IDRC–114e

Cassava Harvesting and Processing

PROCEEDINGS OF A WORKSHOP HELD AT
CIAT, CALI, COLOMBIA
[illegible]–2[illegible] APRIL 1978

EDITORS: EDWARD J. WEBER
JAMES H. COCK
AMY CHOUINARD

CASSAVA HARVESTING AND PROCESSING IDRC-114e

The International Development Research Centre is a public corporation created by the Parliament of Canada in 1970 to support research designed to adapt science and technology to the needs of developing countries. The Centre's activity is concentrated in five sectors: agriculture, food and nutrition sciences; health sciences; information sciences; social sciences; and communications. IDRC is financed solely by the Government of Canada; its policies, however, are set by an international Board of Governors. The Centre's headquarters are in Ottawa, Canada. Regional offices are located in Africa, Asia, Latin America, and the Middle East.

Postal Address: Box 8500, Ottawa, Canada K1G 3H9
Head Office: 60 Queen Street, Ottawa

Weber, E. J.
Cock, J. H.
Chouinard, A.
IDRC
Centro Internacional de Agricultura Tropical (CIAT) IDRC-114e
Cassava harvesting and processing: proceedings of a workshop held at CIAT, Cali, Colombia, 24–28 April 1978. Ottawa, IDRC, 1978. 84 p.

/IDRC publication/. Report of a workshop on /cassava/ /harvesting/ and /food processing/ – discusses /feed production/, /drying/ /food technology/, effects of chip size and shape; /starch/ extraction, use of cassava /flour/ in /food preparation/, cassava /fermentation/ for /fuel/ /alcohol/ production. /List of participants/.

UDC: 633.68 ISBN: 0-88936-188-6

Microfiche edition available

IDRC-114e

Cassava Harvesting and Processing

Proceedings of a workshop held at CIAT, Cali, Colombia, 24–28 April 1978

Editors: Edward J. Weber,[1] James H. Cock,[2] and Amy Chouinard[3]

Cosponsored by the
International Development Research Centre
and the
Centro Internacional de Agricultura Tropical, CIAT

[1]Senior Program Officer, Agriculture, Food and Nutrition Sciences Division, Latin American Regional Office, International Development Research Centre, Bogota, Colombia.

[2]Leader, cassava program, CIAT, Cali, Colombia.

[3]Editor, Communications Division, International Development Research Centre, Ottawa, Canada.

Contents

Cassava Flours and Starches: Some Considerations

Friedrich Meuser
TUB Institut fur Lebensmitteltechnologie Getreidetechnologie, Berlin, West Germany

Abstract. The main questions in the production of starch and flour from cassava are how to extract the linamarin from the roots, whether or not to ferment the cassava during the processing, and how to dry the product. A few of the possible answers are reviewed in this paper, and the analytic compositions and granular structures of fermented and nonfermented cassava products are discussed.

Cassava "flour" is a term that is used interchangeably with cassava "starch"; for this paper, however, it refers only to cassava meal, *farinha de mandioca,* or gari. None of these are processed so as to extract the starch. Cassava meal is produced when roots are peeled, chipped, dried, and milled to a fine meal; *farinha de mandioca* is made by peeling and rasping the cassava roots, then pressing out the water and roasting the moist mash in copper pans; gari is made by crushing the roots, which are then left to ferment before drying. Cassava starch is obtained after an extraction process that separates the starch from the other constituents. After extraction, the starch may be dried or allowed to ferment to produce *almidon agrio* or sour starch. This latter process is described in detail in the article by T. de Buckle (p. 26).

