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Initiative for Improving the Micronutrient Content of Staple Food Crops and their Products in West Africa:

A Concept Paper

OAU/STRC-SAFGRAD - Facilitator of the Initiative

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draft

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Project Title: Improving the Micronutrient Content
of Staple Food Crops and their Products in West
Africa.

Benefiting Countries: 16 - Countries in West Africa.

Country-level Pilot Studies: Benin, Burkina Faso, Côte d'Ivoire,
Ghana, Mali and Nigeria.

Collaborating Institutions:

- NARS and Food Science and Technology
Institutes.
- Food Processors and Farmers.
- Networks and IARCs - IITA and ICRISAT.
- Farmer to Farmer Program, Winrock
International, the private sector, NGOs and
humanitarian institutions.
- OAU/STRC-SAFGRAD: Coordination and
facilitation.

Project Duration:

- Five years (1998-2003).

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I. Background

During the World Food Summit of 1966, governments pledged to reduce the number of undernourished people from the current level of 840 to 400 million by the year 2015 (FAO, 1996). Africa possess a significant portion of the above vulnerable population. The high incidence of chronic under-nutrition in many regions of Africa affect not only the health, vigour, labour and productivity of the individuals, but also the economic development of the communities at large.

Poverty and malnutrition are inter-related problems, which have devastated the livelihoods of millions of households in sub-Saharan Africa. The high prevalence of deficiency diseases such as corneal blindness due to vitamin A deficiency; goitre, due to lack of iodine; anaemia due to insufficient iron and protein energy malnutrition; have led to retardation of growth, poor health and low labour productivity (FAO, 1987).

Several factors have contributed in aggravating the malnutrition problems in the sub-region. Among these are high population growth, poverty, degradation of the environment, poor agricultural development support services, and lack of enabling economic policy environment. ***This initiative moves away from old practice of treating these issues separately towards dealing with them in a holistic way.***

The groups most vulnerable groups to malnutrition are pregnant and lactating women, weaning and pre-school children who are seriously affected. The proposed project can contribute immensely in improving the nutritional quality of the basic diet of the population in West Africa.

Goal:

To improve the nutrition and livelihood of the rural and urban population in West Africa to increase food production of higher quality and the reduction of diseases attributed to micronutrient deficiency.

Purpose:

The incorporation of micronutrients into carbohydrate-based diets through the fortification and development of improved cultivars (i.e. maize, sorghum, millets, cowpea, etc.) high in iron, zinc, pro-vitamin A and reduced levels of anti-nutritional factors.

Objectives:

The strategic objectives of the project are to:

- ◆ Improve the quality of the carbohydrate based-diets of millions of households in West Africa through the environment with micronutrients of staple food crops, such as maize, sorghum, millets, cowpea, etc.
- ◆ Promote the production and productivity of the selected staple food crops with relatively high content of micronutrients.
- ◆ Promote the genetic fortification of selected staple food crops to develop cultivars with relatively higher content of provitamins A, iron, zinc and lower content of phytic acid.
- ◆ Enhance the processing and preservation of selected staple food crops to create demand, market and consumption.
- ◆ Look into other plant sources (indigenous and exotic) for protein and micronutrients.

- ◆ Improve the public awareness of health problems attributed to micronutrient deficiency, to build-up solidarity in the struggle against hunger, poverty and malnutrition.
- ◆ Forge partnership between research and development organizations, at the various levels of operations from production through private sector, processing, marketing, and distribution agencies, farmers, health clinics etc.

II. Justification

The lack of an appropriate weaning food has been attributed to infant malnutrition and mortality in West Africa. Weaning places considerable strain on children because the demand for extra-nourishment increases rapidly. Generally, at this age both calories and protein deficiencies are in the range of 50% since the child is fed on starchy foods, with little or no fish, milk or meat.

In addition, pre-school children have extra need for protein and calories for rapid growth and development. In West and Central Africa, the deficiencies are in the range of 30-40 % below requirement.

In the sub-region, about 12% of children born alive die before their first birthday, and a further 7 to 8% before the second birthday. In addition, about 40% of all children born alive fail to reach adult life. It is estimated that 20% to 30% of mortalities which occur under five years of age can be prevented if children consume enough protein, Vitamin A and other micronutrient rich diets (personal communication, Maud Kordylas, 1998).

