

Evaluation Of The Efficiency Of Retting Of Manihot Esculenta Crantz Tuberos Roots In Congo

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Abstract: Given the negative impacts of bitter varieties of Manihot esculenta Crantz on the health of consumers and although retting techniques improve the nutritional quality of these bitter varieties, it is interesting to know the different retting practices in Congo and evaluate its effectiveness by dosing the hydrocyanic acid content before and after retting. A cross-sectional sample survey made it possible to collect the samples and identify the type of laying-out used as retting of cassava roots in the agricultural sites selected by the PRASAC project, namely the Odziba site and the Oyo site. This study has shown that the barrel is the most used retting medium given the presence of water from boreholes close to homes. In areas where streams exist, retting is carried out in the pond or in the river. The highest percentage of detoxification was obtained at Ignié (90.41%) for retting performed in a barrel for four days and the lowest percentage was obtained in Ngo (56.80%) for a retting performed in a pit for three days.

Keywords: Detoxification percentage, Manihot esculenta Crantz, retting, retting medium

1. Introduction

Coming from tropical America, Manihot esculenta Crantz (cassava) is a plant that is grown in tropical and subtropical countries for its tuberos roots and edible leaves. Cassava roots are a source of energy, thanks to the quality and quantity of starch ranging from 80 to 90 % that they provide [1]. Manihot esculenta Crantz is present in all continents with the exception of Europe. It is the fifth-largest crop production in the world after maize, rice, wheat, potatoes [2], and the third largest food product in the tropics after rice and maize [3]. Cassava grows throughout the Republic of the Congo, where 98% of farmers are mainly engaged in growing cassava. It is inevitably the first crop in Congo in area. Consumed by 90% of the Congolese population, cassava is a staple and strategic food in Congo [4]. In Congo the tuberos root of cassava is used in the form elaborated in "chikwangue" and "foufou" which constitutes the staple food. It is also used in raw form and cooked with water [5]; [6]. "Chikwangue" is a dense paste resulting from the wet processing of the roasted cassava root. The "foufou" is a lighter dough prepared from red and dried cassava root flour [5]. Manihot esculenta Crantz exists in sweet varieties, and in bitter varieties. Sweet varieties contain levels of hydrocyanic acid below 50 mg / kg, and bitter varieties contain levels of hydrocyanic acid greater than 50 mg / kg [7]. The presence of hydrocyanic acid in cassava is one of the problems posed for its direct consumption and is a limiting factor. It is imperative to eliminate this hydrocyanic acid during the various phases of preparation and processing of cassava. Alone or in combination, operations such as peeling, grating, retting, drying, milling, baking (dry or wet) help to eliminate hydrogen cyanide, which is soluble and volatile [8]. Retting is an operation that consists in immersing cassava roots in water, allowing softening and

detoxification of cassava roots [9]. In Congo, retting is a key step in the production technology of "chikwangue" and "foufou". For this, it is interesting to know the different retting practices in Congo and evaluate its effectiveness by measuring the hydrocyanic acid content before and after retting.

2. Material and Methods

2.1. Plant material and sampling

The plant material is the cultivars or ecotype of tuberos cassava roots commonly known as cassava tubers. Samples were collected for most of the cultivars used in agricultural sites selected by the P.R.A.S.A.C project and site selection was made in relation to agroecology. The studied samples were collected at two sites, namely the Odziba site containing Goma Tsé-Tsé and Igné districts in the Department of Pool and Ngo District in the Plateau Department; the Oyo site containing the district of Ollombo in the department of Plateaux, the districts of Owando and Boundji in the department of Cuvette.

2.2. Type of laying-out for the practice of retting

A cross-sectional sample survey was used to collect the samples and identify the type of laying-out used as a retting place for cassava roots in the two previously mentioned sites. 40 producers of which 20 in each site were surveyed. These two sites represent areas of high production of cassava.

3. Evaluation of retting efficiency

To evaluate the efficiency of retting, the hydrocyanic acid contents of cassava roots before and after retting were determined.

4. Determination of Hydrocyanic acid content

The hydrocyanic acid content in the tuberous roots of *Manihot esculenta* has been determined using picric acid, which together with hydrocyanic acid forms an orange-red complex, also called isopurpurine. The latter is used for the identification of hydrocyanic acid. A picric acid solution of 6.25 g / L was used.

