

Manual for Collection of Cassava Germplasm and Associated Farmer Knowledge in Eastern and Southern Africa

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CONTENTS

Introduction	3
Procedure for Collection	4
Questionnaire for Key Informant Interviews	8
Germplasm Collection Form	13
Key Informant Questionnaire Notes	14
Landrace Form Notes	17
Germplasm Collection Form Notes	21
Cassava morphological descriptors	22
Disease Severity Scoring Scales	27

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The users of this manual must ensure that the requirements of any applicable access and benefit sharing agreements, including the Nagoya protocol are met. This includes prior informed consent and mutually agreeable terms. Moore and Williams (2011), provide an introduction to this.

Moore, G. and Williams, K.A. (2011). Chapter 2: Legal issues in plant germplasm collecting. *In: Collecting Plant Genetic Diversity: Technical Guidelines – 2011 Update. Guarino L, Ramanatha Rao V, Goldberg E, editors. 2011. Bioversity International, Rome, Italy. ISBN 978- 92-9043- 922- 6.*
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http://cropgenebank.sgrp.cgiar.org/index.php?option=com_content&view=article&id=390&Itemid=557

Introduction

Cassava germplasm and associated farmer knowledge from southern, eastern and central Africa is under-represented in national and international germplasm collections. This germplasm consists mainly of farmer varieties (landraces) which have been grown for many years and harbor valuable adaptive gene complexes that have evolved under human and environmental selection pressures. The current situation of lack of a repository means that (1) local landraces are not readily available to breeders (2) some farmer landraces contain genetic variation and are not 'clonal' as researchers and breeders assume, and no 'type specimen' exists so breeders are often not sure of what they are breeding with, (3) disease-free farmer landraces are not available, preventing the movement and sharing of germplasm, (4) landraces and the adaptive gene complexes they harbor are vulnerable to genetic erosion from the spread of improved varieties with increased breeding activities in the region and in the face of devastating diseases such as cassava brown streak disease which may cause the total loss of susceptible landraces, and (5) there is no germplasm database concerning the various attributes of particular clones, geographical location and farmer perceptions for use as a decision-making tool. This lack of 'farmer-centric' information means that breeders may not fully understand the subtleties of farmer preferences with implications for varietal adoption of improved germplasm

This manual was produced as a result of a need identified at a meeting organized by the Global Cassava Partnership for the 21st century (GCP21) and the International Institute of Tropical Agriculture (IITA) and entitled '**Cassava Germplasm: Collection Process and Action Plan for South, East and Central Africa**', held at the IITA, Dar es Salaam, Tanzania from 4th to 6th June 2013. The overall goal of the meeting was to develop strategies to efficiently and effectively harness genetic resources and the farmer knowledge associated with these resources for a more 'farmer-centric' approach to cassava breeding in South, East and Central Africa. The premise is this will lead to better adoption of improved cassava varieties particularly by women farmers, with impacts on increased food security, income generation, nutrition which all contribute to improved livelihoods.

The aim of this manual is to provide standard guidelines for the collection of cassava in the cassava growing agro-ecological zones of southern, eastern and central Africa, and to document farmer knowledge relating to the germplasm collected. Standardisation is critical for both genebank management and to curate information into a database format to make it widely available and accessible. The germplasm component takes into account known ontologies, such as those developed by CIAT and Bioversity International and 'Key access and utilization descriptors for cassava genetic resources' published on-line by Bioversity International.

The specific objectives of the farmer knowledge component are:

1. To identify the existing farmer landraces based on farmers' knowledge;
2. To determine the farmers' criteria for cassava characterization and selection;
3. To assess conservation practices undertaken by farmers on the cassava landraces in order to inform an *ex situ* conservation strategy
4. To provide a standard format for the documentation of information

The specific objectives of the germplasm component are:

1. To identify novel farmer landraces
2. To describe in a standard format agro-morphological characters associated with a landrace
3. To describe in a standard format the location and environment from which the landrace was collected

Procedure for Collection

Planning

Prioritization of districts

In this document, “district” should be understood to refer to an administrative unit that is smaller than a state, region or province, but which includes many villages or other local units. The distinction may vary by country, but during the planning phase it should be decided what the proper administrative unit is.

The prioritization exercise should include experts with national-level knowledge of cassava in a variety of fields, including breeders, agronomists, social scientists and pathologists. They should bring along existing data of relevance, such as information on cassava production by district or disease incidence maps. The exercise will start with a listing of districts, by region, which meet one of a number of criteria:

- Districts known to be high in cassava diversity
- Districts where cassava has been cultivated for a long time
- Districts under high or advancing disease pressure, where landraces may be threatened
- Districts with different tribes or ethnic groups who grow cassava
- Districts with distinct environmental characteristics (high elevation, islands, etc.) where specially adapted cassava may be grown

This list can include as many districts as are named by the team. When planning a round of collecting trips, it will be necessary to prioritize some of these – for instance, selecting three districts within a region, which can be visited in a single trip lasting six days. The main objective should be to seek out high diversity of landraces while visiting very different areas, including districts in different regions and ones that were chosen based on different criteria. This will ensure that the highest level of diversity is captured in the collection, with least duplication.

Size of sample

Successful collecting is not measured in terms of the number of interviews completed, but in terms of the interesting and diverse germplasm collected. A single day may be spent interviewing and collecting from several farmers, or it may be spent seeking out a single good informant, or collecting many varieties from a great informant. There is no limit on the amount of time the team should spend finding and interviewing an informant, if this results in valuable material for the collection and farmer knowledge to accompany it.

It is probably better to sample a wider area in the first phase of collection with fewer farmers, and then go back to re-sample particularly interesting areas. Within a district, informants should not all be sought within one village, but in different areas – ethnically, environmentally and agriculturally.

Collection teams

For a single team we suggest, at minimum, one trained interviewer (ideally a social scientist) and one cassava breeder to collect germplasm, plus a driver. When possible a team should have at least one female and one male member, as better quality information is often collected by someone of the same gender as the informant. If travelling with more team members, keep in mind that you will need extra space

in the vehicle for an accompanying extension officer and sometimes a farmer. Before starting the team should decide who will be named as the Principal Collector, as this person will use his or her initials for Collection Nos. and Questionnaire Nos., and will be tasked with keeping these records.