Fermenting the cassava starch or flour increases the yield of dry matter by about 20%. In

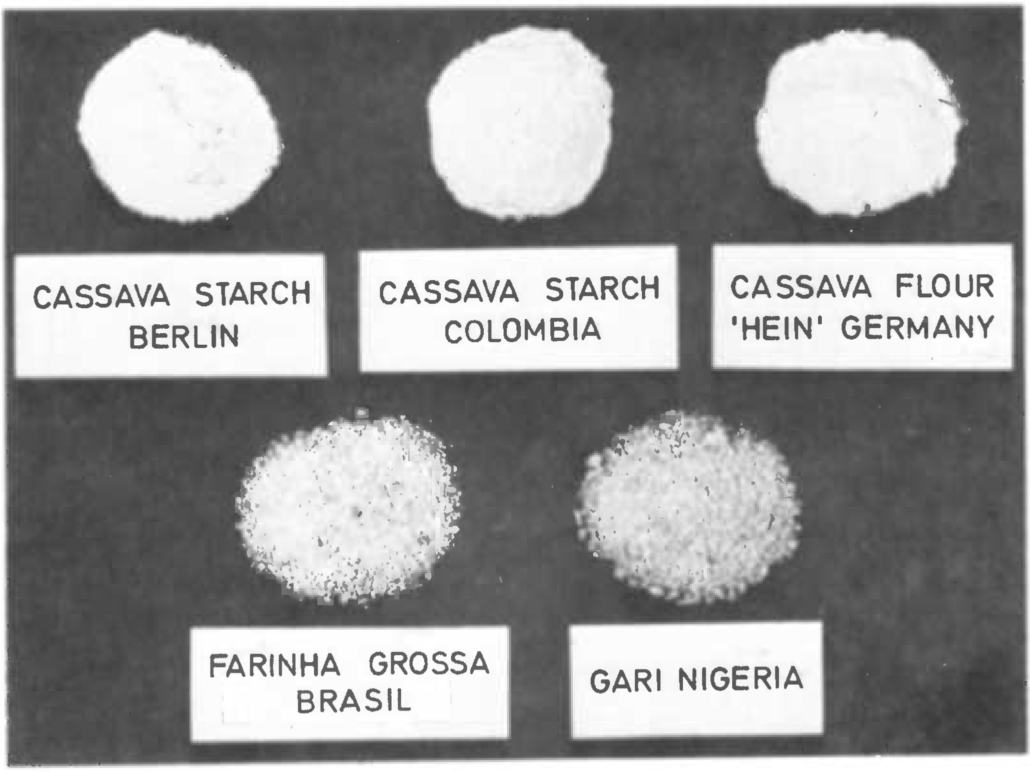

Fig. 1. Samples of five cassava products.

Table 1. Analytical composition of five cassava products.

Ingredients (%)	Farinha grossa (Brazil)	Cassava starch (Berlin)	Cassava starch (Colombia)	Cassava flour "Hein" (Germany)	Gari (Nigeria)
Water	9.1	12.0	12.4	8.6	11.7
Starch	87.6	99.3	95.8	81.1	90.8
Sucrose	1.1	n.d.	n.d.	3.9	0.3
Glucose	0.2	n.d.	n.d.	1.7	0.1
Fructose	0.2	n.d.	n.d.	0.8	0.1
Lactate	n.d.	n.d.	0.4	n.d.	n.d.
Acetate	0.03	n.d.	0.06	0.03	n.d.
Protein	1.9	0.2	0.5	2.8	1.1
Minerals	1.1	0.2	0.4	1.2	0.8
Dietary fibre	4.6	n.d.	0.5	5.4	4.0
HCN(ppm)	2.3	n.d.	1.8	436	2.5

n.d. = not detectable

fermentation, fructose increases rapidly at first (due to hydrolysis of the sucrose), then is converted to lactic acid. The process takes about 3 days after which there is only a small amount of glucose remaining. The formation of lactic and acetic acid lowers the pH and helps preserve the mash.

