NEW CASSAVA VARIETIES FOR CAMEROON

A technical guide

International Institute of Tropical Agriculture
National Root and Tuber Development Program
Institute of Agricultural Research for Development
International Fund for Agricultural Development

IITA
Research to Nourish Africa

PNDRT
COOPERATION CAMEROUN FIDA

IRAD

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Enabling poor rural people
to overcome poverty

This technical guide was compiled by an IITA team composed of Dr R. Hanna (Country Representative, IITA-Cameroon), Mr. E. Njukwe (IITA-Burundi and formerly Research Associate, IITA-Cameroon), Ms. D. Amah (formerly Research Assistant, IITA-Cameroon), Dr. A. Tenkouano (formerly Plant Breeder, IITA-Cameroon), Dr. A. Dixon (formerly Plant Breeder, IITA-Nigeria), Mr. A. Nguenkam (formerly Research Assistant, IITA-Cameroon), Dr A. Fotso Kuate (Research Associate, IITA-Cameroon), Mr Armand Fotio Doumtsop (PhD student, IITA-Cameroon), and Dr. Z. Ngoko (formerly IITA Consultant, Plant Pathologist, IRAD). Plant photos are IITA while cassava products photos are PNDRT and IITA.

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Foreword

Cassava (*Manihot esculenta* Crantz) generally has unstable yields due to biotic and abiotic constraints. Several pests {cassava green mite (CGM), cassava mealybug (CM), African root and tuber scale (ARTS), grasshoppers, and termites} and diseases {cassava mosaic disease (CMD), cassava bacterial blight (CBB), cassava anthracnose disease (CAD), and root rot} can limit cassava yield. These constraints along with lack of improved varieties and the prevalence of poor agronomic practices can severely limit the growth and productivity of this crop. High yielding and multiple pest/disease resistant germplasm with low cyanide potential, along with improved agricultural practices and transformation technologies are now available to elevate cassava productivity and its contribution to food security, income generation and enhancing livelihoods.

The International Institute of Tropical Agriculture (IITA) has a broad mandate within the CGIAR on cassava research for development in Africa, In the quest of enhancing food security in Africa in general and in Cameroon in particular, the Institute has been engaged in research to enhance cassava production through the development of widely adapted high yielding multiple disease/pest resistant varieties along with IPM packages to reduce pest/disease losses, and transformation for increasing market opportunities.

This manual is intended to be a guide for recognition of the distinctive features of improved cassava that have been tested and distributed in Cameroon. Five varieties that have undergone extensive testing in Cameroon are described herein. The guide provides information on origin and geographic adaptation, morphological characteristics, reaction to major diseases and pests, yield and vegetation cycle, sensory and nutritional qualities, and processing options. The five varieties have been tested widely with farmer participation. Four of the varieties are now widely distributed (through PNDRT, private sector partners, and IFAD project with IITA on cassava IPM), although not yet officially released, and three of them are presently being used for the management of the Ugandan strain of EACMV (East African Cassava Mosaic Virus) which was detected jointly by IITA and IRAD in 2009.

This guide is the product of collaboration between the International Institute of Tropical Agriculture (IITA), the National Programme for Roots and Tubers Development (PNDRT), the Institute of Agricultural Research for Development (IRAD) and many Non-Governmental Organizations (NGOs) and farmer associations involved in cassava production and processing, with partial financial support from the International Fund for Agricultural Development and IITA Core Donors.

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IITA TMS 92/0326 (Abui-Pkwem)

Photos legend:
Top and Middle: Young and mature plants
Bottom: Roots with root cut to expose flesh color.