Equipment to prepare

- Printed collection forms, one sided. You will need more Landrace forms and Collection forms than Key Informant questionnaires, as you may use several of these in one interview.
- Clipboards
- Paperclips – for keeping forms from a single interview together
- GPS unit
- Materials for cutting, binding, wrapping and labelling stakes
- Scale, if you plan to take Harvest Index data
- Camera, video camera and/or audio recorder
- A copy of this manual, with photos printed in colour

Preparing for your return

Cassava stakes that have been travelling in a vehicle for up to six days need to be conserved as soon as they arrive on station. Ensure that preparations are made for how this material will be handled and entered into the collection as soon as the teams return from the field.

In the field

Identifying custodians of cassava germplasm

Your first key informants in an area can be identified with advice from an extension officer or others with local connections. Be clear in asking for informants: you are not looking for the most skilled or successful cassava farmers or those with the largest farms, but rather those who are known for growing, conserving or being knowledgeable about older local varieties. These may be elderly farmers, and will often be women. In most cases, if you are clear about what you are looking for, people who farm or work in an area will have suggestions for where to find these custodians.

Key informant interview

Upon meeting with an informant, the **Key Informant questionnaire** should be filled first to gather knowledge from the informant and to identify varieties of interest. The main questionnaire will be followed up with **Landrace forms** for individual landraces of interest, and some of this germplasm may be collected. In deciding what to collect, you will need to use this farmer information as well as the experience of the breeder.

Collecting germplasm

A decision should be made to collect germplasm if (1) a landrace with that name has not been collected before, (2) the landrace name has been collected before, but from a different Parish or area, and (3) if the breeder identifies any unusual or interesting characteristics. If a decision is made to collect material, the breeder can complete the **Collection form** while the other member of the team continues with the key informant interview. Take a stake or stakes from a **single plant** of each landrace to be collected. Label these, tie in bundles, and wrap in newspaper or in a breathable sack so nodes do not get damaged during transportation. Very long stakes may be cut if necessary, but longer stakes preserve better. For the viability

of these samples, the collection trip should not normally last more than six days before returning to the location where these will be conserved.

The label attached to the stake or stakes should include at least:

- Collection No. (see Collection form)
- Landrace name (see Landrace form)
- Village

Photography

If you have a camera, collect photographs of each plant that is collected. The file numbers of the photos should be recorded in the appropriate place on the Collection form. For extra assurance, a piece of paper or tape bearing the Collection No. can be placed within each photo. Record photos of:

- Whole plant
- Apical part of plant with the petioles
- Single leaf
- Close-up of stem at a standard distance, scratched to show both surface colour and epidermis colour
- Root, peeled and cut to show all colour attributes, if you are collecting these

Compensation

It is courteous to leave a present with the informant, in exchange for their time and information. Money should be avoided; we suggest a packet of seed, soap or something similar. On the other hand, if you are collecting stakes – and especially if you are digging up roots or whole plants to collect descriptors – you may need to remunerate the farmer suitably for this material.

Expanding the sample

In the process of conducting the Key Informant questionnaire, pay special attention to question (14), in which the informant is asked for the names of others in the area with knowledge of local landraces. This is valuable information for expanding your sample, and the contact information for these people should also be gathered if possible. Even an informant with no knowledge or interesting material may be very helpful if they can refer you to others who have it.

If informants suggest visiting another village, even in another district, you may want to follow this advice. Be flexible – you don't have to stick to your original plans exactly. If there isn't time, contacts can be followed up on a future collecting trip.

Germplasm sampling strategy

The long-term conservation of genetic variation of any crop is expensive. This is particularly true in the case of clonally propagated crops, such as cassava, that are currently conserved *in vitro* in the form of tissue culture plantlets. *In vitro* collections are also sometimes backed up by field collections. Due to the cost of conservation, strategies that maximize the amount of diversity conserved for the dollar spent should be adopted. Not all diversity can be conserved so decisions must be made on how to maximize the efficiency of conservation taking into consideration the genetic characteristics of the crop.

DNA fingerprinting shows that there is some genetic variation within the old, traditional landraces of Eastern and Southern Africa. This means that one plant of the landrace 'Albert' is not necessarily genetically uniform to another plant of 'Albert'. Within a genebank, an accession of cassava is considered to be clonal

and genetically uniform with no among-plant variation. This makes management and tracking of the accession, as well as utilization of the sample in a breeding context, much simpler. For this reason it is important to collect from a single plant of each landrace in each location. This will ensure genetic uniformity.

Experience shows that landrace name is a good indicator of genetic similarity in a local area, but not across a larger area, where the same name may be applied to genetically different landraces. For this reason, a sample of a 'landrace' should be collected from different farmers in different locations. For example, a cutting from a single plant could be collected from landrace 'Albert' from a farmer in location A, and a second sample, with a different Collection No., collected from a single plant of 'Albert' from another farmer in location B. If the locations are close to one another, the team can use their discretion as to whether to collect a second sample of a landrace with the same name or not. If two farmers have the same named landrace within the same village, then it is probably not necessary to collect a second sample, but the team should still conduct a key informant interview with the second farmer to record his or her knowledge of the landrace.

Once back at the germplasm conservation centre, samples will be genetically fingerprinted to determine their genetic similarity or difference. If samples are genetically distinct enough, they can be maintained as independent accessions, e.g. Albert-1, Albert-2 etc. If they are very similar, one sample can be discarded.

Questionnaire No _____

QUESTIONNAIRE FOR KEY INFORMANT INTERVIEWS

IDENTIFICATION AND DESCRIPTION OF COLLECTED GERmplasm OF CASSAVA BASED ON FARMERS' KNOWLEDGE

The aim of this study is to document farmers' knowledge about old, traditional and unique farmer varieties (landraces) of cassava. We are interested in talking to farmers about landraces of cassava that have been grown in this region for a long time, and in collecting samples of some of these.

We appreciate your participation in this research and willingness to share your knowledge. We will ensure that you and your community are recognized as the source of all information and planting material you contribute, and that this will remain freely available for your use.

District: _____ Sub county: _____

Parish: _____ Village: _____

Latitude: _____ Longitude: _____

1) Name of Informant: _____ 2) Gender: Male Female

3) Age: _____

5) Birthplace (label as district/village/etc.): _____

6) What is the role of the informant in cassava cultivation? Principal caretaker/decision-maker,
 member of household without decision-making role in selection of farmer landrace to plant.

7) How long have you been growing cassava? < 5 years 5 - 19 years 20 - 49 years 50 years +

8) Education level: None Some primary Some secondary Some tertiary

9) Main occupation: Student Farmer Trader/business Informal (wage) work Formal

10) Main source of income: Farming Business Formal employment Informal employment

11) Size of farm: < 1 acre 1 – 4.9 acres 5 – 9.9 acres 10 acres +

12) Plots planted with cassava: < 1 acre 1 – 4.9 acres 5 – 9.9 acres 10 acres +

13) Please list in the Table below all cassava landraces and improved varieties you currently have on your farm.

