



Cassava Cooking Time

By

**Lilian Azevedo Miranda¹,
Adelaide del Pino Beleia²
and**

Nelson Fonseca Jr.³

¹Sítio Mirantro, Londrina-PR, ²UEL, ³IAPAR, Brazil

Abstract

Cassava roots are used at home mainly cooked, or fried after cooked. It is therefore important to have a trustful and simple way to estimate the cooking time. We built an instrument, based on Matheson's to measure peas cooking time. It consists of two aluminum supports and 15 stalks (90g) each with a needle on its end. We worked with six different cultivars, cultivated for two consecutive years. The roots were harvested from 8 to 20 months after planting. We analyzed 3 plants for each cultivar using the median part of each root with a 80 g weight. They were cooked with de-ionized water. Cooking time was settled when 8 needles entered completely the root. The coefficient of variation ranged 2 to 7 %, and cooking time varied from 19 to 35 min. It was possible to statistically distinguish the different cultivars with different ages. Our instrument may help cassava breeding for home uses.

Introduction

Cassava is a plant of the Euphorbiaceae family, and its center of origin is the Amazon region. In Brazil cassava is used as human food. Beyond the popular cassava flour, the roots can be consumed by simply cooking them (known also as "bread of Brazil"), or they can be an ingredient of some recipes as a substitute of potato (Pereira et al. 1983, Silva 1996). However consumption of cassava roots reduced by 50% in the late 1990s - from 120 kg of cassava per capita per year in 1970 (Transformações no padrão de consumo alimentar 1999). This reduction occurred because the roots generally are dirty and have to be peeled; i.e., consuming time of the house owner. The supply of cassava after minimum processing (peeled, washed and packed in plastic bags) to the food markets can increase its use because consumers search for foods with easy handling. The value added through minimum processing contributes also to quality life improvement for the producers and, consequently, for their setting in the agricultural sector.

The main desirable attributes for table cassava roots, beyond high yield, are fast cooking and the pleasant flavor and texture. The irregularity of the culinary quality of the roots is another factor that has restricted the increase of the consumption of cassava. Research carried by cassava breeders has proven difficult for distinguishing between cultivars with distinct cooking times. This trait shows significant variation among plants of the same cultivar, as well as between roots of the same plant, and of parts of the same root (Pereira et al. 1985). Fukuda et al. (1988)

evaluated 22 cassava cultivars for cooking time 11 months after planting. Their technique consisted of kneading the roots cooked with fork and pressuring with the fingers the mass against the palm of the hand. The cooking times varied from 18.3 min to 59.7 min. The coefficient of variation for their assessments ranged between 5 and 20.5 %. Lorenzi (1994) assessed the texture of cassava roots with a fork, and observed variation in cooking time (16-26 min) in samples of the same root, among roots from the same plant (28-60 min), and between different cultivars (32-39 min on average). Safo-Kantanka and Owusu-Nipah (1992) evaluated cooking time of two cassava cultivars 10 to 11 months after planting at two planting dates using the method of Fukuda and Borges (1988). Their research showed that the environment and the genotype influenced the texture of cooked cassava roots. Wickham and Wilson (1988) assessed the effect of storage on three cooking time for cassava cultivars 11 months after planting. About 20 min after cooking, slices from 15 roots of each cassava cultivar were pressed with a fork, and differences between cultivars were recorded. The objective of our research was therefore to identify cassava cultivars with desired cooking time for a minimum processing.

Materials and methods

Experimental design The most popular cassava cultivars of the region of Londrina [Yellow Catherine (CA), White Catherine (CB), Mato Grosso (MT) and Pretona (PR)] along with IAPAR-19-Pioneer (PI) –selected by the Agronomic Institute of Paraná (IAPAR) as a fast cooking cultivars, and IAC-576-70 –recommended by the Agronomic Institute of Campinas for the State of São Paulo, were included in this experiment. Cultivars were planted in Londrina, Paraná (23°19' S, 51°12' W), in a Hapludult soil during two years (September 1996 and September 1997). The field layout was a randomized block design with four replications. Each cultivar was grown in an experimental plot consisting of six rows of 8 m length, 1 m between row, and 1 m between plants within the row. Manure was not applied and when necessary manual weeding was undertaken. There were seven bimonthly harvests in each year, starting 8 months after planting. At each time 3 competitive plants of each block were harvested; thus 12 plants for each cultivar at each time of harvest were assessed.

