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MAIZE QUALITY, PROCESSING AND UTILIZATION RESEARCH IN GHANA

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Executive Summary

Maize is the leading cereal produced and consumed in Ghana. It features prominently in the diets of the various ethnic groups in the country from the coastal belt to the savannah areas of the north.

A lot of research has been carried out into the crop in Ghana and the country has a comparative advantage in the West African sub-region with regard to scientific capability and research into maize. However, almost all our scientific efforts have been in the areas of breeding agronomy and protection and little research attention has been paid to processing and utilisation of the crop in Ghana.

The main research institutions involved in research into maize quality, processing and utilisation in Ghana are the Food Research Institute, Crops Research Institute, the Department of Nutrition and Food Science, University of Ghana and the Department of Biochemistry, Kwame Nkrumah University of Science and Technology.
Under a FRI/GLOBAL 2000 project, some maize varirties were screened and Dobidi had the highest value for test weight and 1000 kernel weight.

Under the National Agricultural Research Project (NARP), 8 varieties of maize supplied by the Crops Research Institute were eviluated for their physico-chemical and?functional properties. GH-2328-88 was found to be the most desirable variety for both kenkey and thin porridge.

Work at the Crops Research Institute centred mainly on the evaluation of the protein quality and the assessment of mixtures of Quality Protein Maize and legumes for food modelling studies.

Introduction

The Food Research Institute of the Council for Scientific and Industrial Research (CSIR) is the main Institution in Ghana concerned with post harvest research on all the major food crops including maize. The other institutions in which some amount of maize quality research goes on include The Crops Research Institute also of the CSIR, The Department of Nutrition and Food Science, University of Ghana and the Department of Biochemistry, University of Science and Technology.

The National Agricultural Research Project (NARP) Structure

Agricultural Research in Ghana has for the past 5 years been co-ordinated by the NARP Technical Secretariat. This secretariat is headed by the Deputy Director General (Agricultural Research) of the CSIR. Under the NARP, there are various Research Programmes responsible for the various commodities. These programmes are headed by Co-ordinators working in close collaboration with Programme Co-ordinating Committees (PCCs). The PCC is responsible for co-ordinating research along multi-disciplinary and multi-institutional lines. Maize quality, processing and utilisation research therefore falls under the NARP Maize Programme.

The Food Research Institute (FRI)

One of the functions of the Institute is to carry out adaptive research into the post harvest related problems like storage, packaging, processing and preservation of a variety of food crops. The crops include roots and tubers like cassava and yams, fruits and vegetables, mushrooms, grains legumes like cowpeas, groundnuts and soybeans, and cereals like rice, sorghum, millet and maize. Research into fish, meat and diary products also goes on in the Institute.

There is a cereals research unit that is responsible for maize quality research.

The FRI Maize Research Programme

Maize (*Zea mays)* is a major staple food crop in many developing countries, including Ghana. In Ghana, the high cost of inputs for maize cultivation coupled with the low yield has made the local maize variety expensive and not competitive on the export market (Ashiama, 1986). Efforts in Ghana have involved varietal improvement research to obtain high-yielding varieties for cultivation by local farmers.

The success of breeder improvement programmes depends not only on high production yields and desirable agronomic characteristics but also on the suitability of the varieties for food uses. Consumer acceptability of any improved varieties will depend on desirable functional and sensory properties for the traditional maize food. In Ghana, consumer complaints concerning improved varieties have included hard grain texture, difficulty in milling (dry or soaked), chaffy meal with low swelling capacity and poor sensory characteristics of the prepared maize dishes (Sallah and Dzah, 1986).

Work on maize variety improvement has remained a steady activity of maize breeders and agronomists and the main aim of the FRI Maize research programme has been to establish and characterise the properties of released varieties and determine their suitability for specific food use. This will help breeders and extension workers to concentrate on the promotion of high yielding varieties with desirable food properties.