Questionnaire No

14) Please list any types of wild cassava that grow in this area (see notes on Pg.16 for definition of 'wild')

Form __ out of __

If there is no landrace/variety name, enter as Village_Informant_1 etc.

	Landrace / variety	Planting location	Collector identification	Survey	Coll. No
1		<input type="checkbox"/> Garden <input type="checkbox"/> Field <input type="checkbox"/> Far away <input type="checkbox"/> Wild	<input type="checkbox"/> I	<input type="checkbox"/>	
2		<input type="checkbox"/> Garden <input type="checkbox"/> Field <input type="checkbox"/> Far away <input type="checkbox"/> Wild	<input type="checkbox"/> I	<input type="checkbox"/>	
3		<input type="checkbox"/> Garden <input type="checkbox"/> Field <input type="checkbox"/> Far away <input type="checkbox"/> Wild	<input type="checkbox"/> I	<input type="checkbox"/>	
4		<input type="checkbox"/> Garden <input type="checkbox"/> Field <input type="checkbox"/> Far away <input type="checkbox"/> Wild	<input type="checkbox"/> I	<input type="checkbox"/>	
5		<input type="checkbox"/> Garden <input type="checkbox"/> Field <input type="checkbox"/> Far away <input type="checkbox"/> Wild	<input type="checkbox"/> I	<input type="checkbox"/>	
6		<input type="checkbox"/> Garden <input type="checkbox"/> Field <input type="checkbox"/> Far away <input type="checkbox"/> Wild	<input type="checkbox"/> I	<input type="checkbox"/>	
7		<input type="checkbox"/> Garden <input type="checkbox"/> Field <input type="checkbox"/> Far away <input type="checkbox"/> Wild	<input type="checkbox"/> I	<input type="checkbox"/>	
8		<input type="checkbox"/> Garden <input type="checkbox"/> Field <input type="checkbox"/> Far away <input type="checkbox"/> Wild	<input type="checkbox"/> I	<input type="checkbox"/>	
9		<input type="checkbox"/> Garden <input type="checkbox"/> Field <input type="checkbox"/> Far away <input type="checkbox"/> Wild	<input type="checkbox"/> I	<input type="checkbox"/>	
10		<input type="checkbox"/> Garden <input type="checkbox"/> Field <input type="checkbox"/> Far away <input type="checkbox"/> Wild	<input type="checkbox"/> I	<input type="checkbox"/>	
11		<input type="checkbox"/> Garden <input type="checkbox"/> Field <input type="checkbox"/> Far away <input type="checkbox"/> Wild	<input type="checkbox"/> I	<input type="checkbox"/>	
12		<input type="checkbox"/> Garden <input type="checkbox"/> Field <input type="checkbox"/> Far away <input type="checkbox"/> Wild	<input type="checkbox"/> I	<input type="checkbox"/>	
13		<input type="checkbox"/> Garden <input type="checkbox"/> Field <input type="checkbox"/> Far away <input type="checkbox"/> Wild	<input type="checkbox"/> I	<input type="checkbox"/>	
14		<input type="checkbox"/> Garden <input type="checkbox"/> Field <input type="checkbox"/> Far away <input type="checkbox"/> Wild	<input type="checkbox"/> I	<input type="checkbox"/>	
15		<input type="checkbox"/> Garden <input type="checkbox"/> Field <input type="checkbox"/> Far away <input type="checkbox"/> Wild	<input type="checkbox"/> I	<input type="checkbox"/>	
16		<input type="checkbox"/> Garden <input type="checkbox"/> Field <input type="checkbox"/> Far away <input type="checkbox"/> Wild	<input type="checkbox"/> I	<input type="checkbox"/>	
17		<input type="checkbox"/> Garden <input type="checkbox"/> Field <input type="checkbox"/> Far away <input type="checkbox"/> Wild	<input type="checkbox"/> I	<input type="checkbox"/>	

15) Can you identify other people in this area who grow other traditional cassava farmer varieties?

LANDRACE name _____ Wild

Questionnaire No _____

1) What language is the name? _____

2) English translation of name _____

3) Why does this landrace have this name?

4) Other names for this landrace? _____

5) How many plants of this landrace are you currently growing?

less than 10 10 - 50 50 - 100 100 - 500 more than 500

6) When did this landrace arrive in the area? (date, date range or historical reference point)

7) Best estimate of arrival, based on the above

Unknown 1950s or before 1960s 1970s 1980s 1990s 2000s 2010s

8) How did this landrace come to the area?

9) Has the planting of this landrace in the area in general increased or decreased in the last five years?

No longer planted Decreased No change Increased Don't know

10) Why are people planting less of this landrace than in the past?

or Why are people planting more of this landrace than in the past?

11) Has your planting of this landrace increased or decreased in the last five years?

Decreased No change Increased Don't know

12) Why are you planting more of this landrace?

or Why are you planting less of this landrace?

or Why are you still planting this landrace despite its decline?

LANDRACE _____

Wild

Questionnaire No _____

13) What uses do you grow this landrace for? (Number in order of importance)

- | | |
|--|--|
| <input type="checkbox"/> No use | <input type="checkbox"/> Sale of roots |
| <input type="checkbox"/> Household food, fresh roots | <input type="checkbox"/> Sale of leaves |
| <input type="checkbox"/> Household food, leaves | <input type="checkbox"/> Sale of processed product _____ |
| <input type="checkbox"/> Household food, processed _____ | <input type="checkbox"/> Sale of beer |
| <input type="checkbox"/> Household beer | <input type="checkbox"/> Sale of fodder |
| <input type="checkbox"/> Household fodder | <input type="checkbox"/> Sale of fencing |
| <input type="checkbox"/> Household fencing | <input type="checkbox"/> Sale of planting material |
| <input type="checkbox"/> Household planting material | <input type="checkbox"/> Shade |
| <input type="checkbox"/> Fixing bicycle tubes | <input type="checkbox"/> Other _____ |

14) Is this landrace early, medium or late maturing? Early Medium Late Months _____

Rate the following qualities of this landrace from 1 to 5.

0= don't know 1= very bad 2= bad 3= fair 4= good 5= very good

	Score	Comment
15) Yield	_____	_____
16) Storability in the ground	_____	_____
17) Drought tolerance	_____	_____
18) Maturity time	_____	_____
19) Disease and pest resistance	_____	_____
20) Cooking quality	_____	_____
21) Processing quality (flour)	_____	_____
22) Taste	_____	_____
23) Market demand	_____	_____

24) Are there any other qualities that make this landrace good to plant?

