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CHARACTERIZING CASSAVA GERM PLASM COLLECTED FROM THE OIAPOQUE INDIGENOUS RESERVE, AMAPÁ, BRAZIL

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Abstract

We collected 33 accessions of cassava germ plasm from the Caripuna Tribe Reservation at Oiapoque, State of Amapá, during 27-30 November 1991. The materials were compared with the local cultivar Pretinha at Mazagão (Amapá) for one year. The accessions with production potential were Bulinha and Sem Nome 8 (16.7 t/ha), Macaxeira 9 (15.4 t/ha), Tapioqueira 33, Ghen Mãniok 20, and Baian (12.8 t/ha), Xingu (12.6 t/ha), and Marapanim 38 (11.8 t/ha). A major parameter was resistance to root rots, an important production constraint in Amapá. Nine accessions presented no disease symptoms.

Introduction

Cassava (*Manihot esculenta* Crantz) is the main crop in the State of Amapá, with an average production of 10.5 t/ha. It is grown mainly by resource-poor farmers for food and income. Crop management is traditional, following an exploratory and migratory type of agriculture. Original vegetation is slashed and burned. Planting material is not selected nor treated for phytosanitary problems. Planting arrangement is erratic, and weeding is usually done once, at the beginning of the crop cycle.

The main product obtained from cassava roots is *farinha*, a traditional food, produced by the family for its own consumption. Surpluses are sold at the market. Other foodstuffs produced include *tucupí* and *goma* or tapioca (Albuquerque, 1969).

The Caripuna tribe is located in the municipality of Oiapoque in Amapá. The main agricultural activity is centred on the cultivation of a broad range of cassava genotypes. Within the tribe, each genotype is well known for its special properties, and care is taken to avoid mixing genotypes.

We visited the Caripuna tribe to collect cassava germ plasm, and related indigenous

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knowledge. When we later evaluated the agronomic and botanical characteristics of this germ plasm, using morphological descriptors and passport information, we found wide genetic diversity.

Materials and Methods

The expedition took place during 27-30 November 1991, as a collaborative effort between the Centro de Pesquisa Agroflorestal (CPAF) of the Empresa Brasileira de Pesquisa Agropecuária (EMBRAPA) and the National Foundation for Native People (FUNAI, its Portuguese acronym). We collected 33 accessions from around the towns of Santa Izabel, Espírito Santo, and Manga, and other communities along the BR 156 Road.

Planting material was selected from the central third of the plants, packed, and identified with a number and the common name. Information on site of collection, date, farmer's name, and root flesh colour was also documented.

The collected accessions were evaluated in experiments during the crop cycle 1992/93 at the CPAF, in the municipality of Mazagão. Trial design consisted of one row of 10 plants, spaced 1 m apart, from which only 6 central plants were harvested. The local cultivar Pretinha was used as check. The trial was not fertilized; other cultural practices consisted of ploughing and soil conditioning.

The following descriptors were used for botanical characterization:

(1) *Germination rate.* Percentage at 75 days after planting (DAP).

(2) *Plant vigour* at 75 DAP, using the scale where 0-1 = weak; 2-3 = intermediate; and 4-5 = vigorous plants.

(3) *Flower and fruit descriptors.* The presence of at least one plant with flowers in any accession was considered to indicate that the accession can flower and produce fruits.

(4) *Leaf descriptors.* The following descriptors were evaluated between 180 and 240 DAP: colours of adult leaf, apical bud, and petiole; and sinuosity of the central lobe.

(5) *Stem descriptors.* The following descriptors were evaluated between 300 and 360 DAP: plant height (cm); number of sprouts; and stem colour. Branching time was recorded as the number of DAP until 50% of the plot had branched.

(6) *Root descriptors.* The following descriptors were evaluated at 360 DAP: root length and diameter (cm, mean of six random roots); numbers of commercial roots and rotten roots; sinuosity of, and ease of removing, the root peridermis; and colours of root exterior, cortex, and parenchyma.

(7) *Traits evaluated at harvest.* The following traits were evaluated at 360 DAP: root and foliage yield (t/ha), ease of harvest, and harvest index estimated as the percentage of root weight over the total biomass harvested for a particular accession.