Cooking Time Evaluation To evaluate the cooking time, an adaptation of the device of Mattson, which was developed to determine the cooking time of peas (Mattson 1946), was made. This device was used for determining cooking time of beans and soybeans (Jackson and Varriano-Martson 1981). The adaptation consisted of a support formed by two parallel grades, and each supporting 15 cylindrical aluminum connecting rods of 90 g contained in the tip a bronze needle. Five healthy roots were selected from each harvested plant, peeled and cut in sections in their central part. The pieces were washed, drained, weighed (80 g), conditioned in polyethylene bags, identified, and placed in cold chamber at 5°C, prior to their cooking in the following day. Since 3 plants per plot were harvested, 15 root pieces were used.



Fig. 1 – Cassava roots distributed inside the pan

In a pan 7 L of de-ionized water were placed, and warmed until boiling. The pieces to be cooked were separated in an aluminum screen within the pan (Fig. 1). A chronometer was used to record the cooking time. Supported in the edge of the pan, the support with the rods was placed (Fig. 2), with utmost care to support the tip of the needle of each rod (Figs. 3 and 4) on of the central part of each piece of the cassava root. The cooking time was recorded

after total penetration of eight needles of the rods in the roots.

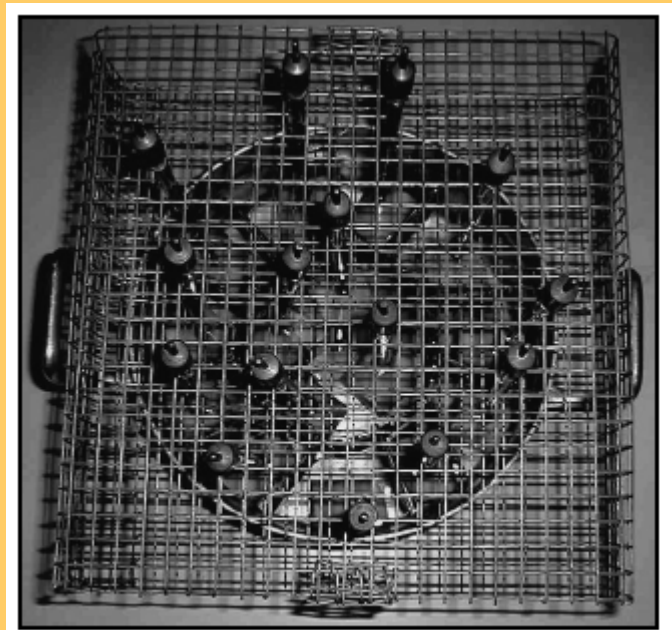


Fig. 2 – Pan showing the support with the rods



Fig. 3 – Rod used to determine when the root is cooked, with a needle on its right end

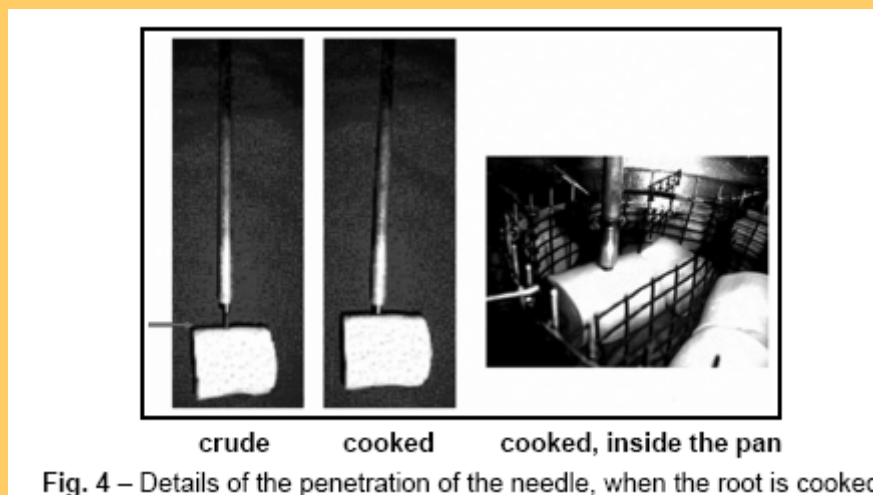


Fig. 4 – Details of the penetration of the needle, when the root is cooked

Analysis of the data Cooking time data were transformed to natural logarithms, which allows a normal distribution, prior to the analyzes of variance (ANOVA) (Steel and Torrie 1980). SAS® 6.12 software was used for the ANOVA, which follows a split-plot treatment design. Graphs were drawn using program STATISTICA 5.0.