The presence of phytic acid, a major anti-nutrient, binds, iron and zinc, in cereals and grain legumes reduce the absorption of these micronutrients in the body. The adverse effects of phytic acid could be reduced through consumption of crop varieties low in phytic acid content or with enhanced levels of bio-availability of micronutrients.

Vitamin A deficiency prevails in the Northern Guinea Savannah, Sahel and Sudan Savannah agro-ecological zones, where B-carotene rich red palm oil (a precursor of vitamin A), is not plentiful. Animal products are the main source of vitamin A, which are beyond the economic reach of people in sub-Saharan Africa. Plant products are an important source of carotenoids that may be converted to vitamin A in the body (pro-vitamin A carotenoids).

Furthermore, the shortage of the B-group vitamins is prevalent in the sub-region. There is also protein-calorie-malnutrition among children, particularly between the ages of 3 to 7 years old, with an estimated mortality rate of about 50%.

There is good potential for incorporating micronutrients into staple food crops and their products for improving human mineral and vitamin nutrition (Graham, R.D and Welch, e. 1996). Grain legumes such as cowpea will be used to complement the nutritional value of cereals in order to improve the dietary quality of weaning foods.

III. Strategy

The implementation of the programme will be participatory and will involve the institutions that have a major role in improving the nutritional status of people of the sub-region. Among the strategies that will be employed include:

- 3.1 The establishment of functional linkages (or informal networking) between food science and technology units and processors (in participating countries) to facilitate the development of fortified food products.
- 3.2 The genetic fortification of maize and cowpea by IITA and sorghum and millet by ICRISAT in collaboration with NARS.
- 3.3 Joint project activities involving crop commodity networks (i.e. maize, sorghum, millet, cowpea, etc.) and farmers of participating countries to enhance the production of seeds of improved cultivars.

3.4 The production of raw materials for processing by facilitating contracts between farmers and processors.

3.5 Partnership of Stakeholders

The activities of this project will complement and reinforce the on-going national and regional efforts and initiatives to alleviate malnutrition in both rural and urban areas. Although the project will benefit all the 16 countries in West Africa, pilot-project activities will be established in Benin, Burkina Faso, Côte d'Ivoire, Ghana, Mali and Nigeria. In these countries, partnerships will be established between farmers, food science and technology institutes, small to medium size processing units to enhance the production of improved cultivars (i.e. maize, sorghum, millets, cowpea, etc.) enriched with micronutrients as raw material for processing and food preparation and fortification. The International Agricultural Research Centers (i.e. IITA and ICRISAT) will develop and promote improved cultivars that contain high micronutrients, while the food research institute will develop the processing technologies. The Farmer to Farmer Program of Winrock International, as a partner, will assess the potential and opportunities of food fortification, product development, processing and propose interventions that will lead to improving the micronutrient contents of staple foods and by-products.

Collaboration with women's groups, the public and private sectors, humanitarian organizations, etc. can facilitate the distribution of fortified products and trials, for example, at Centre Medical St. Camille in Burkina Faso, UNICEF, Save the Children country level activities to measure the effectiveness and impact of fortified products at recuperating centers.

OAU/STRC-SAFGRAD will serve as the regional coordinating and facilitating agency for implementing the project activities.

IV. PROGRAM

4.1 Fortification of Selected Staple Food Crops

Activities:

- 4.1.1 Preliminary baseline studies will be carried out in the selected countries to determine the extent of the nutritional problem.
- 4.1.2 Dietary history be documented from selected samples to determine values of nutrient components of the diets to ascertain energy, protein, vitamins and mineral intake.
- 4.1.3 Micronutrient incorporation studies.
 - To identify micronutrient sources.
 - To determine the levels of micronutrient fortification, for example, cereal flours, grain legume flours, cereal/legume flour mixtures.
- 4.1.4 The National Food Research Institute and the Food Science Departments of the Universities of the selected countries as partners will reorient their program towards the needs of small to medium scale processors in order to enable them formulate micronutrient fortified products.
- 4.1.5 Transfer of processing technologies to processors who would produce the products for marketing and distribution.
- 4.1.6 Evaluation of micronutrient fortified products consumption on the improvement of nutritional status of target groups.

4.1.7 Farmers assisted by researchers and extension agents would be contracted to produce the quantities of raw materials needed for the formulation and production of the micronutrient fortified products.

4.1.8 Provision of technical assistance in food processing, fortification, packaging and marketing and training by "Farmer to Farmer Program of Winrock International".