Origin, pedigree and adaptations:
Source: IITA-Nigeria
Year of introduction: 1999
Year of selection: 2002
Pedigree: (TMS 91934 x TME 1) HS
Adaptation: Center, South, Littoral, East, West, North-West, South-West and Adamawa Regions

Appearance:
Height at first branching: <1.0 m
Petiole color: Reddish green
Storage root peel color: Cream
Storage root size: Length: 75 cm; girth: 30 cm
Storage root flesh color**:** White

Disease and pest reaction:
Cassava mosaic disease (CMD): Resistant
Cassava bacterial blight (CBB): Resistant
Cassava anthracnose disease (CAD): Moderately resistant
African root and tuber scale (ARTS): Tolerant
Cassava green mite (CGM): Tolerant
Biological control of CGM: Highly favorable

Yield and vegetation cycle:
Fresh yield (ton/ha): 20-30
Dry matter content (%): 38
Marketable yield (ton/ha): 23
Vegetative cycle: 12 months

Sensory qualities:
Boil and eat: cooks well in most production areas
Taste**:** normal

Nutritional quality:
Caratenoids: 0.72 ug/g
Iron: 6.08 ug/g
Zink: 5.32 ug/g

Processing options:
"Mintumba", "beignets de manioc" (makala), wet and dry "foufou", "nkonda", "cosettes", "medou-me-mbong", starch, "gari", flour, chips, and vegetables.

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IITA TMS 96/1414 (Nko'h Menzui)

Photos legend:
Top and Middle: Young and mature plants
Bottom: Roots with root cut to expose flesh color.

Origin, pedigree, and adaptation:
Source: IITA-Nigeria
Year of introduction: 1999
Year of selection: 2002
Pedigree: TMS 91/02319 X MANGAZO
Adaptation: Center, South, Littoral, East, West, North-West, South-West and Adamawa Regions

Appearance:
Height at first branching: <1m
Petiole color: Red
Storage root peel color: Cream
Size of storage root: length: 60cm; girth: 20cm
Storage root flesh color**:** White

Disease and pest reaction:
Cassava mosaic disease (CMD): Resistant (also to EACMV-UG)
Cassava bacterial blight (CBB): Moderately resistant
Cassava anthracnose disease (CAD): Moderately resistant
African root and tuber scale (ARTS): Highly susceptible
Cassava green mite (CGM): Susceptible
Biological control of CGM: Not favorable

Yield and vegetation cycle:
Fresh Yield (ton/ha): 22-35
Dry matter content (%): 38
Marketable yield (ton/ha): 23
Vegetation cycle: 12 months

Sensory qualities:
Boil and eat: No – bitter
Taste**:** Normal

Nutritional quality:
Caratenoids: 0.78 ug/g
Iron: 6.20 ug/g
Zink: 7.28 ug/g

Processing options:
"Mintumba", "beignets de manioc" (makala), wet and dry "foufou", "nkonda", "cosettes", alcohol, "gari", flour, chips, and vegetables.

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IITA TMS 96/0023 (Abeng-Lengon)

Photos legend:
Top and middle: Young and mature plants.
Bottom: Roots with root cut to expose flesh color.

Origin, pedigree, and adaptation:
Source: IITA-Nigeria
Year of introduction: 1999
Year of selection: 2003
Pedigree: TMS 91934(4x) HS
Adaptation: Center, South, Littoral, East, and South-West Regions

Appearance:
Height at first branching: <1 m
Petiole color: Reddish green
Storage root peel color: Cream
Size of storage root: length: 30 cm; girth: 20 cm
Storage root flesh color: White

Disease/pest reaction:
Cassava mosaic disease (CMD): Resistant (also to EACMV-Ug)
Cassava bacterial blight (CBB): Resistant
Cassava anthracnose disease (CAD): Resistant
African root and tuber scale (ARTS): Highly tolerant
Cassava green mite (CGM): Tolerant
Biological control of CGM: Moderately favorable

Yield and vegetation cycle:
Fresh yield (ton/ha): 18-27
Dry matter content (%): 37
Marketable yield (ton/ha): 23
Vegetative cycle: 12 months

Sensory qualities:
Boil and eat: cooks well in some production areas
Taste: Normal

Nutritional quality:
Caratenoids: 0.59 ug/g
Iron: 4.49 ug/g
Zink: 7.16 ug/g

Processing options:
"Mintumba", "bâton de manioc", "beignets de manioc" (makala), wet and dry "foufou", "nkonda", "cosettes", "medou-me-mbong", "gari", flour, chips, and vegetables.

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IITA TMS 92/0057 (Ayeng ye-sahti)

Photos legend:
Top and middle: Young and mature plants.
Bottom: Roots with root cut to expose flesh color.