Results and Discussion

Overall, the accessions presented good germination rates, with a trial average of 89.3%; 22 accessions presented 100% germination, and two showed a rate lower than that of the check cultivar Pretinha (83%), and one did not germinate. We therefore evaluated 31 accessions. For early vigour, 18 accessions scored 4 or more (the trial average was 3.6), and 28 had scores higher than those of the check (2.0).

Eighteen accessions showed an ability to flower between 90 and 240 DAP (Table 1). Fourteen showed a capacity to fruit. Four accessions did not fruit, even though they had flowered. The check does not flower or fruit. All accessions had branched by 123 DAP (the check by day 137) (Table 1), while all accessions presented at least one secondary ramification by 165 DAP. Average plant height was 167.2 cm (check is 160 cm tall). All accessions yielded a higher average of planting stakes per plant than did the check (two per plant), with an average of 2.9 (data not shown).

Descriptors based on colours are very important for characterizing accessions. Although most accessions and the check had green leaves, four were purple. About half of the accessions had silver-green stems, while the other half had reddish-green stems. Apical buds were green in 18 accessions and the check, reddish green in 12, and reddish in one. Finally, petioles were reddish green in 13 accessions; green in 9; reddish in 7; and greenish red in 2 and the check (Table 2).

The shape of the central leaf lobe was most frequently linear (21 accessions and the check); 10 accessions presented obovated leaves. In 20 accessions, the central leaf lobe was moderately sinuous; 2 showed pronounced sinuosity, while the remaining 9 and the check had smooth morphology (Table 2).

The surface of roots in most accessions was either dark (18 and check) or light (7) brown; the rest (6) were white. Twenty-one accessions had a yellow or cream-coloured cortex, 9 had a pink cortex, and one and the check a white cortex (Table 2). The colour of root parenchyma is very important, given the higher prices paid for yellow cassava roots, used in the production of yellow *farinha*. Twenty-seven accessions had a yellow or cream-coloured parenchyma, while the remaining four and the check had white.

The average root length was 30.5 cm (check averaged 26.0 cm); the longest roots were found in accessions Marapanim 36 (46.3 cm), Bató San (43.2 cm), and Tapioqueira 33 (40.0 cm). Root diameter averaged the same as for the check 3.7 cm but was thinner than expected. Accession Bulinha had the thickest roots at an average of 6.2 cm (Table 1).

Twenty-three accessions were relatively easy to harvest because the roots were not too deep; the rest and the check presented some difficulties, with a large proportion of broken roots (Table 3). The average harvest index was 52.1%. The highest indices were obtained with accessions Bulinha (77.5%), Bató San (76.7%), Marapanim 38 (66.5%), Xingu (66.3%), and Marapanim 36 (65.3%). The lowest indices were found in accessions Macaxeira 25 (21.3%) and Ló-Urukauá (28.0%).

The incidence of root rots in the humid ecosystem is a very serious constraint for cassava production; we therefore looked for resistant accessions. The incidence of root rots in the evaluation trial was relatively low: 23 accessions showed no symptoms. The most susceptible accession was Pacajá, with a score of 12.5% of rotten roots (the check scored 5.3%) (Table 3).

The average number of commercial roots per plant was 3.1 (the check averaged 3.6); accessions with the largest numbers were Macaxeira 9 (5.7), Bató San (4.3), and Marapanim 38 and Ghen Mãniok 10 (both 4.0). Thirteen accessions showed good foliage development, averaging a production of $\geq$ 7 t/ha (the check averaged 8.2 t/ha). Six accessions had foliage weight of more than 10 t/ha (Table 3). Average root yield (8.9 t/ha) was lower than the State mean (10.5 t/ha), but higher than the check (7.7 t/ha). Eleven accessions presented significantly higher root yields: Bulinha, Sem Nome 8, Macaxeira 9, Tapioqueira 33, Ghen Mãniok 20, Baian, and Xingu (Table 3).

Reference

Albuquerque M. 1969. A mandioca na Amazônia. Superintendência do Desenvolvimento da Amazônia (SUDAM), Belém, PA, Brazil.

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Table 1. Botanical characterization of a local cassava cultivar and 32 accessions collected in the Aldeia dos Caripunas (Oiapoque), Mazagão, State of Amapá, Brazil, 1992.

