

UPOV

TG/CASSAV(proj.3)(rev.)<sup>a</sup>

ORIGINAL: English

DATE: 2012-05-07

## INTERNATIONAL UNION FOR THE PROTECTION OF NEW VARIETIES OF PLANTS

Geneva

DRAFT

## CASSAVA

UPOV Code: MANIH\_ESC

*(Manihot esculenta Crantz.)*

## GUIDELINES

## FOR THE CONDUCT OF TESTS

## FOR DISTINCTNESS, UNIFORMITY AND STABILITY

*prepared by experts from Brazil and Kenya**to be considered by the**Technical Working Party for Agricultural Crops  
at its forty-first session, to be held in Angers, France, from May 21 to 25, 2012*Alternative Names:<sup>\*</sup>

| <i>Botanical name</i>              | <i>English</i> | <i>French</i> | <i>German</i> | <i>Spanish</i> |
|------------------------------------|----------------|---------------|---------------|----------------|
| <i>Manihot esculenta</i><br>Crantz | Cassava        |               |               |                |

The purpose of these guidelines ("Test Guidelines") is to elaborate the principles contained in the General Introduction (document TG/1/3), and its associated TGP documents, into detailed practical guidance for the harmonized examination of distinctness, uniformity and stability (DUS) and, in particular, to identify appropriate characteristics for the examination of DUS and production of harmonized variety descriptions.

## ASSOCIATED DOCUMENTS

These Test Guidelines should be read in conjunction with the General Introduction and its associated TGP documents.

<sup>a</sup> The Test Guidelines has been revised to indicate that it will also be considered by the TWV.

<sup>\*</sup> These names were correct at the time of the introduction of these Test Guidelines but may be revised or updated. [Readers are advised to consult the UPOV Code, which can be found on the UPOV Website ([www.upov.int](http://www.upov.int)), for the latest information.]

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## 1. Subject of these Test Guidelines

These Test Guidelines apply to all varieties of *Manihot esculenta* Crantz.

In the case of ornamental varieties, it may, in particular, be necessary to use additional characteristics to those included in the Table of Characteristics in order to examine Distinctness, Uniformity and Stability.

## 2. Material Required

2.1 The competent authorities decide on the quantity and quality of the plant material required for testing the variety and when and where it is to be delivered. Applicants submitting material from a State other than that in which the testing takes place must ensure that all customs formalities and phytosanitary requirements are complied with.

2.2 The material is to be supplied in the form of cuttings.

2.3 The minimum quantity of plant material, to be supplied by the applicant, should be:

30 cuttings, each one with a length of 40cm with 5 to 8 buds.

2.4 The plant material supplied should be visibly healthy, not lacking in vigor, nor affected by any important pest or disease.

2.5 The plant material should not have undergone any treatment which would affect the expression of the characteristics of the variety, unless the competent authorities allow or request such treatment. If it has been treated, full details of the treatment must be given.

## 3. Method of Examination

### 3.1 *Number of Growing Cycles*

The minimum duration of tests should normally be a single growing cycle.

### 3.2 *Testing Place*

Tests are normally conducted at one place. In the case of tests conducted at more than one place, guidance is provided in TGP/9 "Examining Distinctness".

### 3.3 *Conditions for Conducting the Examination*

The tests should be carried out under conditions ensuring satisfactory growth for the expression of the relevant characteristics of the variety and for the conduct of the examination.

### 3.4 *Test Design*

3.4.1 Each test should be designed to result in a total of at least 20 plants, which should be divided between two or more replicates.

3.4.2 The design of the tests should be such that plants or parts of plants may be removed for measurement or counting without prejudice to the observations which must be made up to the end of the growing cycle.

### 3.5 *Additional Tests*

Additional tests, for examining relevant characteristics, may be established.

## 4. Assessment of Distinctness, Uniformity and Stability

### 4.1 *Distinctness*

#### 4.1.1 General Recommendations

It is of particular importance for users of these Test Guidelines to consult the General Introduction prior to making decisions regarding distinctness. However, the following points are provided for elaboration or emphasis in these Test Guidelines.

#### 4.1.2 Consistent Differences

The differences observed between varieties may be so clear that more than one growing cycle is not necessary. In addition, in some circumstances, the influence of the environment is not such that more than a single growing cycle is required to provide assurance that the differences observed between varieties are sufficiently consistent. One means of ensuring that a difference in a characteristic, observed in a growing trial, is sufficiently consistent is to examine the characteristic in at least two independent growing cycles.

#### 4.1.3 Clear Differences

Determining whether a difference between two varieties is clear depends on many factors, and should consider, in particular, the type of expression of the characteristic being examined, i.e. whether it is expressed in a qualitative, quantitative, or pseudo-qualitative manner. Therefore, it is important that users of these Test Guidelines are familiar with the recommendations contained in the General Introduction prior to making decisions regarding distinctness.

#### 4.1.4 Number of Plants / Parts of Plants to be Examined

Unless otherwise indicated, for the purposes of distinctness, all observations on single plants should be made on 10 plants or parts taken from each of 10 plants and any other observations made on all plants in the test, disregarding any off-type plants.

#### 4.1.5 Method of Observation

The recommended method of observing the characteristic for the purposes of distinctness is indicated by the following key in the second column of the Table of Characteristics (see document TGP/9 "Examining Distinctness", Section 4 "Observation of characteristics"):

MG: single measurement of a group of plants or parts of plants

MS: measurement of a number of individual plants or parts of plants

VG: visual assessment by a single observation of a group of plants or parts of plants

VS: visual assessment by observation of individual plants or parts of plants

Type of observation: visual (V) or measurement (M)

"Visual" observation (V) is an observation made on the basis of the expert's judgment. For the purposes of this document, "visual" observation refers to the sensory observations of the experts and, therefore, also includes smell, taste and touch. Visual observation includes observations where the expert uses reference points (e.g. diagrams, example varieties, side-by-side comparison) or non-linear charts (e.g. color charts). Measurement (M) is an objective observation against a calibrated, linear scale e.g. using a ruler, weighing scales, colorimeter, dates, counts, etc.

