 0.5 ha, a sample representing 1 % of the total plant population is taken and delivered in nets or any appropriate bags immediately to the laboratory for test.
- The merchant is allowed to dispose the rejected cassava appropriately to avoid spread of such diseases.

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# Seed borne cassava diseases that have Zero tolerance

Disease	Tolerance in all seed classes
Cassava mosaic disease (CMD) caused by a <i>Begomovirus</i> ,	Nil during any inspection
Cassava brown streak virus disease (CBSVD) caused by <i>Ipomovirus</i> ,	Nil during any inspection
▪ Bacterial blight caused by <i>Xanthomonas campestris</i> pv. <i>Manihotis</i>	Nil during inspection

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# Seed borne cassava diseases and their tolerances per seed class during inspection

Cassava diseases	Tolerance (number of diseased plants per 1000 plants )				
	Breeder/ plantlets	Pre - basic	Basic seed	Certified seed 1	Certified seed 2 and 3
CMD	0	0	0	0	0
CBSD	0	0	0	0	0
▪ Bacteria I blight	0	0	0	5	10

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# Lot inspection

- Once the results of the laboratory tests show that the seed is free from the stated diseases, the grower is allowed to harvest and package the stem cuttings
- During lot inspection, the inspector picks cassava seed plants stem at random places it on to clean polythene sheet and checks for:
  - diseases and defects
  - Damages
- If cassava seed meets the standards, it is labeled according to seed class.

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# Tolerances for diseases, pests and defects during lot inspection

Disease/Pest /Defect	No. of cuttings per 1000 cuttings	
	Basic seed	Certified seed
CMD	0	0
CBSD	0	0
Bacterial blight	0	10
Mites	0	20
Mealy bugs	0	20
Thrips	0	10
White flies	0	30



# Seed classes, colour of labels and details on the label

- Labels have different colours based on the class of seed being labeled
- Breeder, Pre-basic and Basic seed: White
- Certified seed I: Blue
- Certified seed II and III: Pink
- The details on the label include: crop species, variety, seed class, seed size (length) grade in mm (thickness) , grower number, lot number, packaging unit (bags), year of production, date of certification, country of production, unique certificate's number
- It is the duty of the inspector to affix the official label to the seed at the appropriate position as a mark of quality. Only seed lots that meet the standards are labeled.

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# Dispute resolution:

- In cases where the merchant disputes the verdict of the inspector at any stage of inspection, a senior team of inspectors is constituted by regulatory management to review the case.
- However, where such disputes are not resolved, the Seed and Plant Tribunal will be called to arbitrate.
- If it fails to do so, then the case is filled at a law court. Usually most technical aspects are resolved at senior team level.

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# SEED IMPORTATION / EXPORTATION

- A seed Import/export Permit must be obtained before any importation /exportation of seed is undertaken.
- All imported /exported seed must be accompanied by a Phytosanitary certificate.
- Seeds of all crops are subjected to laboratory quality tests upon arrival and must meet the gazetted minimum standards before being distributed.

## **Marketing and transportation**

- There is no organised Marketing of cassava seed.
- Constraints include: lack of market infrastructure such as cold storage facilities.
- Transmission of market information has however improved due to mobile phone services and radio broadcasts.



**THANKS FOR LISTENING**