

FOOD RESEARCH INSTITUTE

GUIDELINES ON FACTORS TO BE CONSIDERED
FOR THE
IMPLEMENTATION OF A NATIONAL COMPOSITE FLOURS
PROGRAMME IN GHANA

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INTRODUCTION

Despite the increase in demand for bread, the major wheat based product in Ghana, wheat imports for the past five years have dropped. Demand cannot be met owing to scarce foreign exchange resource.

This has generated a lot of discussion and research work on the use of Composite Flours (mixtures of flours derived from cereals, starchy crops and protein rich flours) for breadmaking as a means of reducing foreign exchange expenditure on wheat imports.

The aim of such a programme would be to help and encourage the Local bakery industry to adopt the use of composite flours for bread making.

The following objectives are envisaged.

1. To increase the volume of bread output from the wheat flour available at any particular time in the country.
2. To save foreign exchange that is needed for other development projects.
3. To stimulate increased production of local cereals and other starchy crops.
4. Stimulate the establishment of intermediate or large scale industries to produce non-wheat flours for the bakery and other allied industries.
5. With the creation of the situation as mentioned in (4) it would be easy to develop and promote the status of cereal -based traditional foods with the long term objective of replacing bread partially or completely ⁱⁿ our consumption patterns.

2. CRITERIA FOR SELECTION OF DILUENT

2.1. Production levels and market prices

- Very low levels of production and lack of effective price controls have resulted in high market prices of local cereals and starchy crops for the past years (Tables 1 & 2).

Table I

Production Figures of Local Cereals and Starchy
(Crops - 1975-81 (Thousand metric tons))

Food Crop	1975	1976	1977	1978	1979	1980
Maize	343.4	286.4	274	218	380	424
Sorghum (Guinea Corn)	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	772	726	749	643
Yam	709.2	574.9	533	544	602	650

Source: Economic Research Service, Ministry of Agriculture, ACCRA.

Table 2

Average Annual Market Prices of Local Food Crops
1975-81

Food Crops	1975 ¢	1976 ¢	1977 ¢	1978 ¢	1979 ¢	1980 ¢	1981 ¢
Maize 220lbs/bag	24.94	56.90	118.73	121.14	171.70	413.31	649.90
Sorghum (Guinea Corn) 264lbs/bag	29.21	73.38	163.46	178.80	215.95	630.79	1040.00
Millet 204 lbs/bag	28.93	72.70	159.50	185.71	222.78	495.55	994.66
Local Rice 240 lbs/bag	62.75	129.01	182.54	247.95	282.28	763.73	1200.45
Cassava 200 lbs/bag	11.02	23.46	59.45	55.40	64.61	181.84	397.40

* Average of Prices up to August 1981

Source: Economic Research and Planning Service,
Ministry of Agriculture, ACCRA.

- Comparing the current government controlled prices of white wheat flour and unprocessed maize, one finds that the former, which is in a convenient form to be used readily, is much cheaper by a difference of about ₦65 per bag of 45.5kg weight.
- The costs incurred by the baker in processing the maize grain into a usable meal or flour adds to the already high production costs. This has been a major disincentive to the local baker in the use of composite flours for breadmaking.
- Virtually all locally produced starchy crops which can be used in any composite flours programme, are very important staple foods with high local demands which have not been adequately met by production levels. This has necessitated the import of some of these crops, such as maize, rice and sorghum.

2.2. Nutritional Implication

- Nutritionally, the cereals (rice, maize, millet and sorghum) are superior in quality as compared to the roots, tubers and starchy fruits such as cassava, yams and plantains. This is particularly so with respect to the protein content which ranges from 7-12% in cereals and from 0.5-1.5% in the roots, tubers and starchy fruits.
- Bread made from blends of roots/tubers and wheat flour need to be enriched with protein-rich flours such as soya, milk powder etc. On the other hand, the incorporation of local cereals in bread only slightly reduces the protein content and so the addition of protein-rich flours is not essential.

2.3. Yield in Flour Production

- The yield in flour processed from roots and tubers is very low, with only about 20% of initial material being recovered as flour with storable qualities. This is attributed to the fact that the moisture content and inedible portions (skins, and peels) of these crops are high.

The production of these flours (from roots and tubers) is more complicated, involving more unit processes such as washing, peeling, cutting, drying and milling.

Production costs turn out to be higher for flours prepared from roots and tubers.

The preparation of cereal flours involves only cleaning, decortication (ie. polishing) and milling. Where wholemeals are preferred, polishing of grains is excluded.

The yield in cereal flour preparation generally ranges from 60-90% of the original material, depending on whether the cereal is polished or not.

3. WHEAT FLOUR QUALITY

- The quality of wheat flour is a major determining factor of the optimum level of non-wheat flour that can be incorporated in a composite flour for breadmaking. Strong wheat flours (with high protein content of 12-13%) make doughs with very good capacity to retain most of the gases that are produced in the dough during fermentation, thus giving the loaves the desired lift and volume.
- A survey of wheat imports and market samples of wheat flour has indicated that there is a wide variation in the quality of wheat and wheat flours. Some samples barely satisfy the very minimum quality requirements for breadmaking. In such instances, where flour of medium 'strength' is the only type available, very limited amounts of non-wheat flour (10-15%) can be safely recommended for breadmaking.

4. NON-WHEAT FLOURS

- During an exercise which was carried out in 1973/74 by the Food Research Institute to promote the manufacture of corn bread in Ghana, one of the constraints mentioned by the bakers was unavailability of ready-made, non-wheat flours at prices comparable to that of wheat flour.
- This points to the fact that there is no industrial production of flours from local crops.
- Existing facilities are small scale mills scattered in the various regions of the country.