Results and Discussion

The average cooking time for the seven harvests on the first planting was about 20 min. IAPAR 19-Pioneer was a fast cooking cultivar followed by Catherine Branca. All cultivars showed acceptable cooking time (< 25 minutes) 12

months after planting. Yellow Catherine, Mato Grosso and Pretona showed the longest cooking time on the two years. About 16 months after planting, Yellow Catherine needed about 41 min for cooking, Mato Grosso 46 min, and Pretona 40 min (Table 1). These cultivars are therefore not suitable as table cassava when harvest occurs 12 months after planting. The coefficients of variation in our experiments were very low: (Tables 1 and 2), which indicated that the methodology used was appropriate for assessing cooking time of roots among cassava cultivars.

Table 1. Cooking time among six cassava cultivars at seven times of harvest (months after planting, MAP) (UEL, Londrina 1996 planting)

Cultivars	8 MAP	10 MAP	12 MAP	14 MAP	16 MAP	18 MAP	20 MAP	Average
CA	21 a C	238 a CD	24.4 a CD	25 bc CD	41.4 ab A	27.9 a BC	29.1 ab B	27.5 a
CB	211 a B	212 ab B	22.9 a B	23.3 c B	31.9 abc A	19.3 b B	19.3 b B	22.7 b
MT	18.2 ab D	234 a CD	25.4 a CD	34.1 a B	45.7 a A	28.2 a C	33.2 a B	29.8 a
PI	15 b C	18 b B	18.4 b B	23 c AB	25.2 c A	19.4 b B	22.6 ab AB	20.2 b
PT	224 a D	21.4 ab D	25.1 a CD	32 ab B	40 abc A	22.4 ab D	28.4 ab CD	27/4 a
IAC	17.4 ab C	20 ab C	24.4 a B	29.5 abc A	26 bc AB	20 b C	26.7 ab AB	23.4 b
CV (%)	4	3	6.1	2	3.9	5.2	4.8	4.1

Values followed by same small letters within each column are non-significantly different according to Tukey's test at 5%. Same capital letters indicate that times of harvest were non-significantly different according to Tukey's test at 5%.

CA: Yellow Catherine, CB: Catherine Branca, TM: Mato Grosso, PI: IAPAR 19-Pioneer, PT: Pretona, IAC: IAC576-70

Table 2. Cooking time among six cassava cultivars at seven times of harvest (months after planting, MAP) (UEL, Londrina 1997 planting)

Cultivars	8 MAP	10 MAP	12 MAP	14 MAP	16 MAP	18 MAP	20 MAP	Averages
CA	20.2 b B	23.3 a B	23.1 a B	32.1 a A	30.6 a A	28.4 a A	29.2 a A	26.7 a
CB	23.3ab AB	21.3ab AB	21.2 ab B	21.8 bc AB	25.2 b A	23 a AB	22.6 ab AB	22.6 ab
MT	23.8 ab AB	20.5 ab B	21.9 ab B	25.1b AB	28.1 ab A	27.8 a A	27.4 ab A	24.9 ab
PI	19.5 b AB	15.3 b B	15.9 b B	17.7 c B	25.6 ab A	26.2 a A	22.6 b AB	20.4 b
PT	25.7 a A	22.6 a AB	21.9 ab B	24.9 b A	26.1ab A	25.6 a A	24.9 ab A	24.5 ab
IAC	20.5 b B	19.4 ab B	21.4 ab B	33.4 a A	33.4 a A	25.7 a AB	28.4 a A	26. a
CV (%)	5	6.3	5.3	7.5	5.4	5.5	6.2	3

Values followed by same small letters within each column are non-significantly different according to Tukey's test at 5%. Same capital letters indicate that times of harvest were non-significantly different according to Tukey's test at 5%.

CA: Yellow Catherine, CB: Catherine Branca, TM: Mato Grosso, PI: IAPAR 19-Pioneer, PT: Pretona, IAC: IAC576-70

In conclusion, our research shows the suitability of using medium parts of the roots for assessing cooking time of cassava cultivars with the modified device of Mattson. The cooking time of cassava roots depend on the genotype and therefore breeders can select for, e.g. IAPAR 19-Pioneer can be used as a parental source in crossing blocks

due to its fast cooking trait.

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