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R E P O R T

by the

FAO/ECA

MISSION to DETERMINE the FEASIBILITY of ESTABLISHING
REGIONAL DEVELOPMENT AND TRAINING CENTRES

in

COMPOSITE FLOUR TECHNOLOGY

by

STRENGTHENING EXISTING CENTRES

June - October 1980

(Part 1. of Resolution 3(v) of the
Fifth Conference of African
Ministers of Industry)

United Nations Economic Commission for Africa
Addis Ababa, Ethiopia

Food & Agricultural Organization of the United Nations
Rome, Italy

1981

S U M M A R Y

Pursuant to part 1. of Resolution 3(v) of the Fifth Conference of African Ministers of Industry the professional members of the FAO/ECA Advisory Group on Food and Agricultural Industries Development in Africa (AGEFI), in collaboration with up to three advisors attached to their Mission in certain countries, visited ten countries to ascertain the 'feasibility of establishing regional development and training centres in composite flour technology by strengthening existing centres' - during June through October 1980. This Mission found the establishment of at least two such centres feasible - indeed, essential and urgent? Further that there are only two existing centres of experience and capability that could be recommended. Consequently the Mission recommends that "Regional TCDC Development and Training Centres in Composite Flour Technology" be established at the Institute of Food Technology (ITA), Senegal (Millet) and at the Food Research Centre, Khartoum (Sorghum). Senegal has confirmed in writing its offer to host such a centre. Sudan is expected to confirm soon its offer to host the second centre. On a five-year basis the cost of transferring the "know-how" from Senegal and Sudan is estimated at \$1.5 million each - principally for training and movement of people to and from the two centres.

In addition the Mission recommends that the feasibility of a third such centre to serve the cassava-producing countries be looked into. Lastly, that particular attention be given the interests and needs of the regional grouping of nine Southern Africa Frontline States with regard to composite flour development.

Part 2. of the Resolution calls for the production of a 'technical compendium' on composite flour, and while this is not a subject for this Report it is of interest to note that this work can be now carried out thanks to a grant of \$160 000 recently received by ECA from the Royal Netherlands Government.

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* Technical Cooperation Among Developing Countries

1. INTRODUCTION

The opening sentences in FAO's 1969 publication (Agricultural Services Bulletin 4: "Bread from Composite Flours") are as significant, if not ominous, today as then --

"The growing popularity of wheat products, particularly bread, in many developing countries is continually increasing these countries' imports of foreign wheats. Since the major suppliers of wheat are located in hard currency regions this expanding demand for wheat and bread is tending to create balance of payments difficulties.

Though this trend may to some extent be retarded by the introduction into the consuming countries of high yielding varieties of wheat, many of these countries are capable of producing other cereals such as sorghum, millet and maize, or root starches; such as cassava, in substantial quantities. It therefore appears logical in such countries to attempt to replace, at least in part, imported wheat flour by other flours and meals which are indigenously available."

Imports of wheat to Africa rose at an average annual volume increase of 14% and an average annual value increase of 26%, during the period 1970 to 1978. In 1978 wheat imports reached 13.4 million metric tonnes costing over US\$2 billion (TABLE I). 60 to 80% of these imports are used in the manufacture of bakery products.

Africa is not a natural wheat producing continent, and what success the several scattered wheat-producing projects may have will obviously be limited to the production areas - and will in no way influence the increasing imports of wheat.

For some 17 years FAO has worked in association with many developing countries in Asia, Latin America and Africa - and work has also gone on in a few developed countries, notably Britain, Holland and Canada in bilateral association with several developing countries - on incorporating flours from such locally-produced cereals and tubers as sorghum, millet, maize and cassava, with wheat flour to produce bakery and other food products. The resulting products can now be said to have been widely accepted.

It is technically feasible to produce bakery products from a 'composite flour' - wheat flour mixed with 10 to (currently) 30% of locally produced sorghum, millet, cassava flours with an attendant cost saving on the imported wheat, and distributing an equally nutritious (see following) product.

At the minimum addition of 10% indigenous flour replacing imported wheat the Africa-wide theoretical saving in hard currency is US\$ 200 million.

It is difficult to reason as to why -- with the technical feasibility and resulting economic gains apparent -- so few African countries have sought to exploit this concept of composite flours. Almost 40 African countries produce substantial quantities of sorghum, millet, cassava and maize and consider them staples (TABLES II through V).

This particular area of cereal processing, and specifically composite flours, need not be singled out for lack of attention. The broad field of 'food industry development', in general, continues to suffer from lack of investment despite the fact that the five Conferences of African Ministers of Industry to-date each accorded the development of "food and agro-industries" the highest priority among all industrial sectors. (The CAMI is the only body representing African industry as a whole. Thus its designation of this sector as that of top priority means the strongest support on the broadest front, and at government level.) It may be noted also that this sector accounts for up to 60% of the value added in all industrial manufacturing.

The advantages of composite flour products over those made from 100% wheat flour are several, and all or most apply to every African country with increasing wheat imports yet producing cereals roots or tubers suitable for making flours for composite flour use:

- o increased utilisation of indigenous production and incentive to produce;
- o increased food self-sufficiency;
- o increased food 'security' in times of scarcity of (imported) wheat or reduction in production of a particular cereal or tuber crop used for composite flour*;
- o reduction of dependency of local bakeries and associated industries on wheat imports leading to savings in foreign exchange;
- o increased industrial investment and thus employment;
- o serve as a convenient 'vehicle' for improved nutrition by the addition of flour(s) from proteinaceous legumes, etc.