Milling of Local Cereals

Roller Mills

- The three wheat flour mills use roller mills, designed and fabricated with material that is suitable for milling wheat which is a soft cereal.

- Research trials indicate that such mills give low yield (50%) of flour from coarse cereals such as maize, millet and sorghum.

Attrition Mills

- The type of mill predominantly available in most parts of the country, and suitable for milling wet grains, is the disc attrition mill. For the preparation of fermented maize dough, which forms the basis for most maize-based foods, maize is generally steeped before it is ground, hence the predominant use of attrition mills.
- Since this type of mill is not very suitable for milling dry cereal grains, the local cereals have to be ground two to three times before the desired degree of fineness in the meal is achieved.

Hammer mills

- Hammer mills are most suited for milling dry coarse grains such as maize, millet and sorghum. They are, however, very scanty in number in the country.

Shelf-life of maize meals

- Storage studies carried out on whole - and degermed maize meals, at the FRI, showed that even though whole maize meal is better nutritionally, it has a very short shelf-life of up to two weeks only as compared to degermed maize meal which stores for more than three months. During milling, the lipolytic enzymes (responsible for fat breakdown) in the grains, come into contact with the oil concentrated in the germ portion, resulting in rancidity of the oil in the maize meal during storage. This phenomenon is prevented if the grains are degermed to remove the oil rich portion before they are milled.
- In situations where whole-maize meal is preferred, it should be used up within two weeks so as to forestall development of rancidity in the meal.

Where operations allow stocking up of maize meal, for convenience of planning, especially in the big bakeries, degermed maize meal will allow long storage.

5. BREADMAKING

The small scale bakeries use very simple and traditional methods and are reported to make up a greater proportion of the total number of bakeries.

- In Accra/Tema they form 78 percent of total number and are reported to have handled in 1980/81, 56 percent of total flour supplied to the industry in these two towns.

Level of substitution

- A survey of breadmaking methods carried out by the Food Research Institute revealed that the level of substitution used by the local bakers ranges from 5-20% of non-wheat flour with 10-15% being the most common level. As mentioned under wheat flour quality, the level of substitution that can be achieved depends to a large extent on the quality of wheat flour.
- Higher levels of substitution (30-50%) have been achieved by other workers in developed countries where dough improvers and high speed mixers were used. These materials (emulsifiers and chemical improvers) and equipment have to be imported if we decide to use them since they cannot be manufactured locally.

Breadmaking qualities of wheat and effect of non-wheat flours on these

- Wheat and rye are the only natural cereals whose proteins, in the presence of water, form an elastic substance called gluten.
- The elastic nature of gluten allows wheat dough to expand in volume and retain gases produced during fermentation thus giving the loaves the desired shape.
- Addition of non-wheat flours has the effect of reducing both the total gas produced and gas retained in the dough. This results in low loaf volumes, in other words, the loaves are "heavy".

Mixing tolerance is lowered by addition of non-wheat flours to wheat doughs. It is therefore necessary to reduce dough mixing time.

- The practice of long fermentation in breadmaking which is generally used by most bakeries in Ghana, needs to be slightly modified since fermentation tolerance of doughs made from composite flours is low.

In spite of all these adverse effects that non-wheat flours have on bread qualities, very acceptable bread can be made from composite flours using the traditional methods.

Brown Bread

Wholemeal wheat flour has the same problem of development of rancidity during storage as mentioned under 'shelf-life of maize'.

The usual practice in most countries is to prepare the white flour which has a long shelf-life, and add fresh bran flour in desired proportions to make brown bread.

6. RECOMMENDATIONS

It will be seen from the discussion so far that a lot of constraints exist which hamper the successful implementation of a composite flours programme. The first recommendation is deemed a prerequisite for any of the other recommendations to be considered.

1. Adequate national production levels of local cereals (and other starchy crops) need to be achieved in order to successfully implement a national composite flours programme. This will ensure that traditional staple foods based on the local food crops do not suffer any shortages.
2. A policy on pricing of food crops need to be evolved to make the prices of locally produced cereals and starchy crops compare favourably with the price of wheat flour on the local market.
3. A centralized approach for a composite flour programme, in which a local cereal flour is mixed with wheat flour at the flour mills, will need installation of suitable mills for milling of local cereals. In this approach, the bakers will be supplied with an already mixed composite flour.

4. Since there is no industrial milling of local cereals in Ghana, a decentralized approach can be adopted using existing milling facilities available in the country. The bakers will be supplied with wheat flour and the individual or co-operatives can prepare cereal meal at the service mills (attrition mills) which are scattered all over the country.

5. Cereals have to be degermed before milling in cases where storage for a period of over two weeks is envisaged. This will ensure that there is no development of rancidity which results in bitter after-taste and off - flavours. Fresh whole cereal meals (up to two weeks old) can be used in cases where it is convenient to do the milling as and when needed.

6. Moisture content of meals and flours of cereals should not exceed 12% of total weight if they are to be stored for sometime before use. Higher levels of moisture encourage the growth of micro-organisms such as moulds and bacteria.

7. The wide variation of quality that ~~exists~~^{both} between the different batches of wheat imports and local brands of wheat flour limit the level of substitution to 10-15% of non wheat flour. This is considered a safe level, under the circumstance.

8. Slight modification of traditional breadmaking methods is needed for the production of acceptable bread from composite flours.

9. Bakers can be encouraged to produce brown bread in order to maximise the use of wheat imports. Since whole wheat flour has a short shelf-life, the flour mills, in addition to the white flour they produce, must make available some bran flour to be purchased and used for brown bread.

10. Caution! Large scale adoption of brown bread production by the bakeries would mean depriving the feedmill industry of an essential input - wheat bran. Careful study of the situation needs to be carried out to find an appropriate substitute for wheat bran in the formulation of animal feedstuff.

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