Review of Past Research

Maize is consumed in many parts of Ghana as porridge. The porridge may either be a thin one called "koko" or a thick one called "kenkey". Unlike in most other countries where maize-based foods are prepared from unfermented meals, the Ghanaian porridges are made from fermented doughs. It was realised that these porridges were very popular with the populace, the dough preparation was very laborious and unattractive to urban dwellers. One of the first researches into maize processing at the FRI was therefore the development of dehydrated fermented maize flour ready to be cooked into "koko" or "kenkey" (Andah and Osei-Yaw, 1979). This involves the soaking of the grains in water for 36 to 48 hours, grinding in a disc attrition mill and mixing with a limited amount of water to form a dough which is then fermented for about 48hours. The fermented dough is then dehydrated in a hot air draft oven to a moisture content of about 12%.

In another work under an FRI/GLOBAL 2000 project, two high yielding varieties of maize, namely "Dobidi" (Ejura 7843) and "Aburotia" (Tuxepeno P.B. C16) and one local unimproved variety were evaluated for their physical, chemical, functional and sensory properties in relation to their suitability for common Ghanaian traditional maize foods (Plahar et al., 1987). The "Dobidi" variety had the highest value for test weight and 1000 kernel weight but the least hull proportion of kernel. Milling properties of grains increased with period of soaking for the "Dobidi" variety while the fineness modulus values of "local" and "Aburotia" varieties did not increase significantly after 36h of soaking. Spontaneous fermentation of dough samples showed no varietal effect on the development of flavour components as determined by titratable acidity. High consumer preference scores for the traditional maize foods were recorded for all the varieties.

Under the NARP Maize project, 8 varieties of maize were evaluated for their physico-chemical and functional properties (Manful et al 1997). These varieties

were obtained from plant breeders of the Crops Research Institute. The varieties had reached the "on-farm" trial stage and on the verge of release to farmers.

Results showed that agronomic performance of varieties did not correlate highly with good processing characteristics. Differences in the suitability of cereal varieties for food use as determined by sensory evaluation were recorded (Manful et. al, 1997). The grains were of high physical quality with a wide variation in grain size. GH 2328-88 was found to be the most desirable cultivar for both kenkey and thin porridge preparation. Whilst Obatanpa and GH 132-28 were the least preferred for kenkey. Abeleehi was the least desirable variety for porridge preparation

The FRI in conjunction with the Danish International Development Agency (DANIDA) has carried out research into the nature of traditional fermented foods. Fermented maize foods are some of the main products studied. The object of this project was detailed studies on the microflora occurring in maize dough fermentation and development of starter cultures for these foods. The "kenkey" making process was also studied with the aim of developing a "Good Manufacturing Practice" (GMP) programme for the product.
Microbiological and mycotoxin analyses are also routinely carried out on raw maize, fermented maize and "kenkey".

The FRI has a weaning foods programme in which maize has been used to blend other cereals and legumes in formulating protein rich foods for malnourished children in the country.

The FRI in conjunction with the Natural Resources Institute of the U.K. and the Ghana Standards Board have developed a criteria for grading maize in Ghana.

Crops Research Institute

The Crops Research Institute has a small Biochemistry Unit with a "Quality Protein Laboratory"

The aim of this laboratory is to achieve an improved analytical capacity to enable chemical screening for protein quality keep pace with agronomic selection and articulate the consumption concerns of agricultural development.

The activities of the laboratory include the following:

- Analysis of breeding materials. This year, the laboratory is analysing maize breeding lines for tryptophan and would select high quality protein materials.
- Seed Quality Analysis: About 100 seed maize samples would be analysed this year for protein quality before final certification and purchase by farmers. Some more samples would also be analysed for human nutrition studies.
- Variability in protein quality: About 90 samples would be analysed for variability in tryptophan and lysine content to help in the selection process.
- Food Modelling studies: The current focus in this area is on evaluating mixtures of QPM and legumes for food modelling studies. Based on the outcome of these studies, predictive food choice models based on QPM, product and sensory optimisations will be developed. Consumer acceptability of QPM based foods should give further impetus for QPM development in Ghana.

The Universities

Maize quality research being carried out in the universities is within the general framework of their research. No major landmarks could be identified but this is not in any way to suggest that such work is non-existent in the universities.

Conclusion

Maize continues to be the most important cereal produced in Ghana and research work on the crop continues to be carried out in all the departments of agriculture of the universities in Ghana as well as the relevant institutes of the Council for Scientific and Industrial Research.

The sources of financing these research programmes are varied. These may either be directly from government sources or donor supported. There are also several scientists in the country working on various aspects of maize research, from breeding and agronomy to processing and utilisation.

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