Type of record: for a group of plants (G) or for single, individual plants (S)

For the purposes of distinctness, observations may be recorded as a single record for a group of plants or parts of plants (G), or may be recorded as records for a number of single, individual plants or parts of plants (S). In most cases, "G" provides a single record per variety and it is not possible or necessary to apply statistical methods in a plant-by-plant analysis for the assessment of distinctness."

In cases where more than one method of observing the characteristic is indicated in the Table of Characteristics (e.g. VG/MG), guidance on selecting an appropriate method is provided in document TGP/9, Section 4.2.

## 4.2 *Uniformity*

4.2.1 It is of particular importance for users of these Test Guidelines to consult the General Introduction prior to making decisions regarding uniformity. However, the following points are provided for elaboration or emphasis in these Test Guidelines:

4.2.2 For the assessment of uniformity of clones, a population standard of 1% and an acceptance probability of at least 95% should be applied. In the case of a sample size of 20 plants, 1 off-type is allowed.

## 4.3 *Stability*

4.3.1 In practice, it is not usual to perform tests of stability that produce results as certain as those of the testing of distinctness and uniformity. However, experience has demonstrated that, for many types of variety, when a variety has been shown to be uniform, it can also be considered to be stable.

4.3.2 Where appropriate, or in cases of doubt, stability may be tested, either by growing a further generation, or by testing a new seed stock to ensure that it exhibits the same characteristics as those shown by the previous material supplied.

## 5. Grouping of Varieties and Organization of the Growing Trial

5.1 The selection of varieties of common knowledge to be grown in the trial with the candidate varieties and the way in which these varieties are divided into groups to facilitate the assessment of distinctness are aided by the use of grouping characteristics.

5.2 Grouping characteristics are those in which the documented states of expression, even where produced at different locations, can be used, either individually or in combination with other such characteristics: (a) to select varieties of common knowledge that can be excluded from the growing trial used for examination of distinctness; and (b) to organize the growing trial so that similar varieties are grouped together.

5.3 The following have been agreed as useful grouping characteristics:

- (a) Apical leaf: pubescence (characteristic 2)
- (b) Leaf: predominant shape of central lobe (characteristic 4)
- (c) Petiole: color (characteristic 4)
- (d) Leaf: variegation (characteristic 6)
- (e) Petiole: attitude in relation to stem (characteristic 10)
- (f) Branching habit (characteristic 15)
- (g) Stem: color of cortex (characteristic 16)
- (h) Stem: growth habit (characteristic 19)
- (i) Stem: color of end branches (at top 20 cm of plant) (characteristic 22)
- (j) Root: color of flesh (characteristic 26)

5.4 Guidance for the use of grouping characteristics, in the process of examining distinctness, is provided through the General Introduction and document TGP/9 "Examining Distinctness".

## 6. Introduction to the Table of Characteristics

### 6.1 *Categories of Characteristics*

#### 6.1.1 Standard Test Guidelines Characteristics

Standard Test Guidelines characteristics are those which are approved by UPOV for examination of DUS and from which members of the Union can select those suitable for their particular circumstances.

### 6.1.2 Asterisked Characteristics

Asterisked characteristics (denoted by \*) are those included in the Test Guidelines which are important for the international harmonization of variety descriptions and should always be examined for DUS and included in the variety description by all members of the Union, except when the state of expression of a preceding characteristic or regional environmental conditions render this inappropriate.

### 6.2 States of Expression and Corresponding Notes

6.2.1 States of expression are given for each characteristic to define the characteristic and to harmonize descriptions. Each state of expression is allocated a corresponding numerical note for ease of recording of data and for the production and exchange of the description.

6.2.2 In the case of qualitative and pseudo-qualitative characteristics (see Chapter 6.3), all relevant states of expression are presented in the characteristic. However, in the case of quantitative characteristics with 5 or more states, an abbreviated scale may be used to minimize the size of the Table of Characteristics. For example, in the case of a quantitative characteristic with 9 states, the presentation of states of expression in the Test Guidelines may be abbreviated as follows:

| State  | Note |
|--------|------|
| small  | 3    |
| medium | 5    |
| large  | 7    |

However, it should be noted that all of the following 9 states of expression exist to describe varieties and should be used as appropriate:

| State               | Note |
|---------------------|------|
| very small          | 1    |
| very small to small | 2    |
| small               | 3    |
| small to medium     | 4    |
| medium              | 5    |
| medium to large     | 6    |
| large               | 7    |
| large to very large | 8    |
| very large          | 9    |

6.2.3 Further explanation of the presentation of states of expression and notes is provided in document TGP/7 "Development of Test Guidelines".

### 6.3 Types of Expression

An explanation of the types of expression of characteristics (qualitative, quantitative and pseudo-qualitative) is provided in the General Introduction.

### 6.4 Example Varieties

Where appropriate, example varieties are provided to clarify the states of expression of each characteristic.