25) Are there any other qualities that make this landrace bad to plant?

26) Is this landrace usually grown by men or women? Women Men Both equally Don't know

LANDRACE _____ Wild

Questionnaire No _____

27) How do you ensure that you don't lose this landrace? (check all that apply)

- Keep in multiple plots
 Give to others to plant
 Use clean planting material
 Know where to find more
 Don't care if it is lost
 Other _____

28) In the last 5 years, where did you get your planting material of the landrace? (check all that apply)

- Own material
 Gift from person in community
 Gift from outsider
 Purchased in community
 Purchased from outsider
 Other _____

29) In the last 5 years, have you given away or sold planting material of this landrace? (check all that apply)

- Gift to person in community
 Gift to outsider
 Sold to person in community
 Sold to outsider
 Other _____

30) Do you know of any taboos, rituals or beliefs about this landrace?

31) Do you know any proverbs, stories or songs about this landrace?

Record below, or include reference to longer record, transcript, video or audio recording. Note whether each record pertains to this landrace or cassava in general.

Questionnaire No

COLLECTION No _____ DATE (Day/Month/Year): _____ / _____ / _____

PRINCIPAL COLLECTOR _____ INSTITUTION _____

DISTRICT _____ SUB COUNTY _____ PARISH _____ VILLAGE _____

LATITUDE: _____ N S LONGITUDE: _____ E W ALTITUDE (m): _____COLLECTION SOURCE Farmer's field Wild Homestead Other _____

LOCAL NAME: _____ PHOTOGRAPHS (number or filename): _____

PRIMARY MORPHOLOGICAL DESCRIPTORS (Descriptor numbers according to Fukuda et al. 2010)

1. Colour of apical leaves: Light green Dark green Purplish-green Purple Other _____2. Pubescence of apical leaves: Absent Present4. Shape of central leaflet: Ovoid Ellipic-lanceolate Obovate-lanceolate Oblong-lanceolate Lanceolate Straight or linear
 Pandurate Linear-piramidal Linear-pandurate Linear-hostatilobalate5. Petiole colour: Light green Dark green Green with red Purple Red Other _____7. Number of leaf lobes: Three Five Seven Nine Eleven Other _____15. Flowering: Absent Present18. Colour of stem cortex: Orange Light green Dark green Other _____19. Colour of stem epidermis (internal surface): Cream Light brown Dark brown Orange Other _____20. Colour of stem exterior: Silver-green Light brown or orange Dark brown Dark green22. Growth habit of stem: Straight Zigzag31. Branching habit: Erect Dichotomous Trichotomous Tetrachotomous33. Shape of plant: Compact Open Umbrella Cylindrical39. External colour of storage root: White or cream Yellow Light brown Dark brown40. Colour of root pulp: White or cream Yellow Pink41. Colour of root cortex: White or cream Yellow Pink Purple Other _____Harvest Index: High Medium Low

DISEASES AND PESTS	Incidence (% of plants infected)	Maximum Severity (1 – 5 scale)	DISEASES AND PESTS	Incidence (% of plants infected)	Maximum Severity (1 – 5)
CBSD (foliar)			CMD (foliar)		
CBSD (root)			Other		

TOPOGRAPHY Marshy Rolling hills Flood plain Mountainous Flat, not flood-prone Riparian Steep hills Other _____VEGETATION Semidesert Savanna grassland Deciduous forest (Woodland savanna) Steppe (Grass, bush and thicket)
 Tropical rainforest Montane forest (Tundra) East Africa coastal forest Temperate and mountain grassland Other _____SOIL TEXTURE Sandy Clay Sandy loam Silt Loam Organic origin Clay loam Other _____DRAINAGE Poor Moderate Good ExcellentSLOPE Flat or almost flat (<4°) Moderate slope (4-14°) Steep slope (>14°)

Key Informant Questionnaire Notes

Questionnaire No.

This is a unique identifier that refers to a single key informant interview with a single person. This ties all collected knowledge and material to one location and the one individual who provided it.

The Questionnaire No. should consist of the Principal Collector's initials, the date (YYMMDD), a hyphen and the interview number for the day: e.g. GN130827-1. When visiting a second farmer on the same day, the number would be GN130827-2; a third farmer would be GN130827-3. On the following day, the next questionnaire would start back at GN130827-1.

The Questionnaire No. box is repeated on the top right corner of every page for a reason: **it should be filled in with the same code on every sheet that is used during an interview**, including across multiple Landrace forms and Collection forms. Sheets of paper can often be misplaced during a collecting trip, and this code ensures that every piece of information and material stays connected to the right informant.

Introduction

The two opening paragraphs of the questionnaire explain the aims of the collection trip, including a statement of ethics about use of the knowledge shared by the informant. This does not need to be read out word-for-word, but this information should be explained by way of introduction when meeting the informant.

District / Sub county / Parish / Village

These designations should be modified, if necessary, to match the divisions used in the country where collecting is taking place.

1) Name of Informant

2) Gender

3) Age

4) Tribe/ethnic group

As reported by the informant. Tribe/ethnic group should be considered an optional question, especially in areas where it is a sensitive topic or such distinctions are not used.

5) Birthplace (label as district/village/etc.)

If the informant was born in the same village where the interview is taking place, write "Here". If elsewhere, record the place along with labels (e.g. Namulonge village, Wakiso District). This does not need to be precise to the village level.

6) What is the role of the informant in cassava cultivation? Does the person you are interviewing decide which landraces or improved varieties and how many of each cultivar will be grown?

7) How long have you been growing cassava?

This refers to the estimated number of years the informant has been cultivating cassava in any location, not just on this farm.

8) *Education level*

9) *Main occupation*

10) *Main source of income*

Just one answer should be marked for each of these. If the informant names more than one occupation or income source, ask which is the main one.

11) *Size of farm*

This refers to the entire area farmed by the informant, for cassava or other uses, including fallow land in regular use. The answer to this question should indicate the amount of agricultural land to which this individual has access. Do not include plots that are exclusively used by other household members.

12) *Plots planted with cassava*

This area represents that part of the farm, as defined above in (10), on which cassava is currently planted. This includes plots that are intercropped or mixed, if cassava is one of the crops planted there.

Page 2: Form __ out of __

If the informant names more than 17 landraces or varieties in response to (11) and (12), take the same sheet out of a second, blank questionnaire and continue the list there. Be sure to fill in the Questionnaire No. on both sheets, while labelling the first "Form 1 out of 2" and the second "Form 2 out of 2" (or Form 3 out of 3, etc., as needed).