Origin, pedigree, and adaptation:
Source: IITA-Nigeria
Year of introduction: 1999
Year of selection: 2004
Pedigree: (30555 x TME 1) HS
Adaptation: Center, South, Littoral, East, West, North-West, and South-West Regions

Appearance:
Height at first branching: >1m
Petiole color: Red
Storage root peel color: Cream
Size of storage root: length: 60 cm; girth: 20 cm
Storage root flesh color: White

Disease/pest reaction:
Cassava mosaic disease (CMD): Resistant (also to EACMV-UG)
Cassava bacterial blight (CBB): Moderately resistant
Cassava anthracnose disease (CAD): Moderately resistant
African root and tuber scale (ARTS): Tolerant
Cassava green mite (CGM): Tolerant
Biological control of CGM: Moderately favorable

Yield and vegetation cycle:
Fresh yield (ton/ha): 21-30
Dry matter content (%): 38
Marketable yield (ton/ha): 25
Vegetative cycle: 12 months

Sensory qualities:
Boil and eat: Cooks very well
Taste: Normal

Nutritional quality:
Caratenoids: 0.83 ug/g
Iron: 7.48 ug/g
Zink: 8.83 ug/g

Processing options
"Mintumba", "bâton de manioc", "beignets de manioc" (makala), wet and dry "foufou", "nkonda", "cosettes", "medou-me-mbong", alcohol, "gari", flour, chips, and vegetables.

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IITA TMS 92/0067 (Mbong Wa Tobo)

Photos legend:
Top and middle: Young and mature plants.
Bottom: Roots with root cut to expose flesh color.

Origin, pedigree, and adaptation:
Source: IITA-Nigeria
Year of introduction: 2008
Year of selection: 2010
Pedigree: (91934 x TME 1) HS
Adaptation: East, North-West, Adamawa, and North Regions; drought tolerant.

Appearance:
Height at first branching: ~1m
Petiole color: Red
Storage root peel color: Cream/White
Size of storage root: length: 30 cm; girth: 20 cm
Storage root flesh color: White

Disease/pest reaction:
Cassava mosaic disease (CMD): Resistant (also for EACMV-UG)
Cassava bacterial blight (CBB): Moderately resistant
Cassava anthracnose disease (CAD): Moderately resistant
African root and tuber scale (ARTS): Unknown
Cassava green mite (CGM): Tolerant
Biological control of CGM: Highly favorable

Yield and vegetation cycle:
Fresh yield (ton/ha): 18-24
Dry matter content (%): 22
Marketable yield (ton/ha): 18
Vegetative cycle: 12 months

Sensory qualities:
Boil and eat: Cooks very well
Taste: Normal

Nutritional quality:
Caratenoids: 0.91 ug/g
Iron: 6.89 ug/g
Zink: 9.2 ug/g

Processing options
"Mintumba", "bâton de manioc", "beignets de manioc" (makala), wet and dry "foufou", "nkonda", "cosettes", "medou-me-mbong", "gari", flour, chips, and vegetables.

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APPENDIX I

Cultural practices

Planting material: Healthy cuttings of 25-30cm long with 5-8 nodes.

Planting style: Inclined at an angle (45^0) with nodes facing up and 2/3 buried on ridge or mount .

Planting density: 12,000 plants/ha spaced 1m x 0.8 m.

Planting time: Varies with season/region.
-March-May in mono-modal rainfall area.
-March-April and August-September in bimodal rainfall area.

Harvest time: 10 – 12 months after planting.

Maintenance: Manual weeding is preferred at 1 month after planting and at 2 months interval.

Fertilizer: Organic is preferred if available.

APPENDIX II

Processing options

1) Mintumba

1- Peel and wash fresh cassava roots.
2- Soak in warm water for 3 – 4 days to ferment (to facilitate fermentation, place container near the fire or cover with pawpaw leaves).
3- Wash fermented product properly and put in a clean bag and press to dewater.
4- Sieve to remove lumps and fibers.
5- Grind to form a paste.
6- Salt to taste.
7- Add palm oil to preference.
8- Wrap in leaf and boil.
9- Product could be eaten directly or served with tea, sugar and chocolate.