6.5 *Legend*

- |                |  |                     |
|----------------|--|---------------------|
| (*)            | Asterisked characteristic  | – see Chapter 6.1.2 |
| QL             | Qualitative characteristic                                       | – see Chapter 6.3   |
| QN             | Quantitative characteristic                                      | – see Chapter 6.3   |
| PQ             | Pseudo-qualitative characteristic                                | – see Chapter 6.3   |
| MG, MS, VG, VS |  | – see Chapter 4.1.5 |
| (a)-(c)        | See Explanations on the Table of Characteristics in Chapter 8.1. |                     |
| (+)            | See Explanations on the Table of Characteristics in Chapter 8.2. |                     |

7. Table of Characteristics/Tableau des caractères/Merkmalstabelle/Tabla de caracteres

|            | English    | français   | Deutsch | español | Example Varieties/<br>Exemples/<br>Beispielssorten/<br>Variedades ejemplo | Note/<br>Nota |
|------------|------------|--|---------|---------|---|---------------|
| <b>1.</b>  | <b>VG</b>  | <b>Apical leaf: color</b>                          |         |         |   |               |
| <b>(*)</b> |            |  |         |         |   |               |
| <b>(+)</b> |            |  |         |         |   |               |
| <b>PQ</b>  | <b>(a)</b> | light green  |         |         |   | 1             |
|            |            | dark green   |         |         | Clone 2005/0034   | 2             |
|            |            | purplish green                                     |         |         | Clone 82/001  | 3             |
|            |            | purple   |         |         |   | 4             |
| <b>2.</b>  | <b>VG</b>  | <b>Apical leaf:<br/>pubescence</b>                 |         |         |   |               |
| <b>(*)</b> |            |  |         |         |   |               |
| <b>(+)</b> |            |  |         |         |   |               |
| <b>QL</b>  | <b>(a)</b> | absent   |         |         | Clone 2005/0034   | 1             |
|            |            | present  |         |         | Clone 82/0058   | 9             |
| <b>3.</b>  | <b>VG</b>  | <b>Leaf: predominant<br/>shape of central lobe</b> |         |         |   |               |
| <b>(*)</b> |            |  |         |         |   |               |
| <b>(+)</b> |            |  |         |         |   |               |
| <b>PQ</b>  | <b>(b)</b> | linear   |         |         |   | 1             |
|            |            | obovate  |         |         |   | 2             |
|            |            | oblong   |         |         |   | 3             |
| <b>4.</b>  | <b>VG</b>  | <b>Petiole: color</b>                              |         |         |   |               |
| <b>(*)</b> |            |  |         |         |   |               |
| <b>(+)</b> |            |  |         |         |   |               |
| <b>PQ</b>  | <b>(b)</b> | yellowish green                                    |         |         | Nzalauka, Shibe, Siri   | 1             |
|            |            | green  |         |         | Karibuni  | 2             |
|            |            | reddish green                                      |         |         | Clone 517, Karemba,<br>Tajirika   | 3             |
|            |            | greenish red                                       |         |         |   | 4             |
|            |            | red  |         |         | Clone 2021, Kibandameno,<br>Nguzo   | 5             |
|            |            | purple   |         |         | Clone 1366  | 6             |
| <b>5.</b>  | <b>VG</b>  | <b>Leaf: color</b>                                 |         |         |   |               |
| <b>(*)</b> |            |  |         |         |   |               |
| <b>(+)</b> |            |  |         |         |   |               |
| <b>PQ</b>  | <b>(b)</b> | light green  |         |         | Kibandameno, Nguzo  | 1             |
|            |            | dark green   |         |         |   | 2             |
|            |            | purplish green                                     |         |         |   | 3             |
|            |            | purple   |         |         |   | 4             |

|            | English    | français                                     | Deutsch | español | Example Varieties/<br>Exemples/<br>Beispielssorten/<br>Variedades ejemplo | Note/<br>Nota |
|------------|------------|--|---------|---------|---|---------------|
| <b>6.</b>  | <b>VG</b>  | <b>Leaf: variegation</b>                     |         |         |   |               |
| <b>(*)</b> |            |  |         |         |   |               |
| <b>QL</b>  | <b>(b)</b> | absent                                       |         |         |   | 1             |
|            |            | present                                      |         |         |   | 9             |
| <b>7.</b>  | <b>MS</b>  | <b>Leaf: length of central lobe</b>          |         |         |   |               |
| <b>(+)</b> |            |  |         |         |   |               |
| <b>QN</b>  | <b>(b)</b> | short  |         |         | Clone 2021  | 3             |
|            |            | medium                                       |         |         | Nzalauka, Siri  | 5             |
|            |            | long   |         |         | Kibandameno, Tajirika   | 7             |
| <b>8.</b>  | <b>MS</b>  | <b>Leaf: width of central lobe</b>           |         |         |   |               |
| <b>(+)</b> |            |  |         |         |   |               |
| <b>QN</b>  | <b>(b)</b> | narrow                                       |         |         | Clone 2021  | 3             |
|            |            | medium                                       |         |         | Siri  | 5             |
|            |            | broad  |         |         | Kibandameno   | 7             |
| <b>9.</b>  | <b>VG</b>  | <b>Leaf: color of veins</b>                  |         |         |   |               |
| <b>(+)</b> |            |  |         |         |   |               |
| <b>PQ</b>  | <b>(b)</b> | green  |         |         | Siri  | 1             |
|            |            | reddish green                                |         |         | Kibandameno   | 2             |
|            |            | red  |         |         |   | 3             |
|            |            | purple                                       |         |         |   | 4             |
| <b>10.</b> | <b>VG</b>  | <b>Petiole: attitude in relation to stem</b> |         |         |   |               |
| <b>(*)</b> |            |  |         |         |   |               |
| <b>(+)</b> |            |  |         |         |   |               |
| <b>PQ</b>  | <b>(b)</b> | semi erect                                   |         |         | Karembo, Tajirika   | 1             |
|            |            | horizontal                                   |         |         | Nguzo, Siri   | 2             |
|            |            | drooping                                     |         |         | Clone 1380, Kibandameno   | 3             |
|            |            | irregular                                    |         |         | Nzalauka  | 4             |
| <b>11.</b> | <b>MS</b>  | <b>Stipule: length</b>                       |         |         |   |               |
| <b>(*)</b> |            |  |         |         |   |               |
| <b>(+)</b> |            |  |         |         |   |               |
| <b>QN</b>  | <b>(b)</b> | short  |         |         | Karibuni  | 3             |
|            |            | medium                                       |         |         | Karembo, Karibuni   | 5             |
|            |            | long   |         |         | Clone 517, Nguzo  | 7             |