Accession	Germination	Vigour[a]	Ability to:		Days to branching	Plant height (cm)	Stakes/plant	Root (cm)	
			Flower	Fruit				Length	Diameter
Bulinha	100	3	Yes	Yes	123	135	2.5	31.7	6.2
Sem Nome 8	83	4	No	No	123	175	3.7	29.2	5.0
Macaxeira 9	100	5	Y	Y	123	198	4.0	31.5	4.3
Tapioqueira 33	100	4	N	N	123	198	3.3	40.0	3.8
Ghen Mãniok 20	100	4	Y	Y	123	193	2.7	30.3	5.0
Baian	100	3	N	N	151	163	2.3	25.5	5.2
Xingu	83	4	N	N	137	107	2.5	29.8	3.8
Marapanim 38	100	4	Y	N	137	182	2.8	30.2	3.4
Ghen Mãniok 10	17	4	Y	Y	123	178	3.8	21.5	4.2
Marapanim 36	100	3	N	N	137	126	2.3	46.3	3.8
Dó-Fim	100	5	Y	Y	123	140	2.8	33.8	3.9
Sem Nome 17	100	4	N	N	123	200	3.5	23.2	3.8
Bató San Juan	100	2	N	N	137	147	2.8	36.5	3.4
Bató San	100	4	Y	Y	123	153	3.2	43.2	3.3
Camarão	83	3	N	N	123	137	2.2	31.6	3.8
Sa-Uaua	100	4	Y	Y	123	168	2.5	31.0	4.4
Tapioqueira 35	83	3	Y	Y	123	175	2.8	35.5	3.4
Ró Uei	100	5	Y	Y	123	215	2.8	32.7	3.7
Tumase	100	4	Y	Y	123	193	2.7	28.3	4.3
Bató Seck	100	4	Y	Y	123	150	3.0	35.8	2.7

B.C. Noié	100	5	Y	N	123	200	2.5	39.2	3.7
Gurijuba Pequeno	83	2	Y	Y	123	102	3.7	28.5	3.1
Le Za	100	3	Y	Y	123	145	3.2	28.7	3.6
Macaxeira 6	100	5	N	N	123	198	3.0	34.5	3.7
Palikura Pequeno	100	3	N	N	123	173	3.0	29.0	3.1
Ló-Urukauá	100	4	N	N	151	225	2.5	28.8	3.2
Pacajá	83	5	Y	N	123	132	3.3	22.7	2.9
Bató Uaçá	83	3	Y	Y	165	-	-	23.3	2.7
Agami	100	3	Y	N	137	148	2.5	23.6	2.6
Macaxeira 25	100	3	N	N	123	220	2.3	25.5	2.7
Fei-Fim	67	1	N	N	137	147	3.5	19.8	3.1
Ehe-Taminan	0	-	-	-	-	-	-	-	-
Pretinha (check)	83	2	N	N	137	160	2.0	26.0	3.7
Mean	89.3	3.6	-	-	124.13	167.2	2.9	30.5	3.7
SD	22.73	1.01	-	-	10.63	32.13	0.52	6.22	0.80

a. On a scale, where 1 = very poor vigour and 5 = very vigorous.

Table 2. Morphological characterization of a local cassava cultivar and 31 genotypes collected in the Aldeia dos Caripunas (Oiapoque), Mazagão, State of Amapá, Brazil, 1992.

Accession	Colour of aerial parts				Central lobe		Colour of root parts		
	Leaf[a]	Stem	Apical bud[b]	Petiole[c]	Morph-Ology[d]	Sinuo-Sity[e]	Bark[f]	Cortex[g]	Paren-Chyma[h]
Bulinha	1	3	1	1	2	2	3	4	3
Sem Nome 8	1	2	1	2	2	3	1	3	3
Macaxeira 9	1	2	1	4	1	2	3	4	1
Tapioqueira 33	1	3	1	1	2	3	3	2	2
Ghen Mãniok 20	1	2	1	2	2	2	1	2	3
Baian	2	2	2	4	2	2	1	2	2
Xingu	1	2	1	2	2	2	3	2	2
Marapanim 38	1	3	1	2	1	3	3	4	2
Ghen Mãniok 10	1	2	2	1	2	3	2	2	2
Marapanim 36	1	2	1	2	2	3	2	2	2
Dó-Fim	1	2	1	2	2	2	3	3	3
Sem Nome 17	1	2	1	2	2	1	2	4	2
Bató San Juan	1	3	2	1	1	3	2	2	2
Bató San	1	3	2	4	2	3	3	2	2
Camarão	2	3	2	4	2	2	2	2	2
Sa-Uaua	1	2	1	1	2	3	1	2	2
Tapioqueira 35	1	2	1	3	1	2	3	2	2
Ró Uei	1	3	1	2	1	2	3	4	2
Tumase	1	3	2	4	2	2	3	4	3

