Root crops for food security in Africa

Edited by M.O. Akoroda

ISTRC-AB
CTA
IITA

Proceedings of the Fifth Triennial Symposium of the International Society for Tropical Root Crops - Africa Branch held in Kampala, Uganda, 22 - 28 November 1992

The International Society for Tropical Root Crops - Africa Branch (ISTRC-AB) was created in 1978 to stimulate research, production and utilization of root crops in Africa and the adjacent islands. The activities include encouragement of training and extension, organization of workshops and symposia, exchange of genetic materials, and facilitation of contacts between personnel working with root and tuber crops. The society's headquarter is at the International Institute of Tropical Agriculture (IITA) in Ibadan, Nigeria, but its executive council comprises eminent root crops researchers from national programs throughout the continent.

The Technical Centre for Agricultural and Rural Cooperation (CTA) was established in 1983 at Ede-Wageningen in the Netherlands. CTA operates under the Lomé Convention between member States of the European Community and the African, Caribbean and Pacific (ACP) States. The aim of CTA is to collect, disseminate and facilitate the exchange of information on research, training and innovations in the spheres of agricultural and rural development and extension for the benefit of the ACP States.

Headquarters: "De Rietkampen", Galvanistraat 9, Ede, Netherlands.
Postal address: Postbus 380, 6700 AJ Wageningen, Netherlands.
Tel.: (31) (0) (8380) - 60400 Telex: (44) 30169 CTA NL
Telefax: (31) (0) (8380) - 31052

IITA was founded in 1967 and established in 1971 as an international agricultural research center in the Consultative Group on International Agricultural Research (CGIAR) which is an association of about 50 countries, international and regional organizations, and private foundations. The Federal Government of Nigeria provided a land grant of 1,000 hectares at Ibadan, for a headquarters and experimental farm site, and the Rockefeller and Ford foundations provided financial support. The staff includes around 180 scientists and professionals from about 40 countries, who work at the Ibadan campus and at selected locations in many countries of sub-Saharan Africa. IITA seeks to increase the agricultural production of key food crops in a sustainable way, in order to improve the nutritional status and well-being of people in tropical sub-Saharan Africa. To achieve this goal, IITA conducts research and training on cassava, maize, plantain, cowpea, soybean, and yam, collects and exchanges germplasm, and encourages transfer of technology, in partnership with African national agricultural research and development programs.

c/o TRIP, IITA, PMB 5320, Ibadan, Nigeria
August 1994

ISBN: 978—2079—00—2

Printed by Intec Printers Limited, Ibadan

Proc. 5th Symp. ISTRC-AB, 1994; pp. 340-342

Cassava in the production of bread and bakery products

F. Omoaka and M. Bokanga
Root and Tuber Improvement Program, IITA, PMB 5320 Oyo Road, Ibadan, Nigeria.

A significant proportion of wheat flour can be replaced by cassava flour in the making of bread with little changes in the quality of bread. This paper shows that it is possible to make bread without using wheat flour. Soybean flour can also be mixed with cassava flour to increase the protein content of the baked products. Recipes for making breads, cakes and biscuits from cassava flour, and bread from cassava starch are presented. Sensory evaluation tests show that all baked cassava products are highly acceptable to consumers.

Introduction

The consumption of bread and bakery products has become a habit in Africa, particularly in the urban areas. Unfortunately, many African countries cannot grow wheat necessary to make these products and they spend foreign exchange to import wheat. Using local crops such as cassava in bakery products could save large sums of money which could be used for other pressing needs. Cassava flour can be added to wheat flour in the proportion of 20% cassava to 80% wheat to make composite breads indistinguishable from 100% wheat breads Eggleston and Omoaka 1991; Eggleston et al. In this work, we have shown that it is possible to make bakery products such as bread, cakes, and biscuits without using any wheat at all. They are easy to make and are well accepted in sensory evaluation sessions. They could be at the origin of very successful commercial ventures.

Production of bread and bakery products

Cassava flour preparation. The flour was prepared from IITA improved cassava varieties. The roots were peeled, washed and chipped in a manually operated chipper and sun dried on a black plastic mat. The loading density was 2 kg/m^2; the temperature at the mat surface varied from 26.8 to 49.1^{o}C and the drying time ranged from 14 to 18 hours. The dried chips were milled in a hammer mill and sieved through a 250μm mesh size sieve. The flour obtained had a moisture content of 8-12 % and was stored in air tight glass containers.

Soybean flour preparation. Dehulled full-fat soybean seeds from improved IITA varieties were milled, sieved using a 250μm mesh size sieve and heated in an oven at 150^{o}C for 10 minutes. The flour obtained had a moisture content of 5-6% and was stored in air tight glass containers.

Cassava starch preparation. Cassava roots were peeled, washed and chipped. The chips were blended using twice their weight of water. The mash was filtered through a muslin cloth. The filtrate was allowed to sediment and the supernatant discarded. The sediment was washed twice before being thinly spread on trays and sun-dried. The dried cake was milled using a hammer mill and sieved with a 250um sieve. The starch obtained had a moisture content of 10-12% and was stored in airtight glass containers.