2) Baton de manioc (Bobolo / Myondo)

1- Peel and wash fresh cassava roots.
2- Soak in warm water for 3 – 4 days to ferment (to facilitate fermentation, place container near the fire or cover with pawpaw leaves).
3- Wash fermented product properly and put in a clean bag and press to dewater.
4- Sieve to remove lumps and fibers.
5- Grind to form a paste.
6- Wrap in leaf and boil.
7- Product could be served with groundnut sauce, stew, groundnut and egusi pudding.

3) Beignets de manioc (macalah banana)

1- Peel and wash fresh cassava roots.
2- Grater the fresh roots.
3- Sieve to eliminate fibre and stalk.
4- Pound ripe banana or plantain and mix with sieved product.
5- Add palm oil to give cream colour when fried.

Note: The cassava / banana mixture should not be sticky when rolled for frying. Fried product could be served with pepper sauce or taken with pap or tea.

4) Ndas

1- Peel and wash whole cassava root.
2- Soak in fresh water for 3 – 4 days.
3- Remove whole root.
4- Wrap and boil.

Note: Product could be served with sauce and preferred by the old because it is very easy to chew contrary to baton de manioc.

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5) Dry couscous du manioc (foufou)

1- Peel roots and wash.
2- Soak in water (2 – 3 days).
3- Remove from water, break in pieces and dry.
4- Store in airtight container at room temperature.

Note: For white foufou product, drying should be completed in one day.

6) Fresh couscous (Water foufou)

1- Repeat steps 1 – 5 in 1 (Mintumba).
2- Put product in a clean bag, put on some weight on tied bag or compress to drain water.

Note: Product could be wrapped in polybags and stored in freezer.

7) Konda

1- Peel and wash fresh cassava roots
2- Grater cassava roots
3- Sieve product
4- Mix product with groundnut paste
5- Add salt, pepper, cray fish and palm oil
6- Wrap in leaf and boil
7- Allow to dry in a dryer or band

8) Chips (cossettes) and flour

1- Peel and wash fresh roots.
2- Cut in small pieces.
3- Soak for 24 hours.
4- Remove and sun dry or oven dry.
5- Mill to produce flour.

9) Alcohol

1- Peel and wash fresh roots.
2- Put in a drum or cemented chamber.
3- Cover with nitrogen fixing leaves for 3 days (absence of water).
4- Transfer to a second drum for 3 days in water.
5- Add some sugar and do not seal drum tightly.
6- Make an outlet on the upper surface of the drum.
7- Steam and collect condensed vapor after 6 days.
8- Distilled product may have up to 95° alcohol.

10) Starch (Amidon)

1- Peel and wash fresh cassava roots.
2- Grate, or chip and grind smoothly and mix with a lot of clean water.
3- Filter through a fine mesh sieve or through muslin cloth.
4- Allow the filtrate to settle and decant the supernatant.
5- Wash off the starch residue several times with water to get white, odorless, and tasteless starch.
6- Put in a clean bag and press to dewater.
7- Spread thinly on a tray and sun dry.
8- Mill the dried cake finely and sift if necessary and package in airtight containers.

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13) Gari

1- Peel and wash fresh cassava roots.
2- Grate the root into a mash.
3- Dewater the mash by pressing inside a clean bag.
4- Break the pressed mash into fine granules.
5- Sieve.
6- Add palm oil and fry in a metallic tray or oven to dry (yellow gari).
7- For white gari, fry without adding palm oil.
8- Package in airtight container.

14) Mbom kwem

1- Harvest fresh cassava leaves.
2- Pound.
3- Boil with salt for 15-20 minutes.
4- Dewater by pressing inside a clean bag.
5- Boil palm nut and extract oil.
6- Mix leaf, palm oil, salt, magi, cray fish, groundnut paste, pepper, and bush spices to taste.
7- Wrap and dry in oven.