|            | English    | français                      | Deutsch | español | Example Varieties/<br>Exemples/<br>Beispielssorten/<br>Variedades ejemplo | Note/<br>Nota |
|------------|------------|-------------------------------|---------|---------|---|---------------|
| <b>12.</b> | <b>VG</b>  | <b>Stipule: margin</b>        |         |         |   |               |
|            | <b>(+)</b> |                               |         |         |   |               |
| <b>QL</b>  | <b>(b)</b> | entire                        |         |         |   | 1             |
|            |            | split                         |         |         |   | 2             |
| <b>13.</b> | <b>MS</b>  | <b>Plant: height</b>          |         |         |   |               |
| <b>QN</b>  | <b>(c)</b> | short                         |         |         |   | 3             |
|            |            | medium                        |         |         |   | 5             |
|            |            | tall                          |         |         | Kibandameno   | 7             |
| <b>14.</b> | <b>VG</b>  | <b>Plant: type</b>            |         |         |   |               |
|            | <b>(+)</b> |                               |         |         |   |               |
| <b>QN</b>  | <b>(c)</b> | compact                       |         |         |   | 1             |
|            |            | open                          |         |         |   | 2             |
|            |            | umbrella                      |         |         |   | 3             |
|            |            | cylindrical                   |         |         |   | 4             |
| <b>15.</b> | <b>VG</b>  | <b>Plant: branching habit</b> |         |         |   |               |
|            | <b>(+)</b> |                               |         |         |   |               |
| <b>QL</b>  | <b>(c)</b> | unbranched                    |         |         |   | 1             |
|            |            | branched                      |         |         |   | 2             |
| <b>16.</b> | <b>VG</b>  | <b>Stem: color of cortex</b>  |         |         |   |               |
|            | <b>(+)</b> |                               |         |         |   |               |
| <b>PQ</b>  | <b>(c)</b> | light green                   |         |         | mfaransa  | 1             |
|            |            | dark green                    |         |         | B2C20-65  | 2             |
|            |            | cream                         |         |         |   | 3             |
|            |            | purplish                      |         |         |   | 4             |

|            | English    | français  | Deutsch | español | Example Varieties/<br>Exemples/<br>Beispielssorten/<br>Variedades ejemplo | Note/<br>Nota |
|------------|------------|---|---------|---------|---|---------------|
| <b>17.</b> | <b>VG</b>  | <b>Stem: color of exterior</b>                    |         |         |   |               |
| <b>(*)</b> |            |   |         |         |   |               |
| <b>PQ</b>  | <b>(c)</b> | orange  |         |         |   | 1             |
|            |            | greyish yellow                                    |         |         | Kibandameno   | 2             |
|            |            | greenish yellow                                   |         |         | Clone 2021, Siri  | 3             |
|            |            | golden  |         |         |   | 4             |
|            |            | light brown                                       |         |         | Clone 1380  | 5             |
|            |            | dark brown  |         |         | kiroba  | 6             |
|            |            | grey  |         |         | Karibuni, Nguzo   | 7             |
| <b>18.</b> | <b>VG</b>  | <b>Stem: color of epidermis</b>                   |         |         |   |               |
| <b>PQ</b>  | <b>(c)</b> | cream   |         |         | Karemba, Kibandameno  | 1             |
|            |            | light brown                                       |         |         | Shibe, Tajirika   | 2             |
|            |            | dark brown  |         |         |   | 3             |
|            |            | orange  |         |         |   | 4             |
|            |            | purple  |         |         |   | 5             |
| <b>19.</b> | <b>VG</b>  | <b>Stem: growth habit</b>                         |         |         |   |               |
| <b>(*)</b> |            |   |         |         |   |               |
| <b>(+)</b> |            |   |         |         |   |               |
| <b>QN</b>  | <b>(c)</b> | straight  |         |         |   | 1             |
|            |            | zigzag  |         |         |   | 2             |
| <b>20.</b> | <b>VG</b>  | <b>Stem: prominence of leaf scars on nodes</b>    |         |         |   |               |
| <b>QN</b>  |            | weak  |         |         | Kibandameno, Nguzo  | 3             |
|            |            | medium  |         |         | Karemba, Karibuni   | 5             |
|            |            | strong  |         |         |   | 7             |
| <b>21.</b> | <b>MS</b>  | <b>Stem: distance between leaf scars on nodes</b> |         |         |   |               |
| <b>(+)</b> |            |   |         |         |   |               |
| <b>QN</b>  | <b>(c)</b> | short   |         |         |   | 3             |
|            |            | medium  |         |         |   | 5             |
|            |            | long  |         |         |   | 7             |