4.1. Preparation of solutions

Picric acid solution

Dissolve 5 g of picric acid in a one-liter volumetric flask containing 0.8 liters of distilled water. Add a saturated solution of sodium carbonate drop by drop up to a pH equal to 10. Adjust the flask to the mark with distilled water while maintaining the pH equal to 10.

Preparation of KCN solution samples

Dissolve in 1 L of distilled water, 1 g of KCN previously dried for 24 hours in an oven at 110 ° C. From this stock solution of 1 mg / ml of cyanide, solutions of 0.7; 0.6; 0.5; 0.4; 0.3 and 0.2 mg / mL are prepared by dilution. With a Lightwave II (WPA) spectrophotometer, the absorbance of these solutions were determined at a wavelength of 490 nm (Table 1) and standard graph was plotted (Figure 1).

Table 1: Absorbance of KCN solutions for calibration curve at different concentrations at 490 nm

Cyanide concentration (mg / mL)	Absorbance
0,2	0,231±0,004
0,3	0,388±0,007
0,4	0,570±0,005
0,5	0,702±0,008
0,6	0,877±0,007
0,7	1,018±0,013

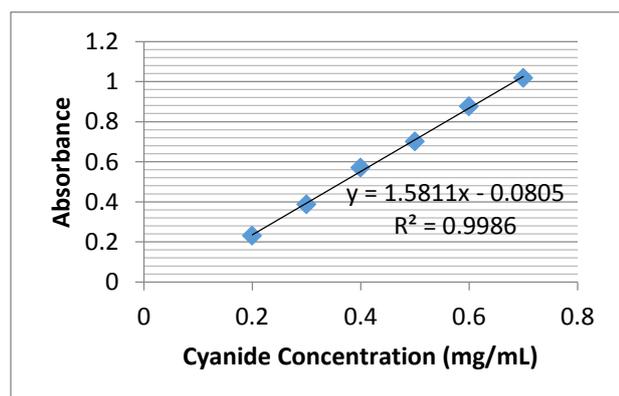


Figure 1: Calibration curve using KCN solution

Preparation of the aqueous extract of tuberous roots of cassava After cleaning with water, the tuberous roots are peeled, cut into very small pieces and crushed by mortar pounding. Add 100 mL of distilled water to 10 g of ground material. Filter the mixture and measure the volume of the filtrate.

4.2. Determination of cyanide in the aqueous extract

The measurements are made in two test tubes as shown in Table 2:

Table 2: Evaluation of cyanide content by the picric acid method

Solutions	Blank test	Dosage
Aqueous extract	-	0.5 mL
Distilled water	0.5 mL	-
Picric acid solution adjusted to pH 10	4.5 mL	4.5 mL

The contents of the tubes are homogenized and brought to a water bath at 95 ° C for 5 minutes. After cooling, the absorbance is measured at a wavelength of 490 nm using a spectrophotometer. From the cyanide content calibration curve (Figure 1), the cyanide content in 10 g of tuberous roots is determined. This cyanide content is then converted into hydrocyanic acid content reported at 1 kilogram of tuberous roots.

5. Data processing and analysis

Sphinx Plus software version 5.1.0.7 was used for data processing and analysis.

3. Results and Discussion

3.1. Laying-out as a retting medium for tuberous cassava roots

Figure 2 below gives the survey results on the type of laying out for retting.

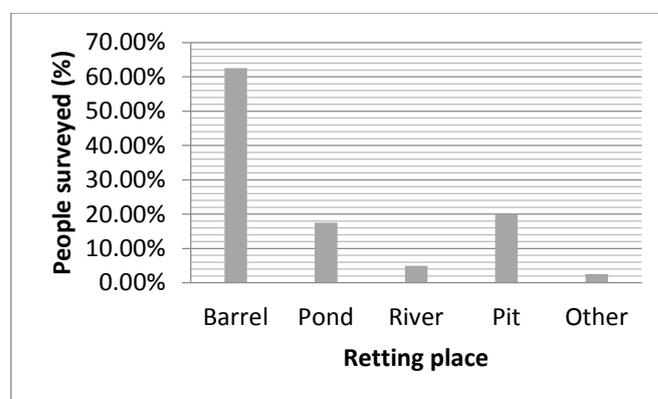


Figure 2: Type of laying - out for retting

Figure 2 shows that 62.5 % of persons surveyed use the barrel to ret cassava roots. However, the results reveal with significant differences a proportion of 20 % of respondents who ret cassava roots in a pit, and 17.5 % do so in ponds.