Composition

Samples of cassava meal (produced in Germany), *farinha grossa* (produced in Brazil), cassava starch (produced in Germany), and sour starch (produced in Colombia) (Fig. 1) were compared in a limited study to ascertain the differences in fermented and nonfermented cassava products. They showed very similar analytical composition (Table 1), containing starch and small amounts of lower polymer carbohydrates, minerals, and protein. The fermented products could be recognized very easily, however, because of their lactate content. Under the electron microscope, greater differences were apparent. For example, many starch granules in the *farinha grossa* were partially decomposed by amylolytic enzymes and the viscosity of the product was low. Much of the starch was gelatinized. In contrast, the gari had a high viscosity, and, in the sample viewed, the starch granules had been slightly gelatinized by the heat during drying. The cassava meal contained fibres as well as starch, and the residual solubles appeared on the surface of the granules. The sour starch from Colombia had a few fibres and other impurities, but the cassava starch from Germany had none.

Producing Starch and Flour

The processes for flour and starch production share two overall problems: how to eliminate linamarin and how to dry the product. The linamarin is the source of hydrocyanic acid (HCN) and must be removed before the product can be consumed. It is commonly removed by extracting the water that contains it, i.e., by mashing and washing the roots. It may also be removed by sun drying, during which the linamarin and linamarase in the roots react and produce HCN. The HCN volatizes and evaporates with the water. Fermentation does not remove the linamarin; hence washing is necessary whether the cassava mash is fermented or not.

Removing the Water

In large-scale operations, decanters may be used to remove the cassava pulp from the fruit water. Composed of a screw-conveyer and a solid bowl centrifuge, they separate the different ingredients in the fruit water through centrifugal force, depositing the components along the walls of the bowl (Fig. 2). The process is continuous — the fruit water and the solids moving counter currently — and is called dewatering. It can easily be combined with washing (removal of linamarin) before drying.

Drying is the final step in both starch and flour production. In the past, it was weather-dependent, with the sun providing the heat. Today, there are several mechanical methods that are suitable for drying starch and flour. They include fluid-bed driers, tray driers, and flash driers. In fluid-bed

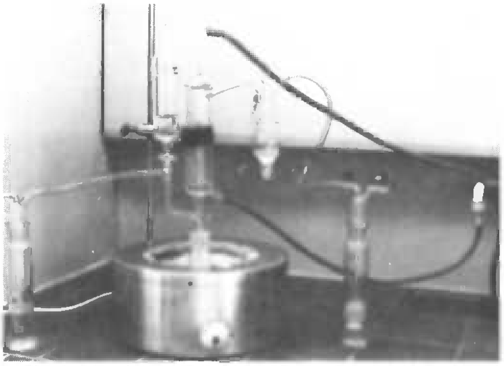

Fig. 2. One of the many types of centrifuges available for large-scale processing.

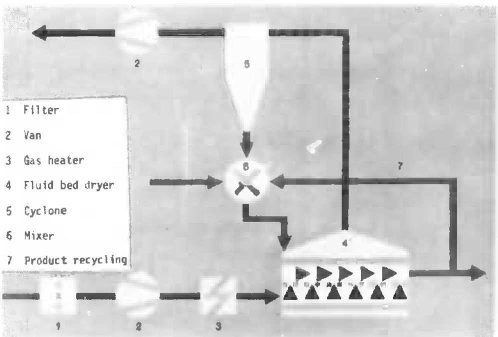

Fig. 3. Fluid-bed drier.

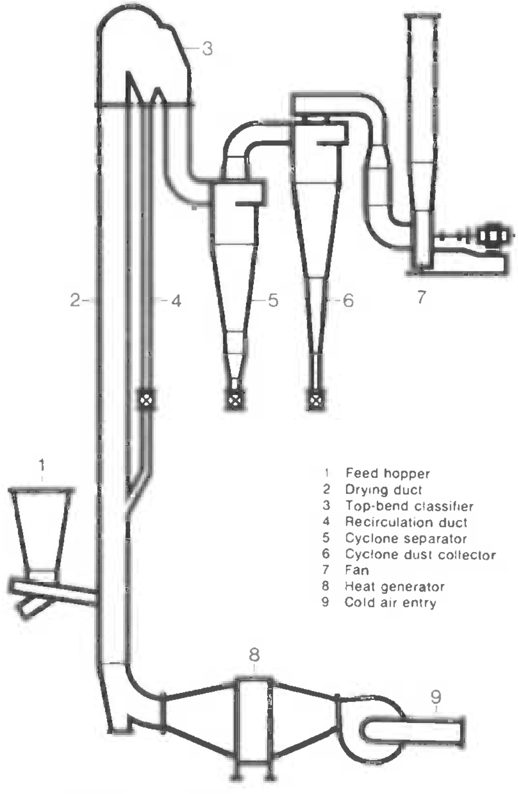

Fig. 5. Flash drier for gritty products.