13) *Please list all cassava landraces and improved varieties you currently have on your farm.*

The second column of the table on this page should be filled in with the names of all landraces or improved varieties currently growing on the informant's farm. Allow the informant to complete the list to their satisfaction before filling in the other columns of the table.

Landrace / Variety: List the names of landraces and improved varieties as they are given. This should, if possible, be done by someone with a good knowledge of the language the names are in to ensure proper spelling. If the farmer mentions a landrace but doesn't know the name, fill this in with the code Village_Informant_1, etc. For instance, if the village is Namulonge and the informant's name is Mary, call the unnamed landrace Namulonge_Mary_1. If Mary mentions another improved variety with an unknown name, this will be called Namulonge_Mary_2.

Planting location: Check more than one if the informant is growing this landrace/variety in multiple locations. These are defined as:

Garden: Grown next to the house; also known as a homestead or infield plot.

Field: Grown elsewhere but within walking distance; also known as an outfield.

Far away: A plot in another village, or beyond walking distance. This will most likely be visited infrequently or only seasonally. It may not be possible to collect material that is only grown far away.

Wild: Germplasm listed in answer to question (13).

Collector identification: In this column you can write a different identification based on the assessment of the collection team. If, for instance, the team recognizes an improved variety based on visual

identification, they can note its other name here. **If it is clearly an improved variety, identifiable or not, check the “ I” box.** In this case neither a Landrace form nor a Collection form will be completed, and the germplasm will not be collected.

Survey: A check here indicates that a Landrace form will be filled out with this informant for this farmer landrace. In most cases, if a landrace is listed and is not noted as an improved variety in the previous column, this box should be checked and a Landrace form should be completed and attached. In practice, if an informant has many landraces and little time, some landraces should be prioritized in case not all can be completed (see Landrace form notes below).

Coll. No.: If a collection is made of this landrace, the Collection No. from the Collection form must be recorded here. The format for this is the Principal Collector’s initials and a sequential number, e.g. GN45. Alternatively, if this informant's material is not collected because the team has already collected the landrace from another informant nearby, **and they are confident that this represents the same landrace**, the Collection No. from the existing collection should be entered here. **In either case it is very important that this number be entered, as this unique identifier connects all farmer knowledge to the germplasm that it describes.**

14) Please list any types of wild cassava that grow in this area.

In some regions of Africa, farmers recognize and use different types of “wild” cassava. This may be material from old planting sites that continues to regenerate in the wild, or hybrids with a wild relative. Farmers have different uses for these plants, and may grow them near their homestead or know where to find them nearby.

If the informant knows of any such wild types, list their names in the same table as the cultivated landraces. If they don't have a name for a type, use the same coding described under question (12). The team can decide whether to complete a Landrace form for a wild type depending on the informant's apparent knowledge of it, and most importantly, on whether it can be collected. If the informant has heard of wild cassava but doesn't know where to find it, you probably will not want to complete a form, but if they can show or bring you examples of the material so that a Collection form can be completed and a stake collected, it may be worthwhile.

15) Can you identify other people in this area who grow other traditional cassava landraces?

This question should be asked of all informants, even those who are not able to provide very useful information. Asking this question enables the identification, through social networks, of other informants. You should record names and contact information for any people mentioned, and see if the informant, the extension agent, or someone else can introduce you or direct you to the person.

In some cases you may find that the informant you are interviewing is not the only, or the most, knowledgeable member of their household when it comes to cassava landraces. They may ask a spouse, elder, or other person for information about some landraces. If someone else is brought into the conversation, you should ask whether they are the one who actually grows this landrace. **If another person is the source of the knowledge, and especially if they are the source of germplasm that will be collected, it is important that this be connected and credited to him or her.** You should finish filling in the Landrace form, asking questions to the new person directly. After completing this, you should fill in a new Key Informant questionnaire with their information, and edit the Questionnaire No. on the Landrace form so it is linked to this new questionnaire and informant.

Landrace Form Notes

A separate Landrace form should be completed with the informant for each farmer landrace of interest that they have: whether a named landrace, a landrace of unknown name, or a wild type that the informant can locate. It should not be completed if the team identifies the germplasm, by name or visual appraisal, as an improved variety.

The best place to complete a Landrace form is in the field, next to plants of the landrace. This provides a good visual reference for both the interviewer and informant. This may not always be possible, but effort should be made to at least visit the field and look at the landrace before retiring elsewhere to complete the Landrace form. For this purpose, the team may want to complete forms for landraces in order of location, so plants in a single plot can be visited and possibly collected before moving on. Or if time is short, they may want to complete the forms in order of importance – starting with landraces that haven't been encountered before and might be collected. The order is not important, but **once a Landrace form is begun it should be completed before moving on to the next one**, so the informant and interviewer do not get confused about which landrace they are discussing.

Throughout the form, wherever the placeholder [landrace] is used in a question, the interviewer should replace this with the name of the landrace being discussed. The more this is repeated, the easier it will be for the informant and interviewer to keep track of which landrace they are talking about.

Questionnaire No: This is the same code from the key informant questionnaire, which should match all other forms completed during this interview. As stated above, **this must be written in the top right corner of every sheet in case anything is misplaced.**

Landrace / Variety: This is the name as given by the informant, or the code in the format Village_Name_1 for landraces of unknown name. This is also repeated at the top of each sheet in the Landrace form, and **must be filled in on each.**

Wild: If completing a Landrace form for a wild type, mark this box at the top of each sheet. The form will not be filled out as fully as others, since many of the questions are not applicable. Ask only questions (1), (2), (3), (4), (13), (26), (29) and (30) for wild types.

1) What language is the name?

Specify even if the name is in English, but not if the language is unknown or if it is named after a person, place, etc.

2) English translation of name

If it is translatable, known, and not already in English.

3) Why does the landrace have this name?

This is not simply the translation, but the informant's explanation of why it is named this.

4) Are there other names for this landrace?

Based on the informant's knowledge, not identification by the collectors.

5) How many cuttings of the landrace are you currently growing?

The aim of this question is a total estimate of the amount of this landrace growing on an informant's farm. This can be difficult for a farmer to calculate, and you can approach the question in different ways depending on farming customs in the area. If farmers keep track of planting in bundles, you can first ask for the number of bundles they have planted, then how many sticks come in a bundle, and finally how many cuttings are obtained per stick (this may differ per landrace). If the informant knows only the size of the plot, you can ask how many cuttings are needed per unit of land. This is just an estimate, but the team should work with informants to find a suitable way to calculate a reasonably good total.