|            |            | English  | français | Deutsch | español | Example Varieties/<br>Exemples/<br>Beispielssorten/<br>Variedades ejemplo | Note/<br>Nota |  |
|------------|------------|--|----------|---------|---------|---|---------------|--|
| <b>22.</b> | <b>VG</b>  | <b>Stem: color of end branches (at top 20 cm of plant)</b> |          |         |         |   |               |  |
| <b>(*)</b> |            |  |          |         |         |   |               |  |
| <b>PQ</b>  | <b>(c)</b> | green  |          |         |         | Karembo, Karibuni   | 1             |  |
|            |            | reddish green  |          |         |         | Kibandameno   | 2             |  |
|            |            | purplish green   |          |         |         | Nguzo, Nzalauka   | 3             |  |
|            |            | greenish purple  |          |         |         |   | 4             |  |
|            |            | purple   |          |         |         |   | 5             |  |
|            |            | red  |          |         |         | Clone 2021  | 6             |  |
| <b>23.</b> | <b>VG</b>  | <b>Root: peduncle</b>                                      |          |         |         |   |               |  |
| <b>(+)</b> |            |  |          |         |         |   |               |  |
| <b>QL</b>  | <b>(c)</b> | absent   |          |         |         | Clone 1366, Nzalauka  | 1             |  |
|            |            | present  |          |         |         | Karembo, Nguzo, Tajirika  | 9             |  |
| <b>24.</b> | <b>VG</b>  | <b>Root: external color</b>                                |          |         |         |   |               |  |
| <b>PQ</b>  | <b>(c)</b> | whitish  |          |         |         | Karembo, Kibandameno, Tajirika  | 1             |  |
|            |            | light brown  |          |         |         | Karibuni, Nguzo, Siri,  | 2             |  |
|            |            | dark brown   |          |         |         | Clone 1380  | 3             |  |
| <b>25.</b> | <b>VG</b>  | <b>Root: color of cortex</b>                               |          |         |         |   |               |  |
| <b>PQ</b>  | <b>(c)</b> | white  |          |         |         |   | 1             |  |
|            |            | cream  |          |         |         |   | 2             |  |
|            |            | yellow   |          |         |         |   | 3             |  |
|            |            | pink   |          |         |         |   | 4             |  |
|            |            | purple   |          |         |         |   | 5             |  |
| <b>26.</b> | <b>VG</b>  | <b>Root: color of flesh</b>                                |          |         |         |   |               |  |
| <b>PQ</b>  | <b>(c)</b> | white  |          |         |         |   | 1             |  |
|            |            | cream  |          |         |         |   | 2             |  |
|            |            | light yellow   |          |         |         |   | 3             |  |
|            |            | dark yellow  |          |         |         |   | 4             |  |
|            |            | pink   |          |         |         |   | 5             |  |
| <b>27.</b> | <b>VG</b>  | <b>Root: texture of epidermis</b>                          |          |         |         |   |               |  |
| <b>QL</b>  | <b>(c)</b> | smooth   |          |         |         | Clone 2021, Karembo   | 1             |  |
|            |            | rough  |          |         |         | Nguzo, Nzalauka   | 9             |  |

|            | English           | français                                      | Deutsch | español | Example Varieties/<br>Exemples/<br>Beispielssorten/<br>Variedades ejemplo | Note/<br>Nota |  |
|------------|-------------------|---|---------|---------|---|---------------|--|
| <b>28.</b> | <b>VG</b>         | <b>Root: shape</b>                            |         |         |   |               |  |
|            | <b>(+)</b>        |   |         |         |   |               |  |
| <b>PQ</b>  | <b>(c)</b>        | conical                                       |         |         | Karibuni, Nguzo, Nzalauka   | 1             |  |
|            |                   | conical to cylindrical                        |         |         | Clone 2021, Kibandameno   | 2             |  |
|            |                   | cylindrical                                   |         |         | Clone 1380, Clone 2095  | 3             |  |
|            |                   | irregular                                     |         |         | Shibe, Siri   | 4             |  |
| <b>29.</b> | <b>MS/<br/>MG</b> | <b>Root: cyanide content</b>                  |         |         |   |               |  |
|            | <b>(+)</b>        |   |         |         |   |               |  |
| <b>QN</b>  | <b>(c)</b>        | low   |         |         |   | 1             |  |
|            |                   | medium  |         |         |   | 2             |  |
|            |                   | high  |         |         |   | 3             |  |
| <b>30.</b> | <b>VG</b>         | <b>Root: adherence of<br/>cortex to flesh</b> |         |         |   |               |  |
|            | <b>(+)</b>        |   |         |         |   |               |  |
| <b>QN</b>  | <b>(c)</b>        | weak  |         |         | Karembo, Karibuni,<br>Kibandameno   | 3             |  |
|            |                   | medium  |         |         | Clone 1380, Clone 2021,<br>Nguzo  | 5             |  |
|            |                   | strong  |         |         | Clone 1366  | 7             |  |

8. Explanations on the Table of Characteristics

8.1 *Explanations covering several characteristics*

Characteristics containing the following key in the second column of the Table of Characteristics should be examined as indicated below:

- (a) Observations should be made after 90 days (3 months) from planting
- (b) Observations should be made after 180 days (6-9 months) from planting and at the middle third of the plant unless otherwise specified
- (c) Observations should be made after 360 days (12 months) from planting