Figure 3 presents survey results on type of laying-out by district

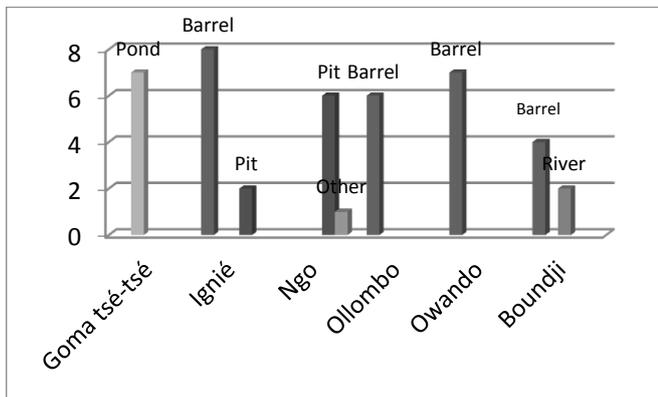


Figure 3: Type of retting medium by district

Figure 3 shows that the retting medium used to ret cassava roots is different for the districts visited. In the zones with weak hydrographic network (Ignié, Ngo) are used mainly the barrel and the pit. However, in areas with streams (Goma Tsétsé, Boundji) the roots are retted in the pond or river. There are areas with streams (Ollombo, Owando), but using barrels for retting because of the presence of water from the boreholes that are close to the village.

Evaluation of retting efficiency

Table 3 presents the results of the hydrocyanic acid contents before and after retting of the tuberous roots of the cultivars taken as an example.

Table 3: HCN content of tuberous roots before and after retting

District of sample collection	Name of the cultivar to be retted	Retting medium	Number of immersion days	HCN content of the tuberous root (mg/kg)		Percentage of detoxification (%)
				Before retting	After retting	
Goma Tsétsé	Ntouloubandoumba	Rivière	3	73.04 ± 0.41	16.45 ± 1.52	76.79
Ignié	Violet	Fût	4	71.53 ± 0.25	6.86 ± 0.45	90.41
Ngo	Boudzi ou mati	Fosse	3	96.17 ± 1.52	29.7 ± 0.82	69.11
Ollombo	Ongana	Fût	2	67.66 ± 0.32	19.9 ± 0.62	70.50
Boundji	Awourou Oyeba	Fût	3	56.99 ± 0.20	7.48 ± 0.55	87.00
	Nzete ya mbongo	Fût	3	110.64 ± 0.22	19.67 ± 0.50	82.22
Owando	Eyaoya	Fût	3	86.45 ± 0.12	11.93 ± 0.48	86.20

Retting of analyzed samples taken directly from growers in different districts was done with different cultivars and retting places. Examination of Table 3 shows that the highest percentage of detoxification is observed in Ignié (90.41 %) and the lowest percentage in Ngo (69.11 %). The Goma Tsétsé sample namely "Ntouloubandoumba" cultivar retted for 3 days in a river gives a detoxification percentage of 76.79 %. In Ignié the studied cultivar is called Violet. It was retted in a barrel for 4 days, the percentage of detoxification is 90.41%. The cultivar named "Boudzi" of Ngo retted in a pit for 3 days and gave a detoxification percentage of 69.11 %. The sample of Ollombo, is the cultivar "Ongana" which retted in a barrel for 2 days; the percentage of detoxification obtained is 70.50 %. In Boundji, two cultivars were analyzed, namely the cultivar "Awourou Oyeba" and the cultivar "Nzété ya mbongo". Both cultivars were retted in a barrel for three days and analyses gave respectively 87.00 % and 82.22 % for detoxification percentages. In Owando, the cultivar analyzed is "Eyaoya", which retted for 3 days in a barrel; the percentage of detoxification is equal to 86.20 %.

Conclusion

Congolese cassava growers use retting to soften the cassava roots for the production of "chikwangue" and "foufou". The barrel is the most used retting medium given the presence of water drilling near houses. In areas where streams exist, retting is carried out in the pond or in the river. The highest percentage of detoxification was obtained for retting

performed in a barrel for four days and the lowest percentage was obtained for retting performed in a pit for three days.

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Author Profile



Celestine Kiminou Ngounga received the Master's degree in Food Chemistry and Technology from Marien Ngouabi University in 2014. Currently she is conducting research on cassava and working at the laboratory of the National Polytechnic School of Marien Ngouabi University of Brazzaville.