Harvesting and Processing

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Cassava Harvesting and Processing

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Use of Fresh Cassava Products in Bread Making

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**Abstract.** Various fresh cassava products were prepared on a pilot scale and substituted for 20% of wheat flour in bread. The cassava products were assessed for their ease of preparation, ease of incorporation in the recipe, and their effects on bread quality, i.e., loaf shape, crust colour and structure, crumb texture, etc. The loaves were also evaluated for softness, moistness, sponginess, freshness — sensory evaluation. Bread containing fresh minced cassava rated higher than any other product in all assessments except sensory evaluation. The bread containing blanched or cooked minced cassava samples, which were more difficult to prepare, scored high in sensory evaluation.

Over the last 40 years, numerous studies have been conducted on the use of dried cassava products, notably flour and starch, in bread making and have been reviewed (Dendy et al. 1975; Kasasian and Dendy 1977). To date, however, no studies have been published on the use of fresh cassava in bread (Jones 1974, personal communication). Such use would have the advantage of eliminating the need for an energy-consuming drying stage and should be of special interest to bakeries in rural areas of the developing world where fresh cassava is readily available.

Recently, the authors investigated the use of fresh cassava in bread and confirmed its feasibility. We investigated the effects of mincing, blanching, and cooking cassava as simple methods of preparation that would be suitable for rural areas of developing countries.

The literature makes little reference to the enzymes present in cassava, but effective blanching inactivates the ones that might adversely affect the quality of the bread containing a fresh cassava product. Blanching also removes oxygen from the tissues, reduces cell turgidity, and may gelatinize some of the starch.

Cooking produces the effects associated with blanching but also involves major textural changes associated with, for example, cellular breakdown and hydration. It is usually easier to mash root crops after cooking (Gooding 1972).

**Materials and Methods**

Cassava tubers, which were airfreighted from Nairobi, were washed and partially peeled with a mechanical bench peeler, peeling being completed by hand; peeling losses were 20–30%. The tubers were sliced mechanically to 1-cm thickness. Portions of the slices were processed as follows:

- **Sample 1** was minced mechanically by passing the slices successively through %8-inch (0.95-cm) and %4-inch (0.48-cm) plates;
- **Sample 2** was blanched in water at 80 °C for 5 minutes, plunged into cold water, and tested for enzyme inactivity using hydrogen peroxide;
- **Sample 3** was mechanically minced and then boiled for 1 hour in a closed sleeve of mutton cloth and cooled;
- **Sample 4** was boiled in water for 1 hour and mechanically minced;
- **Sample 5** was boiled in water for 1 hour and hand mashed using a potato masher.

The cassava products were scored for ease in preparation with regard to the number of processing operations; the capital cost, labour, and energy inputs to the equipment; handling difficulties; yield; and perishability.

When using fresh cassava in bread making, the hydrocyanic content of the tubers is important. If the tubers contain high levels of HCN, they are not safe for human consumption; however, cassava containing 50 mg HCN/kg or less is classified as sweet or nontoxic (Grace 1971, p. 10).

In this study, we determined the HCN content of the uncooked minced cassava and of a crumb from the resultant loaf. Using an alkaline titration method (Grace 1971, p. 85), we found 50 mg HCN/kg. The HCN content of the blanched and cooked samples (2, 3, 4, and 5) was not
determined but was assumed to be less than that of the fresh product because of the heat treatment.

The expected HCN content of the baked loaf containing the uncooked minced cassava was, by calculation, 16 mg/kg; however, it proved to be 10 mg/kg, which corresponds to a loss during baking of 6 mg HCN/kg, i.e., 30%.

Bread-Making Procedures

Before bread making, we determined the moisture contents of the cassava products, using the AACC method (1969). Ranging from 62.4% in the minced product (sample 1) to 78% in the minced and cooked product (sample 3), the results were used to determine the amount of each sample required to substitute for 20% of the flour, calculated on a 14% moisture basis.

A bulk fermentation method of bread making was used, the recipe being: 10 g active dried yeast; 3 g sugar; 110 ml water at 38 °C; 1300 g flour (80% bakers' flour and 20% cassava product at 14% moisture basis); 23.4 g salt; 9.1 g fat; 10 g sugar.

The baker's flour used was of about 72% extraction and 12.4% protein content. The first three ingredients were combined first — aerobic respiration 15 minutes at 38 °C — and then added to the other constituents. The dough was mixed in a laboratory scale mixer at slow speed for 4 minutes. We varied the water, depending on the moisture content of the cassava product used. The dough was scaled at 450 g, allowed to prove to a height of 11.5 cm, and baked for 25 minutes at 218 °C.

The cassava products were scored for ease of incorporation into the dough (ease of handling and ease of mixing), and the specific volumes of the baked loaves were determined by seed displacement, expressed as a percentage of mean control loaf volume.

The loaves were also given an overall loaf score (maximum 40) that included observations on shape, crust colour and structure, crumb texture, colour and odour, and crumb feel and recovery from compression; then they were frozen in sealed polythene bags and stored at −10 °C until sensory evaluation.

Minced fresh cassava (sample 1) scored the highest in physical assessment; it was prepared in a single operation and blended easily with dry ingredients used in bread making; the loaf of bread containing it also had the highest overall score (30) with a specific volume equaling 82.2% of the mean for control loaves. Blanched, minced cassava (sample 2) was sticky, bulky, and difficult to blend with the dry ingredients. This was also true of the cooked and minced cassava (sample 4). The loaves containing samples 2 and 4 respectively received overall scores of 27 and 24 and had specific volumes equal to 78.3% and 78.8% of the control value. The hand-mashed, cooked cassava (sample 5) was less sticky and easier to handle — a finding that supports the results of Gooding (1972) who compared gentle and vigorous mashing of cooked yams — but was difficult and time-consuming to prepare because of the fibre content of the cassava. In fact, hand mashing proved so difficult we would not recommend it, even though the overall loaf score for sample 5 was 28 and the specific volume was 84.6% of control. We would also not recommend using cooked, minced cassava (sample 3) because it is a dark gelatinous product that is very difficult to handle. Also, in sample 3 there was a loss of material during cooking due to the leaching of solubles and fine particles passing through the mesh into the cooking water. Dough containing this sample was very soft, and the resultant loaf had well-defined edges where the dough had spread into the corners of the tin. The loaf score was low (18) because of the open and sticky crumb texture and dark crumb colour, and the specific volume was only 77.1% of the mean for control loaves.

Sensory Evaluation

A panel of at least 18 assessors, some of whom were from the developing countries, were recruited from laboratory staff to evaluate the sensory quality of the bread. They judged hardness or softness, dryness or moistness, doughiness or sponginess, freshness, and acceptability by marking along a 10-cm line. These assessments were converted into scores out of 40 (Fig. 1–5).

Although the fresh, minced cassava (sample 1) received the highest score in physical assessment, it received the lowest rating for softness, moistness, freshness, and overall sensory acceptability. Loaves containing blanched or cooked samples scored better, even though they generally had large pieces of meal embedded in their surface.

Conclusion

We have shown that it is feasible to incorporate fresh cassava into wheat flour bread, thus eliminating a drying stage. Of the samples we used, fresh minced cassava was the easiest to prepare and to mix with the other ingredients in
the recipe; however, it also proved to be the least acceptable in sensory evaluation. Blanched and cooked samples scored better on softness, moistness, freshness, and acceptability.

Further work in cassava-growing areas using different cassava cultivars would be required before definite recommendations could be made for the commercial use of these cassava products in bread. Moreover, consideration would have to be given to the local bread-making techniques, the quality of the bread-making flour, and consumer preferences.