4.2 Promotion of the production and productivity of the selected staple crops

The USAID supported networks in West and Central Africa, namely the maize, sorghum and cowpea networks and other regional programmes, and NARS have been quite successful in developing varieties and agronomic practices for each of the named commodities. Also, IITA, NARS and ICRISAT of West and Central Africa (WCA) have developed improved sorghum, millet, cassava and yam varieties. Some of the improved maize, millet, sorghum, cowpea, cassava and yam varieties have been released and have been widely adopted in the sub-region resulting in increased food production on a sustainable base. However, the adoption of these improved varieties is not as high as desirable due to ineffective technology transfer.

These networks would support the development and promotion of improved varieties through funding support to the collaborative research projects executed by the NARS in the selected countries. Through the collaborative projects, high yielding, disease and pest resistant varieties of the staple crops would be developed for adoption by farmers. Also through the community level seed production schemes funded by the networks, adequate quantities of seed or planting materials would be made available for commercial production by the selected collaborating farmers to be involved in the micro-nutrient project. These farmers would be contracted to produce adequate quantities of the high micronutrient containing cultivars staple food crops for sale to collaborating small to medium scale processors who will be registered by the project to carry out the fortification with the micro-nutrients.

Essential linkages would be established with churches, polyclinics, women's groups and UNICEF in identifying and creating markets for the distribution of the micronutrient fortified products.

4.3 Promote processing and preservation of staple crops

Activities:

- 4.3.1 National Food Research, Food Science and Technology Institutes in partnership with NARS would develop appropriate post harvest technologies for handling and storage of selected staple crops and transfer these technologies to farmers at levels of production.
- 4.3.2 In partnership with food processors, the project will facilitate the development of effective processing and preservation technologies with value-added products to stimulate demand, marketing and consumption of the crops produced.
- 4.3.3 Transfer of the technologies developed through the project to private processors at all levels.
- 4.3.4 In order to facilitate the distribution of micronutrient fortified foods and other value-added products, linkages will be established to involve, NGOs, women's groups, schools, government agencies, such the Ministry of Agriculture, Health and Education will be established.

4.4 Genetic Fortification of Maize, Sorghum, Millet and Cowpea

- 4.4.1 Development of varieties of cereals such as maize, sorghum, millet, etc., that load high amounts of iron, zinc, and pro-vitamin A carotenoids in their seeds holds great promise for making a significant, low cost, and sustainable contribution to reducing vitamin A, iron and zinc deficiencies in humans in sub-Saharan Africa.

4.4.2 This programme will identify improved cultivars of maize, sorghum, millet and cowpea that are high in micronutrients (iron, zinc and pro-vitamin A) with reduced levels of anti-nutritional factors; to promote adoption of cultivars and accompanying methods for fortification of flour with micronutrients at the household and industrial levels and to develop a strategy for further improvement of micronutrient content through selection and breeding.

The activities will include:

- ⇒ Screening of African land races of maize, sorghum, millet and cowpea, including screening exotic germplasm for pro-vitamin A content.
- ⇒ Developing crop cultivars with high content of micronutrients.
- ⇒ Determine levels of phytic acid in adapted local and improved maize, sorghum, millet and cowpea cultivars.
- ⇒ Identify best cultivars with high micronutrient content for dissemination and further evaluation by NARS, processors, etc.
- ⇒ Development of processing technologies which will enable village women to prepare food products with acceptable organoleptic characteristics.
- ⇒ Evaluating the stability of micronutrients to traditional processing methods and organizing workshops and demonstrations in collaboration with village women.

Expected output

Some of the expected outputs of this initiative include:

- ⇒ Affordable micronutrient fortified food products for improving the basic diet in rural and urban areas.

- ⇒ Prevention of diseases attributed to deficiencies of micronutrients in carbohydrate-based basic diets.
- ⇒ Availability of improved crop cultivars that contain high protein and micronutrient levels and reduced level of phytic acid for production in rural areas.
- ⇒ Viable technologies for processing, packing and marketing of fortified food products that will lead to micro enterprise development.
- ⇒ Improved technical skills of women and men in the utilization of technologies, such as the production of improved cultivars, processing, fortification and distribution.*
- ⇒ Sensitization to build public awareness of health problems attributed to micronutrients deficiency.
- ⇒ An informal network of multi sectorial and multi disciplinary partnerships involving ministries of agriculture, education and health; research, farmers, NGOs, UNICEF, processors, etc., to facilitate technology transfer, distribution of fortified products and including trials to measure the effectiveness and impact at recuperating centers.

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