8.2 *Explanations for individual characteristics*

Ad. 1: Apical leaf: color



1  
light green



2  
dark green



3  
purplish green



4  
purple

Ad. 2: Apical leaf: pubescence

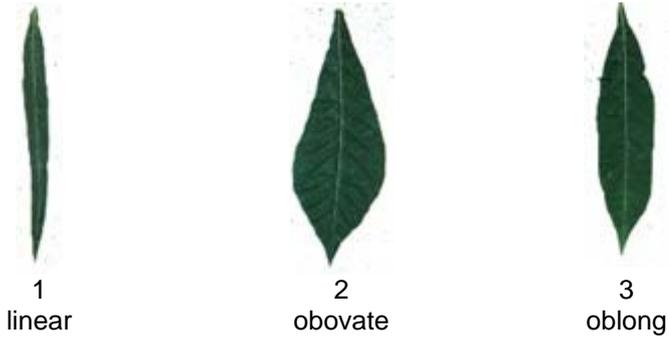


1  
absent

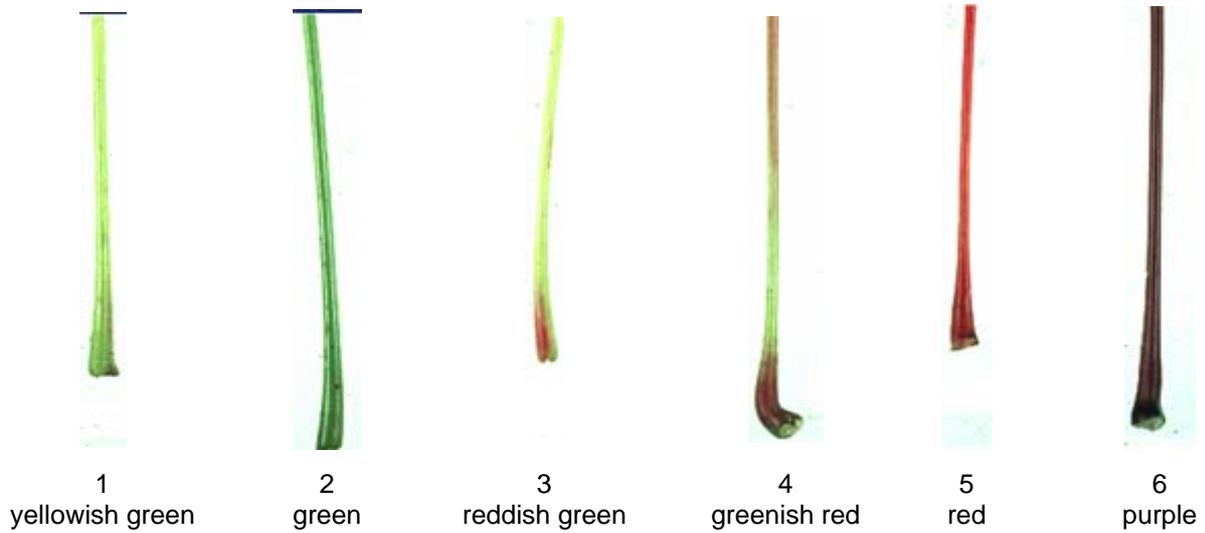


9  
present

Ad. 3: Leaf: predominant shape of central lobe



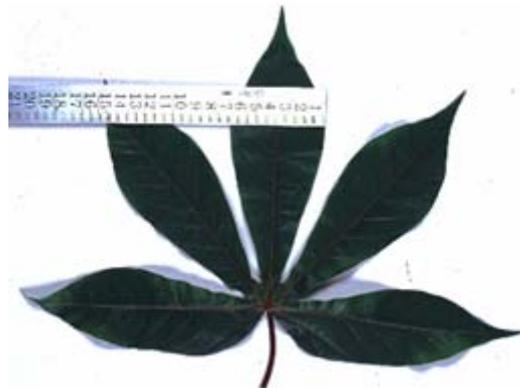
Ad. 4: Petiole: color



Ad. 7: Leaf: length of central lobe



Ad. 8: Leaf: width of central lobe



Ad. 9: Leaf: color of veins



1  
green



2  
reddish green



3  
red

Ad. 10: Petiole: attitude in relation to stem



1  
semi erect



2  
horizontal



3  
drooping



4  
irregular

Ad. 11: Stipule: length



3  
short



5  
medium



7  
long

Ad. 12: Stipule: margin



1  
entire



2  
split

Ad. 19: Stem: growth habit



1  
straight



2  
zigzag

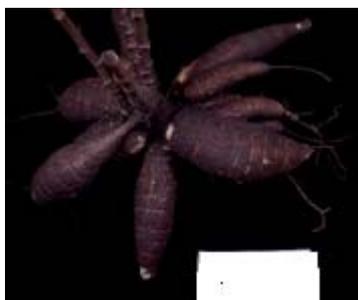
Ad. 21: Stem: distance between leaf scars on nodes

short < 8 cm

medium 8 - < 15 cm

long >15 cm

Ad. 23: Root: peduncle

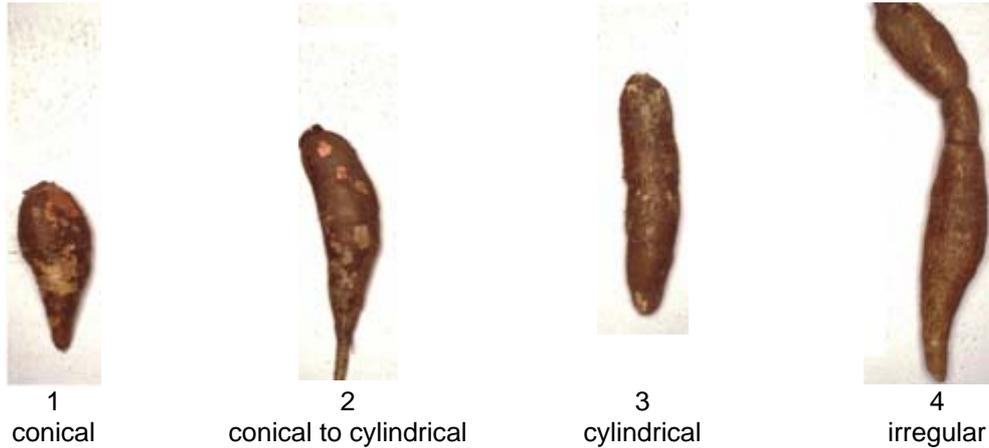


1  
absent



9  
present

Ad. 28: Root: shape



Ad. 29: Root: cyanide content

**Rapid screening assay of cyanide content of cassava (Williams and Edward (1980) method)**

This is a rapid, inexpensive screening assay developed in order to measure the cyanide content of cassava (*Manihot esculenta* Crantz.) tubers. A small disc of parenchyma tissue cut with a cork borer or alternatively grated tissue placed in a stoppered glass tube with a filter paper previously spotted with a drop of tetra-base [4,4'-methylenebis-(N,N-dimethylaniline)] and cupric acetate and hydrogen. Cyanide liberated produces a blue color on the filter paper. The intensity of the blue color developed within one hour is rated visually on a graded scale from 0 to 5. The correlation coefficient between samples accurately analyzed for total cyanide and also tested using the rapid assay is 0.77.

|                        |            |
|------------------------|------------|
| Low cyanide content    | 0 to 1.9   |
| Medium cyanide content | 2.0 to 3.9 |
| High cyanide content   | 4.0 to 5.0 |

Ad. 30: Root: adherence of cortex to flesh

Involves hand removal of root cortex from the middle third of freshly harvested root tuber. Weak adherence is when the cortex is removed round the root tuber without any breakage while strong adherence is when peeling of the cortex exhibits a lot of breaking and for medium adherence there is minimal breaking of the cortex.

