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FOOD RESEARCH INSTITUTE
(C.S.I.R.)

TECHNICAL INFORMATION
FOR THE

IMPLEMENTATION OF THE DEHYDRATED FERMENTED MAIZE MEAL
PROJECT

BY

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INTRODUCTION

The major objective for the establishment of the Food Research Institute is to offer assistance to the local Food Industry to diversify and improve on their operations. In order to play this vital role, the Institute's research programmes place a lot of emphasis on the investigation of local traditional food processes with a view to upgrading the technology and improving the quality of final product.

One of the areas studied has been the development of processes and methods for the preservation of perishable local food items. In this regard, a dehydrated fermented maize meal with a shelf-life of about six months has been developed to serve as a substitute for the perishable (3 days shelf-life) fermented maize dough which is used for the preparation of many important staple dishes such as kenkey and banku.

This paper provides relevant technical information to be used as part of a feasibility report for a project that seeks to establish a plant for the production on commercial scale of dehydrated fermented maize meal.

SOURCES OF RAW MATERIAL

Maize the only raw material is grown in every region in Ghana and is the most important staple cereal, contributing more than 55% of total cereal production (Appendix I). The major maize growing areas in the different regions in Ghana are shown in Appendix 2 most important maize areas being Mampong/Ejura areas in Ashanti Region, Nkoranza/Kintampo areas in the Brong Ahafo Region, Asesewa in the Eastern Region and Ho/Denu areas in the Volta Region

Trade links exist between some principal rural and urban wholesale markets in each region while key wholesale markets like Kumasi and Accra have inter-regional trade links with various rural markets (Appendix 3). Direct links also exist between some farms and urban markets through regular purchasing trips.

Maize Consumption and Utilization

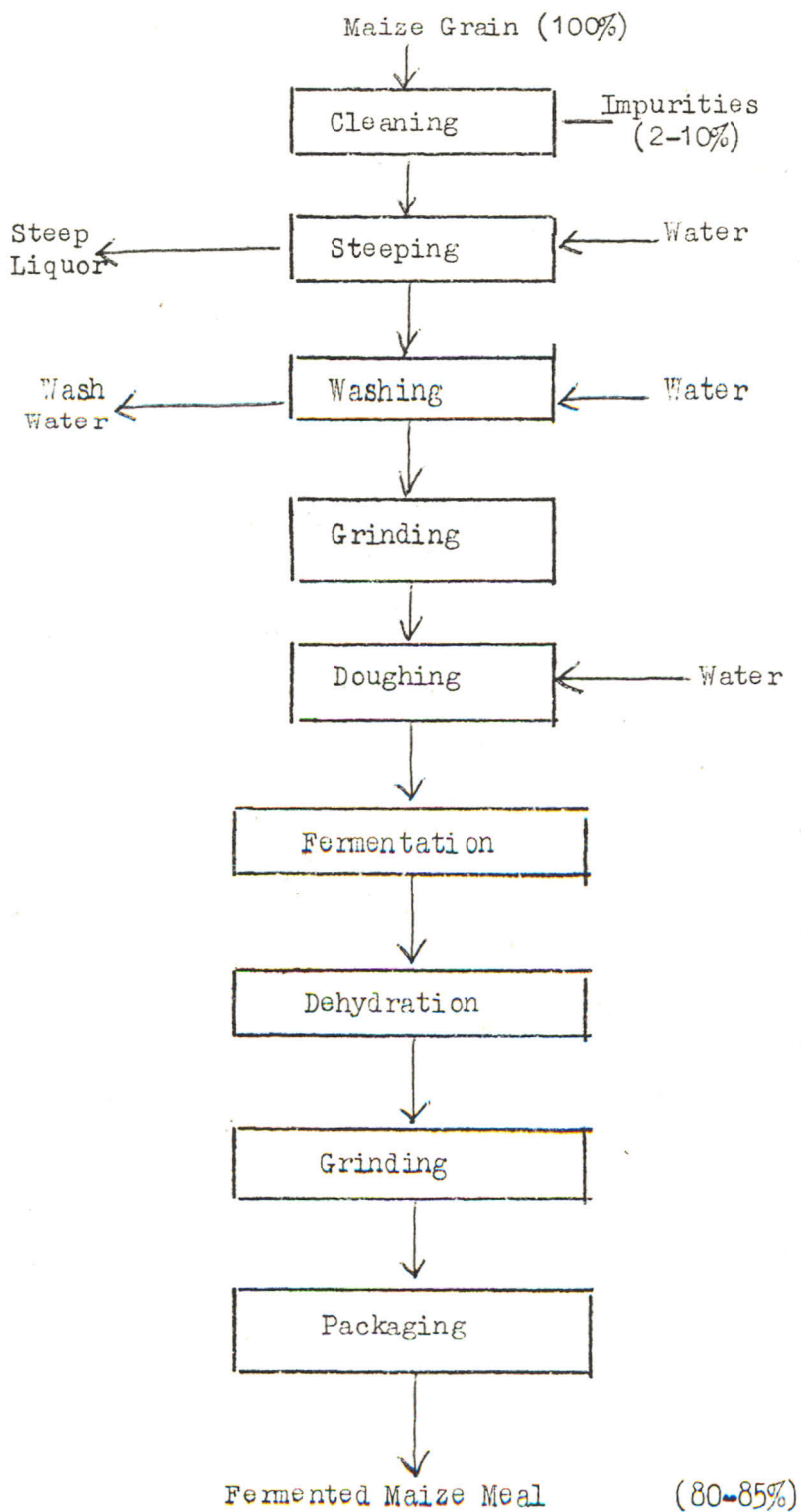
On average, the annual per capita consumption of cereals in Ghana is 180lbs or about 60% of total carbohydrate intake. Per-capita consumption is increasing, especially in the urban areas and maize contributes at least 50% of total cereal intake.⁽⁴⁾