6) When did the landrace arrive in the area? (date, date range or historical reference point)

7) Best estimate of arrival, based on the above

The informant may answer the first question in any way they wish, and it should be recorded as given. The estimate in (7) should be made only if the informant has specific knowledge of the landrace's first arrival. If, for instance, they say "my parents were growing this since I was young" or "the landrace was already grown here when I came to the area", the estimate should be marked Unknown. This is not an estimate of this informant's history with the landrace, but the landrace's history in the area.

8) How did the landrace come to the area?

The answer should be recorded as given, with all possible detail on who brought it, which place it came from, etc.

9) Has the planting of the landrace in the area in general increased or decreased in the last five years?

This question is comparing the amount of the landrace grown in the area right now to the amount grown five years ago. If, for instance, it was very popular five years ago, fell out of use three years ago, and is starting to return now, this should still be recorded as a decrease if the amount is still lower than its former level.

*10) Why are people planting less of the landrace than in the past?
or Why are people planting more of the landrace than in the past?*

Ask according to the answer given to question (9).

11) Has your planting of the landrace increased or decreased in the last five years?

As noted for (9), this is comparing the current amount with five years ago, regardless of fluctuations in between.

*12) Why are you planting more of the landrace?
or Why are you planting less of the landrace?
or Why are you still planting the landrace despite its decline?*

Ask according to the answer given to question (11). Use the third form if the informant said that people in general are growing less of the landrace, but they are growing the same amount.

13) What uses do you grow the landrace for? (Number in order of importance)

The answer(s) should be numbered to the left of the list, starting from 1 (most important). It is acceptable to use the order in which the informant mentions the use as an indicator of importance, but if uncertain ask for confirmation.

Household food, fresh roots: Eaten as fresh (cooked, but unprocessed) roots.

Household food, processed: Eaten within the household in processed form. Write the type of product in the blank.

Household beer: Fermented for beer consumed in the household.

Household fodder: Given to livestock within the household.

Household fencing: Stems used as fencing material, or planted along boundaries as a live fence.

Household planting material: Grown for multiplication to provide more planting material within the household.

Fixing bicycle tubes: Latex is extracted to repair punctures – most often a tree-like wild type.

Sale of roots: Roots are sold to others, including to processors or as part of a marketing group.

Sale of processed product: Processed by the informant into a product that is then sold. Name the product in the blank. If the informant is selling the roots to a processor, this is not recorded here but under “Sale of roots”.

Sale of beer: Fermented by the informant, who then sells the beer to others. If the informant is selling the roots to a brewer, this is not recorded here but under “Sale of roots”.

Shade: Grown as a source of shade – most often a tree-like wild type.

14) *Is the landrace early, medium or late maturing?*

This is based on the informant's classification, even if they name a number of months that the team would classify otherwise. If the informant does not know the number of months, this can be left blank.

Rate the following qualities of the landrace from 1 to 5.

Explain to the informant that you are going to list some qualities and they should rate these from 1 to 5 for this landrace, with 1 being very bad and 5 being very good. In some cases it may be easier to give the informant five seeds or pebbles as an aid, and ask them to award these to this landrace's qualities. **Detail any additional commentary in the blank next to each quality.** Enter 0 if the informant can't comment, for instance if they haven't yet experienced a drought with this landrace or don't participate in the market.

15) *Yield:* The production of this landrace compared to others.

16) *Storability in the ground:* How long and how well the roots persist in the ground after maturity.

17) *Drought tolerance:* How well this landrace yields in drought, whether it drops its leaves, whether the taste changes, etc.

18) *Maturity time:* Whether a landrace is early or late maturing, the farmer may find this a negative or a positive attribute depending on their own needs and uses.

19) *Disease and pest resistance:* Many farmers will not differentiate between pests or diseases, but will know if a landrace produces under high pressures. Record any names or symptoms mentioned.

20) *Cooking quality:* How long it takes to cook and how soft the roots or leaves get; be specific in comments.

21) *Processing quality (flour):* What attributes make it good/bad to process? Comment on the quality of the processed product? Be specific in your answers.

22) *Taste*: Taste of the cooked roots, processed product or leaves; specify in comments.

23) *Market demand*: If sold, whether people would buy it and pay as much or more than for other varieties. This may apply to any products sold, including planting material.

24) *Are there any other qualities that make [landrace] good to plant?*

25) *Are there any other qualities that make [landrace] bad to plant?*

For any special qualities not covered above.

26) *Is the landrace usually grown by men or women?*

Based on convention, regardless of whether the informant is male or female. This question can be considered optional in regions where cassava is exclusively a women's crop or men's crop.

27) *How do you ensure that you don't lose this landrace? (check all that apply)*

Ascertain practices used by the informant to conserve the landrace in case of disease, theft, or other unexpected losses. You may prompt with examples if the informant is unsure.

28) *In the last 5 years, where did you get your planting material of the landrace? (check all that apply)*

If the informant obtained planting material other than their own in the last five years, was this given or sold to them, and were the sources within the community (as defined by the informant) or outside?

29) *In the last 5 years, have you given away or sold planting material of the landrace? (check all that apply)*

If the informant provided planting material to other farmers in the last five years, did they give or sell it, and were the recipients within the community (as defined by the informant) or outside?

30) *Do you know of any taboos, rituals or beliefs about the landrace?*

31) *Do you know any proverbs, stories or songs about the landrace?*

Both of these should be asked as a general question about beliefs, proverbs etc. they have heard of, as some informants will not want to be seen as believing in these themselves. Answers for (29) and (30) may be recorded together on the bottom half of this sheet and don't need to be differentiated, but the questions should be asked separately to prompt for more.

The interviewer should be clear to ask for anything relating to this landrace in particular, but in many cases the traditions shared will be about cassava in general. These can be recorded too, but label each entry with either "Cassava:" or "Landrace" to specify.

Responses can be recorded in any way: written in the original language, with a translation; summarized (with as much detail as possible) in translation; written on separate pages or in a notebook; documented with relevant photographs; or as an audio or video recording. Outside records or recordings should be given a unique identifier and this should be cited at the bottom of this sheet.

If the informant asks someone else to share something, record this person's name and details so the knowledge can be properly attributed.

Germplasm Collection Form Notes

Collection No.