9. Literature

Allem, A.C., 2002: The origin and taxonomy of cassava. CABI, pp. 1-16.

Alves, A.A. C., 2002: Cassava botany and physiology. CABI, pp. 67-89.

Brazilian Agricultural Research Corporation (*EMBRAPA*) test guideline for cassava.

Kenya Agricultural Research Institute (*KARI*) 2008/2009 National cassava breeding & improvement program.

10. Technical Questionnaire

|  |  |   |
|--|--|---|
| TECHNICAL QUESTIONNAIRE  | Page {x} of {y}  | Reference Number:   |
|  |  | Application date:<br>(not to be filled in by the applicant) |
| <b>TECHNICAL QUESTIONNAIRE</b><br>to be completed in connection with an application for plant breeders' rights |  |   |
| 1. Subject of the Technical Questionnaire  |  |   |
| 1.1 Botanical name   | <input type="text" value="Manihot esculenta Crantz."/> |   |
| 1.2 Common name  | <input type="text" value="Cassava"/>                   |   |
| 2. Applicant   |  |   |
| Name   | <input type="text"/>                                   |   |
| Address  | <input type="text"/>                                   |   |
| Telephone No.  | <input type="text"/>                                   |   |
| Fax No.  | <input type="text"/>                                   |   |
| E-mail address   | <input type="text"/>                                   |   |
| Breeder (if different from applicant)  | <input type="text"/>                                   |   |
| 3. Proposed denomination and breeder's reference   |  |   |
| Proposed denomination<br>(if available)  | <input type="text"/>                                   |   |
| Breeder's reference  | <input type="text"/>                                   |   |

|                         |                 |                   |
|-------------------------|-----------------|-------------------|
| TECHNICAL QUESTIONNAIRE | Page {x} of {y} | Reference Number: |
|-------------------------|-----------------|-------------------|

#4. Information on the breeding scheme and propagation of the variety

4.1 Breeding scheme

Variety resulting from:

4.1.1 Crossing

(a) controlled cross [ ]  
(please state parent varieties)

(.....) x (.....)  
female parent male parent

(b) partially known cross [ ]  
(please state known parent variety(ies))

(.....) x (.....)  
female parent male parent

(c) unknown cross [ ]

4.1.2 Mutation [ ]  
(please state parent variety)

.....

4.1.3 Discovery and development [ ]  
(please state where and when discovered and how developed)

.....

4.1.4 Other [ ]  
(please provide details)

.....

# Authorities may allow certain of this information to be provided in a confidential section of the Technical Questionnaire.

|                         |                 |                   |
|-------------------------|-----------------|-------------------|
| TECHNICAL QUESTIONNAIRE | Page {x} of {y} | Reference Number: |
|-------------------------|-----------------|-------------------|

4.2 Method of propagating the variety

4.2.1 Vegetative propagation

- (a) cuttings [ ]
- (b) *in vitro* propagation [ ]
- (c) other (state method) [ ]

[ ]

4.2.2 Seed [ ]

4.2.3 Other [ ]  
(please provide details)

[ ]

|                         |                 |                   |
|-------------------------|-----------------|-------------------|
| TECHNICAL QUESTIONNAIRE | Page {x} of {y} | Reference Number: |
|-------------------------|-----------------|-------------------|

5. Characteristics of the variety to be indicated (the number in brackets refers to the corresponding characteristic in Test Guidelines; please mark the note which best corresponds).

| Characteristics  | Example Varieties              | Note |
|--|--------------------------------|------|
| <b>5.1 Apical leaf: color</b><br><b>(1)</b>                      |                                |      |
| light green  |                                | 1[ ] |
| dark green   | Clone 2005/0034                | 2[ ] |
| purplish green   | Clone 82/001                   | 3[ ] |
| purple   |                                | 4[ ] |
| <b>5.2 Apical leaf: pubescence</b><br><b>(2)</b>                 |                                |      |
| absent   | Clone 2005/0034                | 1[ ] |
| present  | Clone 82/0058                  | 9[ ] |
| <b>5.3 Leaf: predominant shape of central lobe</b><br><b>(3)</b> |                                |      |
| linear   |                                | 1[ ] |
| obovate  |                                | 2[ ] |
| oblong   |                                | 3[ ] |
| <b>5.4 Petiole: color</b><br><b>(4)</b>                          |                                |      |
| yellowish green  | Nzalauka, Shibe, Siri          | 1[ ] |
| green  | Karibuni                       | 2[ ] |
| reddish green  | Clone 517, Karembo, Tajirika   | 3[ ] |
| greenish red   |                                | 4[ ] |
| red  | Clone 2021, Kibandameno, Nguzo | 5[ ] |
| purple   | Clone 1366                     | 6[ ] |
| <b>5.5 Leaf: variegation</b><br><b>(6)</b>                       |                                |      |
| absent   |                                | 1[ ] |
| present  |                                | 9[ ] |

|                         |                 |                   |
|-------------------------|-----------------|-------------------|
| TECHNICAL QUESTIONNAIRE | Page {x} of {y} | Reference Number: |
|-------------------------|-----------------|-------------------|