Bató Seck	1	3	1	1	2	2	3	3	3
B.C. Noié	1	3	2	2	1	2	3	4	1
Gurijuba Pequeno	1	3	2	1	2	2	3	2	2
Le Za	1	2	1	1	1	2	3	2	2
Macaxeira 6	2	3	2	4	2	2	3	4	1
Palikura Pequeno	2	2	3	4	2	2	2	2	2
Ló-Urukauá	1	3	2	2	1	1	3	3	3
Pacajá	1	3	2	2	2	2	3	2	3
Bató Uaçá	1	2	1	2	1	3	1	2	3
Agami	1	2	1	3	1	2	1	3	3
Macaxeira 25	1	2	2	2	2	2	3	4	1
Fei-Fim	1	2	1	1	2	2	2	1	3
Pretinha (check)	1	2	1	3	2	3	3	1	1

a. 1 = green; 2 = purple.
b. 1 = green; 2 = reddish green; 3 = reddish.
c. 1 = green; 2 = reddish green; 3 = greenish red; 4 = reddish.
d. 1 = obovated; 2 = linear.
e. 1 = pronounced; 2 = linear; 3 = smooth.
f 1 = white; 2 = light brown; 3 = dark brown.
g. 1 = white; 2 and 3 = yellow or cream-coloured; 4 = pink.

h. 1 = white; 2 and 3 = yellow or cream-coloured.

Table 3. Agronomic characterization of a local cassava cultivar and 31 accessions collected in the Aldeia dos Caripunas (Oiapoque), Mazagão, Amapá, Brazil, 1992.

Accession	Ease of harvest[a]	Root rot (%)	Commercial roots/plant	Foliage weight (t/ha)	Root yield (t/ha)	Harvest index (%)
Bulinha	1	0	3.3	4.8	16.7	77.5
Sem Nome 8	1	0	3.2	4.5	16.7	64.1
Macaxeira 9	2	0	5.7	9.0	15.4	63.0
Tapioqueira 33	2	0	3.8	12.5	13.0	51.0
Ghen Mãniok 20	1	0	3.5	7.2	13.0	64.5
Baian	1	0	3.2	4.5	12.8	74.0
Xingu	1	9.5	3.8	6.4	12.6	66.3
Marapanim 38	1	0	4.0	9.7	11.3	66.5
Ghen Mãniok 10	1	0	4.0	12.0	11.1	48.0
Marapanim 36	1	0	2.6	5.6	10.6	65.3
Dó-Fim	1	11.1	2.7	10.8	10.4	49.0
Sem Nome 17	2	4.0	3.8	14.8	9.8	39.9
Bató San Juan	2	0	3.0	8.3	9.5	53.3
Bató San	2	0	4.3	2.8	9.3	76.7
Camarão	1	7.7	2.4	5.2	9.0	63.4
Sa-Uaua	1	0	3.0	4.8	9.0	58.1
Tapioqueira 35	1	0	3.0	8.2	8.7	51.5
Ró Uei	1	0	3.2	1.7	11.7	42.6
Tumase	1	0	3.5	6.7	8.5	56.0
Bató Seck	2	5.3	3.6	6.8	8.0	54.1
B.C. Noié	2	0	3.0	10.2	6.7	39.6
Gurijuba Pequeno	1	0	3.5	5.8	6.5	53.1
Le Za	1	0	3.2	7.2	6.1	28.4
Macaxeira 6	1	6.3	2.5	6.8	5.4	44.2
Palikura Pequeno	2	0	3.3	5.8	4.7	44.4

Ló-Urukauá	1	0	2.5	11.8	4.6	28.0
Pacajá	1	12.5	1.8	5.0	3.9	43.7
Bató Uaçá	1	0	2.0	2.8	3.5	55.6
Agami	1	0	2.0	3.7	2.6	41.5
Macaxeira 25	1	10.0	1.5	8.0	2.2	21.3
Fei-Fim	1	0	1.3	2.0	2.1	51.6
Pretinha (check)	1	5.3	3.6	8.2	7.7	29.7

a. 1 = relative ease; 2 = difficult.