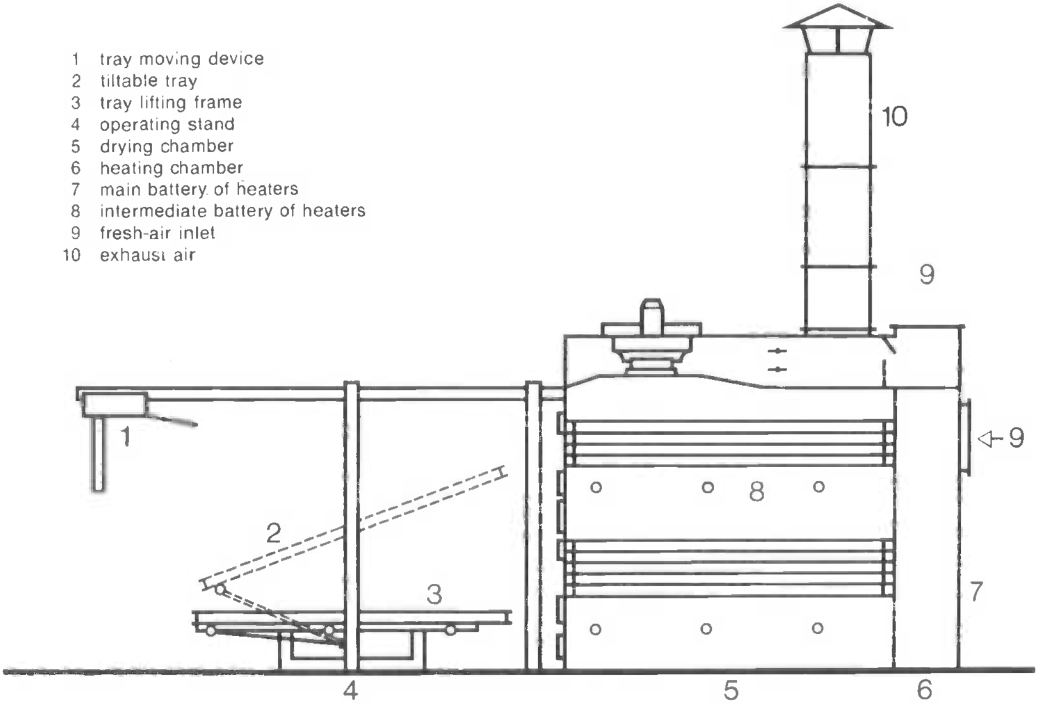

Fig. 4. Tray drier for granular products.

driers, the wet material is fed onto a flat bed that moves continuously (Fig. 3). Heated air is passed up through the bed and may be recycled. The motion of the bed maximizes the surface area of the drying material, moving it in much the same way as boiling liquid. Fluid-bed driers that vibrate generally handle layers of material approximately 250 mm thick, although thinner layers dry more quickly.

In tray driers, the wet material is fed in thin layers onto trays that are stacked in a heated compartment (Fig. 4). The air in the compartment is forced up through the trays and is recycled. Tray driers are simple, space-saving devices, but they are not as quick as flash driers, which maximize air circulation and the surface area of the wet material. In flash driers, the material is fed into a drying chamber, or duct, through which hot air passes. The wet material is in contact with the hottest gases; however, due to evaporative cooling, the material itself does not become very hot. Hence, this drier is ideal for such processes as starch production where excess heat can be damaging. The hot air carries the material into a classifier that returns oversized particles to the drying duct and sends the dry material for packaging (Fig. 5).