| Characteristics                                       | Example Varieties       | Note |
|---|-------------------------|------|
| <b>5.6 Petiole: attitude in relation to stem (10)</b> |                         |      |
| semi erect  | Karembo, Tajirika       | 3[ ] |
| horizontal  | Nguzo, Siri             | 5[ ] |
| drooping  | Clone 1380, Kibandameno | 7[ ] |
| irregular   | Nzalauka                | 9[ ] |
| <b>5.7 Stipule: length (11)</b>                       |                         |      |
| very short  |                         | 1[ ] |
| very short to short                                   |                         | 2[ ] |
| short   | Karibuni                | 3[ ] |
| short to medium                                       |                         | 4[ ] |
| medium  | Karembo, Karibuni       | 5[ ] |
| medium to long  |                         | 6[ ] |
| long  | Clone 517, Nguzo        | 7[ ] |
| long to very long                                     |                         | 8[ ] |
| very long   |                         | 9[ ] |
| <b>5.8 Stem: color of exterior (17)</b>               |                         |      |
| orange  |                         | 1[ ] |
| greyish yellow  | Kibandameno             | 2[ ] |
| greenish yellow                                       | Clone 2021, Siri        | 3[ ] |
| golden  |                         | 4[ ] |
| light brown   | Clone 1380              | 5[ ] |
| dark brown  |                         | 6[ ] |
| silver  | Karibuni, Nguzo         | 7[ ] |
| <b>5.9 Stem: growth habit (19)</b>                    |                         |      |
| straight  |                         | 1[ ] |
| zigzag  |                         | 2[ ] |

|                         |                 |                   |
|-------------------------|-----------------|-------------------|
| TECHNICAL QUESTIONNAIRE | Page {x} of {y} | Reference Number: |
|-------------------------|-----------------|-------------------|

| Characteristics  | Example Varieties | Note |
|--|-------------------|------|
| <b>5.10 Stem: color of end branches (at top 20 cm of plant)</b><br><b>(22)</b> |                   |      |
| green  | Karemba, Karibuni | 1[ ] |
| reddish green  | Kibandameno       | 2[ ] |
| purplish green   | Nguzo, Nzalauka   | 3[ ] |
| greenish purple  |                   | 4[ ] |
| purple   |                   | 5[ ] |
| red  | Clone 2021        | 6[ ] |
| <b>5.11 Root: cyanide content</b><br><b>(29)</b>                               |                   |      |
| low  |                   | 1[ ] |
| medium   |                   | 2[ ] |
| high   |                   | 3[ ] |

|                         |                 |                   |
|-------------------------|-----------------|-------------------|
| TECHNICAL QUESTIONNAIRE | Page {x} of {y} | Reference Number: |
|-------------------------|-----------------|-------------------|

6. Similar varieties and differences from these varieties

*Please use the following table and box for comments to provide information on how your candidate variety differs from the variety (or varieties) which, to the best of your knowledge, is (or are) most similar. This information may help the examination authority to conduct its examination of distinctness in a more efficient way.*

| Denomination(s) of variety(ies) similar to your candidate variety | Characteristic(s) in which your candidate variety differs from the similar variety(ies) | Describe the expression of the characteristic(s) for the <b>similar</b> variety(ies) | Describe the expression of the characteristic(s) for the characteristic(s) for <b>your</b> candidate variety |
|---|---|--|--|
| <i>Example</i>  |   |  |  |
|   |   |  |  |
|   |   |  |  |
|   |   |  |  |

Comments:

|                         |                 |                   |
|-------------------------|-----------------|-------------------|
| TECHNICAL QUESTIONNAIRE | Page {x} of {y} | Reference Number: |
|-------------------------|-----------------|-------------------|

#7. Additional information which may help in the examination of the variety

7.1 In addition to the information provided in sections 5 and 6, are there any additional characteristics which may help to distinguish the variety?

Yes [ ] No [ ]

(If yes, please provide details)

7.2 Are there any special conditions for growing the variety or conducting the examination?

Yes [ ] No [ ]

(If yes, please provide details)

7.3 Other information

8. Authorization for release

(a) Does the variety require prior authorization for release under legislation concerning the protection of the environment, human and animal health?

Yes [ ] No [ ]

(b) Has such authorization been obtained?

Yes [ ] No [ ]

If the answer to (b) is yes, please attach a copy of the authorization.

|                         |                 |                   |
|-------------------------|-----------------|-------------------|
| TECHNICAL QUESTIONNAIRE | Page {x} of {y} | Reference Number: |
|-------------------------|-----------------|-------------------|

9. Information on plant material to be examined or submitted for examination.

9.1 The expression of a characteristic or several characteristics of a variety may be affected by factors, such as pests and disease, chemical treatment (e.g. growth retardants or pesticides), effects of tissue culture, different rootstocks, scions taken from different growth phases of a tree, etc.

9.2 The plant material should not have undergone any treatment which would affect the expression of the characteristics of the variety, unless the competent authorities allow or request such treatment. If the plant material has undergone such treatment, full details of the treatment must be given. In this respect, please indicate below, to the best of your knowledge, if the plant material to be examined has been subjected to:

- |   |         |        |
|---|---------|--------|
| (a) Microorganisms (e.g. virus, bacteria, phytoplasma)    | Yes [ ] | No [ ] |
| (b) Chemical treatment (e.g. growth retardant, pesticide) | Yes [ ] | No [ ] |
| (c) Tissue culture  | Yes [ ] | No [ ] |
| (d) Other factors   | Yes [ ] | No [ ] |

Please provide details for where you have indicated "yes".

.....

10. I hereby declare that, to the best of my knowledge, the information provided in this form is correct:

Applicant's name

Signature

Date

[End of document]