

## Three brazilian *Manihot* species with tolerance to stress conditions

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A study of natural habitats of three wild *Manihot* species, *M. caerulescens* Pohl, *M. stipularis* Pax, and *M. procumbens* Mueller has revealed certain genetic potentialities in the material. It has been possible to detect, among other characteristics, resistance to drought and excessive soil toxicity and adaptation to cool temperature.

Wild *Manihot* species represent a potential source of many genetic characters, but, for the most part, the value of these characters in improving cassava has not been determined (Martin 1976). Economic characters of wild cassava such as a tuber formation, nutritive value of tuber and resistance to severe conditions have received little attention from botanists working on flora. For this season, our aim was to collect and screen these species to detect useful characteristics for use in breeding programs. A survey of some species in their natural habitats was reported by the author earlier (Nassar 1978a,b). The present report describes three other species.

The program for conservation and evaluation of wild *Manihot* species at the Instituto de Ciências Biológicas, Goiânia permitted extend trips to be made to several states of Brazil by the author. The distribution and the identification of the wild *Manihot* species was based on Rogers and Appan's monograph (1973) and Mueller (1874).

Descriptions of the natural habitats were recorded and the species were examined for tuber formation and growth habit. Tubers of the tuber-forming species were analyzed for protein content according to Association of Official Analytical Chemists (AOAC) methods (1970). Chemical analysis of soil was carried out according to Black et al. (1965). Annual rainfall, evaporation, and temperature ranges were extracted from records of federal meteorological stations. Results of the screening process showed some species to be of particular interest:

***M. caerulescens* Pohl** > collected from Araripina, state of Pernambuco, and from Posse, state of Goiás. Shrubs 1 ½-3m tall, with a deeply extend root to about 2 m underground. Rarely forms tubers; out of 20 plants investigated only plants were found forming tubers. Tubers are intermittent, at depths exceeding 50cm, external color was brown, surface smooth and cortex white. Protein content was 3,9% on a dry matter basis and HCN content was 125mg/Kg unpeeled fresh root. Chemical analysis of soil showed it to be very poor (Table1).

A fascinating aspect of the ecology of *M. caerulescens* is its habitat in the Western part of Pernambuco and South Ceará, which are among the most arid of the world tropics. Annual rainfall, evaporation potential and the temperature range of this region show mean annual rainfall of about 500 mm, with a high evaporation capacity and high temperature. This unfavorable climate coupled with poor soil suggests that this species is capable of affording a potential source of resistance to drought.

It seems likely that adaptation of *M. caerulescens* to this arid region depends on its deeply growing root system. However, this species has some distinct characters distinguishing it from other *Manihot* species. For example, it has very large ribbed fruit, 4-6 times the normal size of *Manihot* fruit. The author was informed by local inhabitants that seeds are used as food in times of famine.

This species has a wide geographic range which extends from Northeastern to Central Brazil. Some biotypes of this species have apparently spread throughout this area. They tolerate a wide range of environmental conditions varying from severe drought in the regions of Araripina, Picos, Crato in states of Pernambuco, Piauí, and Ceará to a considerable amount of moisture at Posse in Goiás state (Table2).

***M. stipularis* Pax** > collected from Brasília, very short subshrub, ca. 20cm tall, does not form tubers, has a woody root, grows on rocky banks. Soil analysis indicates a poor soil (Table1). This species is characterized by dioecious flowers. This character together with its very short height distinguishes it from other *Manihot* species. *M. stipularis* was collected from an altitude of about 1450m in one of the highest regions of Brazil. This species may offer genes for adaptation to coolness in cassava breeding.

***M. procumbens* Mueller** > collected from Corumbá, this procumbent subshrub (ca.

40cm) had a large yellow root with yellow latex. This species was found growing in a very poor soil (Table 1). In an earlier report (Nassar 1978b), the author found another species, *M. paviaefolia* Pohl, which was adapted to extremely poor soil, but *M. procumbens* may have more potential for tolerance to soil toxicity and absence of major elements.

Hybridizations between cassava and these species are under way. Preliminary results show high fertility of crosses. In other cases where *M. oligantha* subsp. Nesteli, *M. anomala*, *M. tripartita* and *M. zehntneri* were used in interspecific hybridizations with cassava, satisfactory fertility of resulting crosses and high viability of the hybrids were obtained (Nassar 1978c). Moreover, all species examined cytologically by the author (Nassar 1978d) were shown to have 18 pairs of chromosomes which were completely homologous, a fact that would permit transference of desirable genes of wild *Manihot* species to cassava.

**Table 1.** Analysis of soils at 0-15cm from natural habitats of three *Manihot* spp§

Species	pH	Ca+++Mg++ (mg/100g)	P (ppm)	K+ (ppm)	Al+++ (meq/100ml)
<i>M. caerulescens</i>	5.2	0.1	1	9	0.2
<i>M. procumbens</i>	4.9	0.2	0	18	0.5
<i>M. stipularis</i>	5.0	0.3	1	28	0.6

§ According to standards laid by the Estadual commission for soil fertility, Goiás, Brazil, the common good soil is that which has:

Ca+++Mg++	P	K+	Al+++
2.1-5	>10	>50	<0.1

**Table 2** Precipitation, evaporation and Temperature in natural habitats of *M. caerulescens*

Month	Precipitation (mm)		Evaporation potential (mm)		Temperature °C	
	Picos	Posse	Picos	Posse	Picos	Posse
Jan.	98.8	286.2	149.1	129.0	26.3	22.5
Feb.	162.3	89.4	138.4	129.3	25.9	22.2
Mar.	130.3	68.5	124.8	264.0	25.5	25.3
Apr.	31.4	117.5	120.1	167.9	25.4	23.5
May	12.6	16.4	122.4	224.3	24.5	22.5
Jun.	4.1	17.6	121.9	230.9	24.3	22.0
Jul.	1.1	0.7	121.2	364.1	24.1	21.9
Aug.	1.3	20.7	137.7	352.3	26.4	22.8
Sep.	3.2	26.3	147.0	369.1	27.8	24.5
Oct.	17.9	195.2	160.6	202.4	26.1	24.1
Nov.	32.2	204.3	150.3	135.6	26.0	23.9
Dec.	61.7	344.1	145.8	128.0	26.2	24.9
<b>Total</b>	556.7	1386.4				

§ Data from Picos and Posse federal stations.

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