About IITA

The International Institute of Tropical Agriculture (IITA) is an Africa-based international research-for-development organization, established in 1967, and governed by a board of trustees. Our vision is to be one of Africa's leading research partners in finding solutions for hunger and poverty. We have more than 100 international scientists based in various IITA stations across Africa. We work with partners in Africa and beyond to reduce producer and consumer risks, enhance crop quality and productivity, and generate wealth from agriculture. IITA is an international non-profit R4D organization since 1967, governed by a Board of Trustees, and supported primarily by the CGIAR (www.cgiar.org).

Africa has complex problems that plague agriculture and people's lives. We develop agricultural solutions with our partners to tackle hunger and poverty. Our award winning research-for-development (R4D) is based on focused, authoritative thinking anchored on the development needs of sub-Saharan Africa. Our mission is to enhance food security and improve livelihoods in Africa through research-for-development (R4D). IITA's R4D model proves effective in setting a research course that addresses major development problems in Africa rather than simply contributing to scientific knowledge, say external reviews. IITA and partners have delivered the bulk (70%) of the international research impact in SSA in the last three decades. Our R4D model is unique in that (1) it focuses on long-term development needs to guide our research design and choice of partners; and (2) it incorporates two critical elements absent in traditional models: a mid-process initial research-outcome and an explicit *EXIT*-strategy for IITA.

We group all our R4D projects and activities under the following programs: Agriculture and Health, Agro-biodiversity, Banana and Plantain Systems, Cereals and Legumes Systems, Horticulture and Tree Systems, Roots and Tubers Systems, Opportunities and Threats, and System-wide Program on Integrated Pest Management (SP-IPM). For further information, please www.iita.org

About PNDRT

The Roots and Tubers Market-Driven Development Programme has the aim of promoting the development of this sector and improving the food security and income of the poor. The project particularly targets women, who are key participants in the sector in rural areas.
More specific objectives of the programme are to:

- reinforce the structuring of roots and tubers sub-sector;
- improve the access of producers and/or processors to local, national and sub-regional channels for the marketing of R&T ;
- improve the quantitative and qualitative response of producers and processors to the market demand ; and
- contribute to the sustainable intensification of the production of R&T.

The programme contributes to growth in roots and tubers production by promoting techniques that can be widely adopted by poor farmers in post-harvest processing. It represents one of the first applications of Cameroon's rural development strategy. For further information, please www.pndrt-cm.org

About IRAD

The Institute of Agricultural Research for Development (IRAD) created and reorganized by the presidential decree N° 96/050 of March 12th, 1996 and N° 2002/230 of September 6th, 2002 respectively, is a public establishment with administrative character, endowed with the moral personality and the financial autonomy. It is under the technical supervision of the Ministry of Scientific Research and the financial supervision of the Ministry of Economy and Finance.

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IRAD has as mission to respond to the preoccupations of actors of agricultural development (stockbreeders, farmers, processors of agricultural, forestry and livestock products, etc.) throughout the national territory. To this effect, it conducts research activities aiming at promoting agricultural development in the domains of plants, animal, and fisheries productions as well as faunae, forestry and environment. It also has the responsibility to put in place food and agro-industrial technological innovations. IRAD disposes to this effect: a head office, five regional research centers based in the five major agro-ecological zones and three specialized centers of research with regional and international status, twelve multipurpose Stations, four specialized Stations, thirty-three research antennae and ten reference laboratories.

IRAD maintains fruitful relationship of collaboration and cooperation with important research organizations both at the national and international level. To realize its mission, IRAD has benefited important financing from the Cameroon government and some of its partners in the first rank of which are African Development Bank and France, through several conventions and partnership agreements during the past years. For further information, please visit www.irad-cameroon.org

About IFAD

The International Fund for Agricultural Development (IFAD) works with poor rural people to enable them to grow and sell more food, increase their incomes and determine the direction of their own lives. Since 1978, IFAD has invested over US$11 billion in grants and low-interest loans to developing countries, empowering some 350 million people to break out of poverty. IFAD is an international financial institution and a specialized UN agency based in Rome – the UN's food and agricultural hub. It is a unique partnership of 165 members from the Organization of the Petroleum Exporting Countries (OPEC), other developing countries and the Organization for Economic Co-operation and Development (OECD). For further information, please visit www.ifad.org