Maize, a major staple crop is eaten in all the regions of the country. In the coastal areas where it forms the main starchy staple, it is generally made into a fermented dough which forms the basis for a variety of dishes such as kenkey, banku, akple and akasa.⁽²⁾

Studies carried out on the suitability of introduced high-yield varieties of maize for the preparation of kenkey, identified "La Posta" as the most suitable, being closely similar to local maize varieties in its cooking properties.⁽¹⁾

Fig.1

FLOW DIAGRAM FOR THE PRODUCTION OF
FERMENTED MAIZE MEAL



PRODUCTION PROCESS

The processing method is diagrammatically shown in Fig. I.

Cleaning

Mature maize grains are weighed and cleaned. Impurities such as pieces of earth, sand, stones, pieces of leaves and maize-cob are separated from the maize grain. Level of impurities ranges from 2-10% of grain weight.

Steeping

The cleaned maize is steeped in water and left overnight. Steeping allows the grains to absorb moisture and to be in a state that is suitable for efficient milling. Fermentation of the maize spontaneously begins at this stage of the process. After steeping, the steep-water is decanted. The grain is then washed with fresh water and strained in baskets which allow excess wash-water to drain off.

1st Grinding

Steeped maize is ground into a fine whole meal using a disc mill to the same fineness as is done in the traditional preparation of maize dough.

Doughing

Moist maize meal is mixed with appropriate quantity of water into a dough which is left to ferment.

Fermentation

Fermentation of the dough is spontaneous and is acidic in nature. The fermented dough is sour owing to the development of acids (lactic, acetic etc.) which impart the characteristic flavour to the product.

Dehydration

Artificial drying of the fermented dough is done in hot-air tray driers at appropriate temperatures that ensure optimal rate of moisture loss and preservation of desired flavour characteristics.

Drying reduces the moisture content of the dough to a safe level of 8-10% suitable for efficient storage.

Cooling

Dried fermented maize dough in the form of irregular lumps is spread on wooden trays and left to cool at room temperature.

2nd Grinding

After drying, the irregular lumps need to be ground into a meal to ensure easy handling after packaging. A hammer mill was found suitable for this purpose.

Packaging

The final product, dried fermented maize meal, is packaged in polythene bags or other such material that has appropriate moisture barrier to prevent moisture absorption from the atmosphere during storage.

Yield

Losses of material occur during the cleaning stage due to removal of impurities and subsequent processing stages as a result of spillage. The total yield of final product is 80-85% of initial weight of raw material. There are no by-products.

Quality Control

It is essential that at all times there is uniformity in the quality of raw materials which should be reasonably high. For efficient storage, maize should have a moisture content of not more than 13.5%. Deterioration in maize quality can be caused by mould growth, resulting in discolouration, development of odour, etc. when maize of a higher moisture content is stored. The use of moisture testers at the point of purchase helps to check the moisture content of grain offered for sale. Local grain storage authorities, such as CMB pest control division, should be contacted to discuss and recommend appropriate storage and fumigation practices. If dried to the right moisture content (8-10%) and properly packaged, the final product stores at room temperature with good ventilation for about 6 months.

Other parameters for ensuring a standard product have been worked out. These include optimal processing conditions such as moisture content of steeped grain, particle size of ground meal, moisture content of dough, extent of fermentation, dehydration temperatures, and moisture content of final product. Specifications for these were fixed through laboratory and pilot tests as well as examination of market samples of fermented maize dough collected from 5 markets in Accra.