The Collection No. is an important unique identifier that is used to keep track of a single collected sample and all information collected with it. It is made up of the Principal Collector's initials and a sequential number. For example, the first sample collected by a team might be **GN1**, and the second **GN2**. This number keeps increasing whenever the same Principal Collector finds new material; a number should not be re-used, even across different collecting trips. If you are returning to the field as Principal Investigator, be sure to check your records and know the highest number you previously used.

Questionnaire No.

As on every other form, this box must be filled with the same code (e.g. **GN130827-1**) designating the informant interview that resulted in this collection. This is the important link between the germplasm collected, the source of that germplasm, and the knowledge gathered about it. **It must be entered on every form.**

Photographs:

If you are taking photographs of the plant collected, record the file numbers here. See guidelines under *Procedure for Collecting: Photography*.

Primary morphological descriptors

See the *Cassava Descriptors* section below for photo references. At least one member of your team should be trained in collecting these descriptors.

It should be decided as part of the planning process if you will be attempting to collect root descriptors. This will require digging up at least one root from the plant being collected, which may not always be possible (as where the plants are too young). Likewise, collecting Harvest Index will require uprooting the entire plant, as well as travelling with a portable scale. These descriptors should be considered optional where time or farmer cooperation is limited.

Diseases and pests

Where observed, these can be recorded in terms of incidence (among all plants belonging to the landrace in the plot, or for a large plot, a representative group of 30 plants) and maximum severity (on the most symptomatic plant observed). The severity scale appropriate to the specific disease or pest should be used. Severity scales for Cassava mosaic disease and Cassava brown streak disease are included in the *Cassava Descriptors* section below.

CASSAVA MORPHOLOGICAL DESCRIPTORS

Adapted from Fukuda et al. (2010). The descriptor number relates to that in Fukuda et al. (2010).

1. Colour of apical leaves

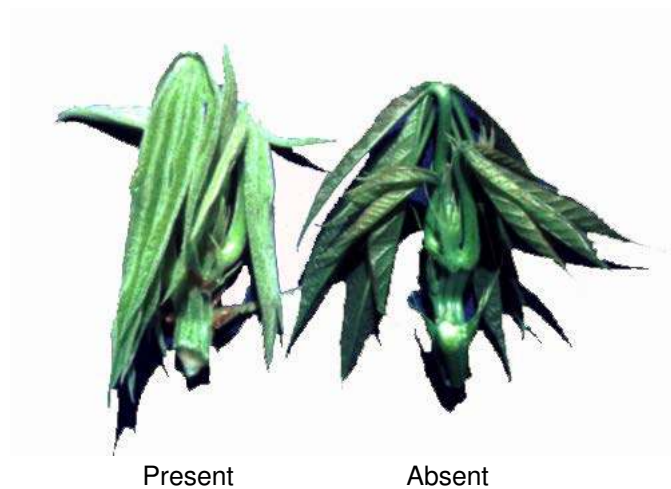
Record the most frequent occurrence

Damage by cassava green mite may obscure this trait, so it is better to score earlier rather than later.



2. Pubescence on apical leaves

Record the most frequent occurrence

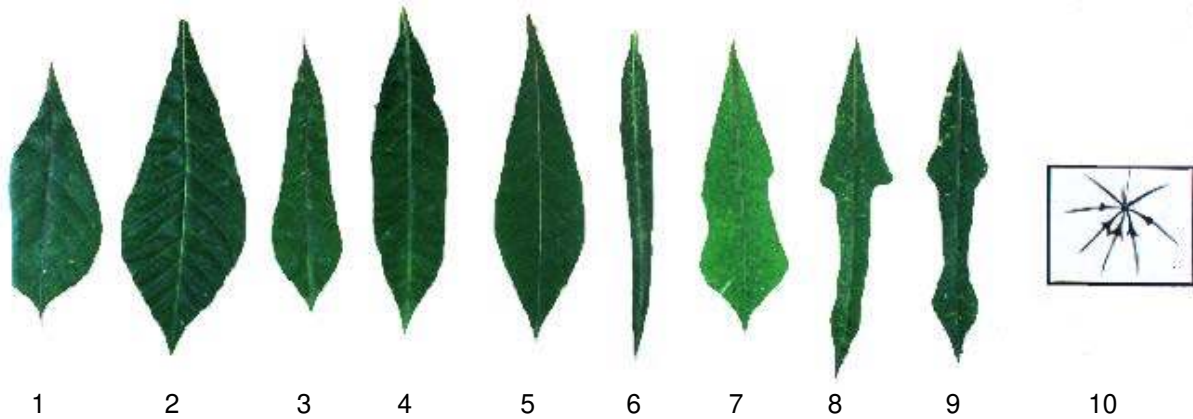
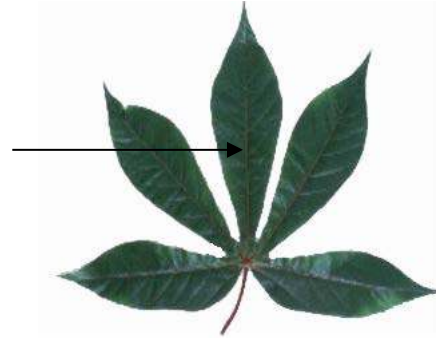


4. Shape of central leaflet

Leaf taken from a mid-height position
Record the most frequent occurrence

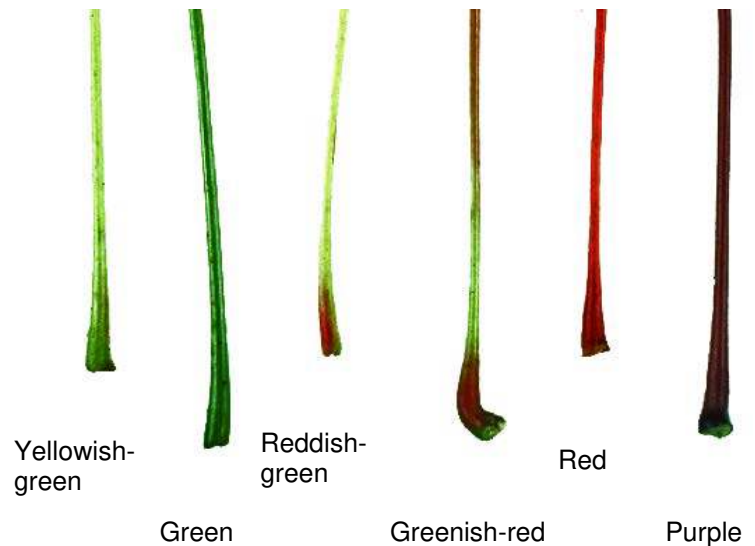
- 1 Ovoid
- 2 Elliptic-lanceolate
- 3 Obovate-lanceolate
- 4 Oblong-lanceolate
- 5 Lanceolate
- 6 Straight or linear
- 7 Pandurate
- 8 Linear-piramidal
- 9 Linear-pandurate
- 10 Linear-hostatilobalate