Production of cassava starch bread buns. Margarine (50g) was heated in a saucepan until it completely melted. (Alternatively 50g of vegetable oil may be used.) Water (90 ml) and salt (1.5g) were added to the hot oil and allowed to boil. The hot emulsion was poured onto 100g of cassava starch and stirred at low speed. A whisked whole egg was added and the mixing continued until a uniform viscous batter was obtained. The batter was divided and shaped into round balls of different sizes. The balls were baked at 200^{o}C for 20 minutes.

Production of cassava-soy bread. Cassava flour (80g) and soybean flour (20g) were weighed into a mixing bowl. Sugar (6g), salt (1.5g), yeast (1.5g) and margarine (10g) were added and mixed for 1 minute until a homogeneous mixture was attained.

Egg white was whisked for 2 minutes with a fork or egg whisk. Water (100 ml) and the egg white were added to the mixture of ingredients and mixed for 10 minutes at high speed. The amount of water added varied from 90 to 120 ml depending on the cassava variety used. The viscous batter obtained was poured into a greased baking pan and allowed to stand for 60 minutes in a fermentation cabinet at 30°C and 80-95% relative humidity. The fermented batter was baked at 200°C for 30 minutes.

Production of cassava ginger and Pepper bread. The standard cassava-soy bread recipe was followed. The only modification was that 0.5g of ginger or 0.5g of pepper were added to 100g of mixed soy-cassava flour before adding the water and egg white.

Production of cassava biscuits. Margarine (50g) and sugar (100g) were mixed in a Kenwood mixer at medium speed until fluffy (approximately 15 minutes). One whole beaten egg and three tablespoons of milk were added while mixing.

Cassava flour (100g) and spices were slowly introduced into the mixture. The thin paste so obtained was refrigerated for 20 minutes or until it was firm to the touch. The paste was rolled on a flat surface sprinkled with flour. Biscuits of various shapes were cut out of the rolled paste and baked at 150°C for 8-15 minutes.

Production of cassava cakes. Margarine (300g) and sugar (200g) were creamed until soft and fluffy. Four eggs were thoroughly beaten. Cassava flour (300-400g) was mixed with baking powder.

The three components were mixed gradually, first the egg into the creamed sugar, then the flour into the mixture, along with spices. The mixture was put in a greased baking pan and baked at 150°C for 25-30 minutes.

Findings

Sensory evaluation of baked products. All baked products were subjected to sensory evaluation at various stages of product development with 20 panelist. Table 1 shows the results of a hedonic taste of all baked products. It shows the degree of liking (or disliking) of these products by a cross-section of people from a wide range of income groups. The data shows that all products were liked (all scores below 5).

Table 1. Sensory evaluation of breads and other bakery products

Product	Score
Cassava cake	1.762 a
Cassava Starch bread bun	2.238 ab
Cassava-soy biscuit (plain)	2.524 ab
Commercial wheat bread	2.524 ab
Cassava biscuit (with cinnamon)	2.357 b
Cassava biscuit (plain)	3.143 bc
Cassava-soy bread	3.952 cd
Ginger bread (cassava-soy)	4.000 cd
Pepper bread (cassava-soy)	4.286 d

Scale: 1: Like extremely; 2: Like very much; 3: Like moderately, 4: Like slightly; 5: Neither like nor dislike; 6: Dislike slightly; 7: Dislike moderately; 8: Dislike very much; 9: Dislike extremely. Values followed by same letter are not significantly different ($P = 0.05$).

The cassava cake was the most liked compared to the pepper bread, probably because of its sweet taste. The cassava starch bread was highly appreciated. Panelists asked for more after the test and wanted to know the recipe, a sign of overall acceptance.

Comments from the taste panelists indicate that the cassava-soy bread would be preferred when used with stews and sauces just like any other starchy staple food.

Key parameters for breadmaking quality. The loaf specific volume, crust appearance, crumb structure and taste of the breads were evaluated by trained sensory analysts. Flour quality is essential for breadmaking ability.

An off-white colour of the flour is a sign of deterioration during flour preparation and/or storage. Flour particle size also contributes to breadmaking quality. Large particles size leads to non-uniform starch gelatinization during baking and poor quality bread. Cassava flour with a high diastatic activity shows a low maximum paste viscosity and produce dense and gummy pudding-like structures.

Varietal differences. Out of 22 clones tried for bread making, 18 gave acceptable results. The flour diastatic activity was correlated with good bread making ability. The range of diastatic activity measured in cassava flour varied from 80 to 575 mg maltose per 10 g of flour. This wide range offers opportunities for plant breeders to improve this characteristic.

Effect of additives. Cassava bread baked without fat or egg white collapsed in the oven and had a coarse and irregular crumb structure with a gummy (rubbery) texture. Margarine has been shown to increase the amount of entrapped air in the batter at the mixing stage with a subsequent increase in gas retention capacity of the batter (2). The addition of egg white prevented the loaf from collapsing and increased the loaf volume of the bread. It also produced a more regular crumb structure with much finer and smaller cells, reduced the gumminess while maintaining a soft texture.

References

Eggleston, G.; Omoaka, F.E. Alternative breads from cassava flour. Paper presented at the 9th symposium of the International Society for Tropical Root crops ISTRC, 20-26 October, 1991, Accra, Ghana.

Eggleston, G.; Omoaka, P.E.; Ihedioha, D.O. Development and evaluation of products from cassava flour as new alternatives to wheaten breads. Journal food Science Agriculture, Vol. 59, 377-358, 1992.