CONSUMER ACCEPTANCE

Acceptability studies have been conducted with workers of the Food Research Institute and the Council for Scientific and Industrial Research Secretariat. These people were randomly selected to represent a cross-section of the staff. The meal was judged by its appearance, taste (acidity), flavour, colour and texture. Respondents, who totalled 60 in number, were asked to use samples of fermented maize meal as a substitute for fermented maize dough in their homes in traditional staple dishes. It was reported that such dishes as kenkey, banku, akple and koko were prepared with the samples given out. Results of these studies show that the fermented meal is highly acceptable - 90 percent of the respondents rated the meal between very good and excellent.

LIST OF EQUIPMENT

The throughput of the plant is 400kg/8hrs.

<u>ITEM</u>	<u>QUANTITY</u>	<u>DESCRIPTION</u>	<u>SOURCE/ ESTIMATED PRICE</u>
Platform Weighing Scale	1	Capacity 120kg by 200g divisions	£1479.00
Speedy Grain Moisture Tester	2	Caliberated for 0-50% moisture	Baird & Tatlock, Box1, Ramfords RMI IHA Essex, England (Cat. No. 319/0068 with accessories. Local Agents CONEB TRADING AGENCY Republic House Annex Accra.
Disc Mill (Corn Mill)	1	Premier No. 2A 10Hp Motor 415V 50Hz	£2053.55
Cake Mixer	1	About 40 litre bowl capacity	Hobart Manufacturing Co. Troy, Ohio 45373, USA
Hot air tray drier (atmospheric)	3	Electrically heated Thermostatically controlled. Temp. range 0-300°C. Drier expected to extract a total of 140kg moisture from maize dough per 8hrs. Manufacturer will indicate capacity and other specifications if it is stated that 3 units are needed.	(1) Apex Construction Ltd. Chemical Pharmaceutical Engineers, 15 Scho Square London W.I. (2) Kestner Evaporator & Engineering Co. Ltd. Station Road, Greenlithe, Kent, England.
Table Scales	2	Capacity 10kg.	Nettler Instrumente A.G. CH-8606 Greifensee Zurich, Switzerland.
Sealing Machine	2	220/240V for polythene bags, 2-5 kg packaged units	(1) Hulme-Martin Ltd. 4 Brownlow Mews Guilford Street, London WC1. (2) Star Engineering Gosport Ltd., Star Yard, High Street, Gosport, England
Hammer Mill	1	Yeoman Major 71.5KW electric power & drive suitable for operating on 415V, 3phase 50 cycle supply.	£2000

<u>ITEM</u>	<u>QTY.</u>	<u>DESCRIPTION</u>	<u>SOURCE/ ESTIMATED PRICE</u>
Electric Power generating plant (as stand by)	1	Diesel operated engine	-
Miscellaneous (to be imported)		Tools for maintenance and repair, fire extinguishers	-
Miscellaneous (to be locally fabricated)		Steeping Tanks, baskets fermentation troughs, trays, push carts.	ø500,000

MAN POWER REQUIREMENTS

(a) OPERATIVES

A total of TWELVE (12) Operatives will be needed to man the various equipment per 1 shift of 8 hrs.

APPENDIX I

Production Levels of Local Cereals(3)
and Starchy Crops (Thousand Metric Tons)

Food Crop	1975	1976	1977	1978	1979	1980
Maize	343.4	286.4	274	218	380	424
Sorghum	135.1	188.5	131	121	158	132
Millet	121.9	144.4	125	93	149	82
Rice	71.1	69.8	109	109	93	78
Cassava	2398.0	1818.9	1811	1895	1759	2322
Plantain	1245.7	1255.6	927	940	817	734
Cocoyam	1099.4	773.3	722	726	749	643
Yam	709.2	574.9	533	544	602	650

APPENDIX 2

Major Maize Growing Areas in Ghana (6)

1. Wenchi-Kintampo-Atebubu-Techiman-Nkoranza District (Brong-Ahafo Region)
2. Mampong-Ejura-Bekwai District (Ashanti Region)
3. Swedru-Foso-Dunkwa District (Central Region)
4. Aseewa-Frankadua District (Eastern Region)
5. Sogakope-Ho-Denu-Peki-Hohoe District (Volta Region)
6. Damango-Tamale-Bimbila Zone (Northern Region)
7. Tumu-Kundugu-Wa District (Upper Region)

APPENDIX 3

Some Rural and Urban Markets for Maize in Various Regions (6)

<u>REGION</u>	<u>RURAL MARKET</u>	<u>URBAN MARKET</u>
Brong Ahafo	Nkoranza Techiman	Sunyani
Ashanti	Ejura	Kumasi
Central	Bawjiase, Kasewa, Swedru	Accra (Inter-regional link)
Eastern	Asesewa	Accra (Inter-regional link)
Volta	Ho	Keta

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