Central leaflet



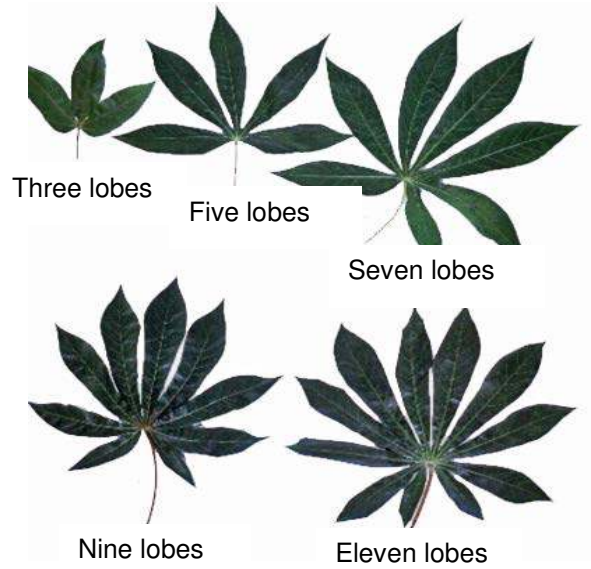
5. Petiole colour

Leaf taken from a mid-height position
Record the most frequent occurrence
Intermediate descriptor states allowed.



7. Number of leaf lobes

Observe a leaf from the middle of the plant.
Assess on five leaves and take the predominant number of lobes.
Record only one score.



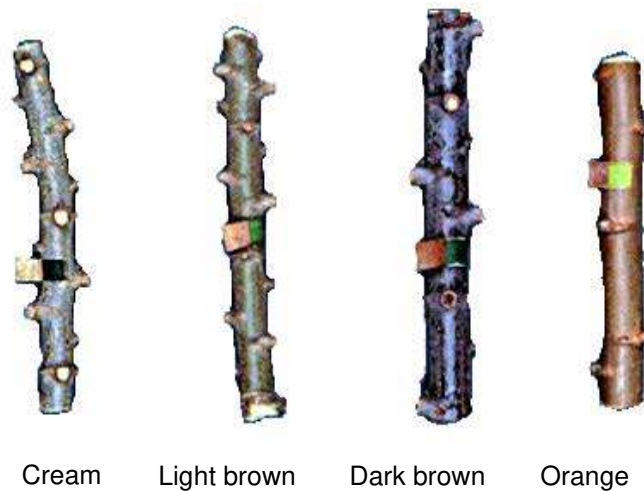
18. Colour of stem cortex

Observe from the middle third of the plant.
Make a small shallow cut and peel back the epidermis as in picture below.



19. Colour of stem epidermis

Peel epidermis back and look at underside of epidermis (skin)



20. Colour of stem exterior

Observed on middle third of the plant



Silver green



Light brown or orange



Dark brown



Dark green

22. Growth habit of stem



Zig-zag



Straight

31. Branching habit

Observed at the lowest or first branching.
Record the most frequent occurrence on the plot.



Erect



Dichotomous



Trichotomous



Tetrachotomous

33. Shape of plant

Record the most frequent occurrence on the plot.



Compact



Open



Umbrella



Cylindrical

39. External colour of storage root

Record the most frequent occurrence.



White or cream

Yellow

Light brown

Dark brown

40. Colour of root pulp (parenchyma)

Record the most frequent occurrence.
(no picture of orange pulp)



White

Cream

Yellow

Pink

41. Colour of Root Cortex

Record the most frequent occurrence.



White or
cream

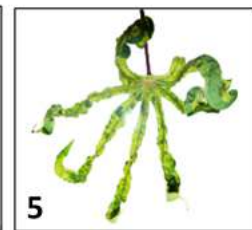
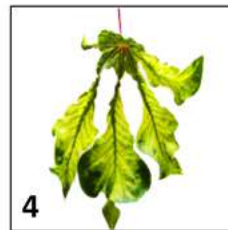
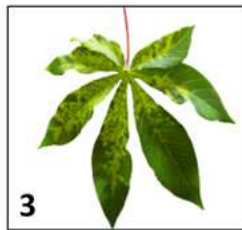
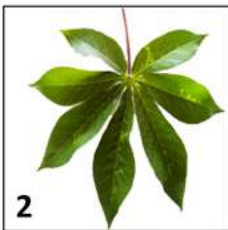
Yellow

Pink

Purple

Disease severity scoring scales**Cassava Mosaic Disease (CMD)**

Score	Description
1	No symptoms
2	Up to 25% leaf area chlorotic, mild leaf distortion, no stunting
3	25–50% leaf area chlorotic, moderate leaf distortion, no stunting
4	50–75% leaf area chlorotic, severe leaf distortion, moderate stunting
5	75–100% leaf area chlorotic, severe leaf distortion, small leaflets (almost no lamina), severe stunting



(Fauquet, pers. com.)

Cassava Brown Streak Disease (CBSD) Foliar symptoms

Leaf Score	Description
1	No symptoms on leaves or stems
2	Mild / slight vein yellowing or chlorotic blotches on leaves No brown streaks / lesions on green stem portions
3	Mild / slight vein yellowing or chlorotic blotches on leaves and mild brown streaks / lesions on green stem portions. Extensive / severe chlorosis on the leaves
4	Severe / extensive vein yellowing or chlorotic blotches on leaves Severe brown streaks / lesions on green stem portions No defoliation, stem dieback or stunting
5	Severe / extensive vein yellowing or chlorotic blotches on leaves Severe brown streaks / lesions on green stem portions Defoliation, stem dieback and stunting



(CBSD leaf scoring from Maruthi, pers com)

Cassava Brown Streak Disease (CBSD) Root symptoms

Root Score	Description
1	no symptoms on storage roots
2	less than 5% of storage root tissue is necrotic
3	5-10% of storage root tissue is necrotic
4	10-25% of storage root tissue is necrotic
5	More than 25% of storage root tissue is necrotic

Cassava Brown Streak Disease (CBSD) Root symptoms



(Maruthi, pers. com.)

References:

Fukuda, W.M.G., C.L. Guevara, R. Kawuki and M.E. Ferguson (2010). Selected morphological and agronomic descriptors for the characterisation of cassava. International Institute of Tropical Agriculture (IITA), Ibadan, Nigeria. 19pp.