Food self-sufficiency, the development of industry and of human resources are basic priorities of the Lagos Plan of Action. Two other priority areas of the Plan are the development of subregional and regional co-operation and the promotion of TCDC, and the promotion of science and technology. All these five find a place in the concept of composite flour and its stimulation of indigenous production and utilization, etc (above), and the consideration given the establishment of regional development and training centres in this technology on which this Report is based.

Further, ten specific goals are given for the Plan and five are aimed at in the thinking on the regional centres:

* As composite flours can successfully be made from one or more indigenous flour-producing products -- a lack of one can be made up by an increase in another.

- o national food security;
- o cereal production to reduce dependence on wheat (and barley) imports;
- o training;
- o inter-country cooperation;
- o external assistance (investment, technical and training).

It should also not be forgotten that the 1980s have been designated by the United Nations as the "Industrial Decade."

Against the above background the African Ministers of Industry unanimously adopted the following Resolution at its Fifth Conference at ECA Addis Ababa on 20 October 1979:

"3(v) Regional Development and Training Centres on Composite Flour Programmes

The Conference of African Ministers of Industry

Taking note of substantial continuing expensive increases in imports of wheat and wheat flour into Africa during the last ten years, the availability of cheaper non-wheat grains and roots, tubers (sorghums, millet, cassava) in African countries, and the progress made in the utilisation of indigenous non-wheat flours from these grains and tubers in breadmaking especially in the Sudan and Senegal, in cooperation with FAO

1. Calls upon FAO and ECA, in cooperation with UNIDO, to undertake a feasibility study on the strengthening of existing composite flour development and training centres to serve regional needs - one for East and Southern African countries, the other for West, Central and North African countries;
2. Requests FAO and ECA, in cooperation with UNIDO, to compile technological processes for the production of composite flours utilizing indigenous grains such as sorghum, millet, maize and cassava and make these available to member States as soon as possible."

The FAO/ECA Advisory Group on Food and Agricultural Industries Development in Africa (AGFI), based in the Joint ECA/UNIDO Industry Division at ECA Headquarters participated in the discussion leading to the Resolution at the Sixth Meeting of the Follow-up Committee on Industrialisation in Africa immediately preceeding the Fifth AMI Conference - and at the Conference itself. The action called for in the Resolution is consistent with the "Activities" of the UNDP-financed, UNIDO-associated, AGFI Project and thus it was considered an AGFI mandate and the three professional members of the Project formed the Mission core.

William J. Gall - Mission Leader

John F. Okorio - Cereal Technologist

Bossa M. Vlavonou - Agro-Industrial Economist

FAO's Regional Office for Africa covered the cost of a consultant in Marketing -

Amadou Dembele, of the Institute of Food Technology (ITA) Dakar, to join the Mission during its West Africa itinerary (Senegal, Upper Volta, Ivory Coast, Ghana, Cameroon). Senegal, as a result of ITA Dakar's work, being the most advanced African country with respect to the commercialisation of composite flour for bakery use, it was useful for these other West African countries to hear of Senegal's progress at first hand from Mr Dembele.

In Ghana the Mission was also joined by:

Jacques C. Faure - Food Industries Officer
Food and Agricultural Industries Service, FAO, Rome

and

T.E. Jakubczyk - FAO Regional Agro-Industries Officer, Accra.

The Mission visited ten countries over a four-month period in 1980 as follows:

Kenya	12-16 June
Botswana	18-27 June
Tanzania	30 June - 11 July
Uganda	12-18 July
Senegal	11-19 August
Upper Volta	20-28 August
Ivory Coast	29 August - 9 September
Ghana	10-13 September
Cameroon	15-23 September
Sudan	1-10 October

These number of countries selected was held to ten as time, personnel and particularly funds were limited. The original thinking of two centres in the Resolution was based on language - one to serve Francophone, the other Anglophone, countries - and the selection also reflected this. Finally the selection was made of those countries where FAO's work or requests to it for assistance in the field of composite flours showed definite activity, interest or potential.

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In each country visited, at the initial general meeting which was arranged in most countries, the Mission explained the background to the CAMI Resolution, including the meaning of 'composite flours', their economic significance and the associated technology and, in general terms, the potential role of the proposed regional centres.

Then the Mission explained its wish to ascertain and assess the country's -

- o interest and experience in composite flour development/ utilization;
- o potential for a national composite flour programme;
- o demand for training in composite flour technology;
- o interest in the establishment of a 'regional TCDC centre for development and training in composite flour technology' and its willingness to participate in such a centre;
- o interest in participating in a workshop on composite flours.

2. CONCLUSIONS and RECOMMENDATIONS

In all ten countries visited the interest in the potential of composite flours was quite "positive". The activity in this area varied from 'high' (Senegal and Sudan) to 'low' (a commercial-level trial having been made some years ago but not followed up). But in nine of the ten activity was going on at the research, development and/or commercialisation level.

In the eight countries other than Senegal and Sudan the varying levels of activity appeared to lack sufficient senior Government support and co-ordination - and in final ('round-up') meetings the Mission offered proposals aimed at establishing 'national composite flour programmes' to give direction and cohesion. Further, it was emphasized that a country can best (really, only) participate in a regional (centre) programme if it has a national one.

All countries were interested in participating in a regional centre - and six were willing to host it. All were also interested in participating in one of the two workshops on composite flour that AGFI proposes to hold in December 1981 (FRC Khartoum) and 1982 (ITA Dakar). These workshops will be held before the proposed target establishment dates of the regional centres and serve, in part, as an introduction to them and a fora for discussion of their role by the countries to participate in them.

It became clear to the Mission that a third African regional centre concentrating on cassava utilisation in composite flours was required - as the two regional centres proposed (below) for Sudan and Senegal will be principally involved with these countries main crops - sorghum and millet respectively.

A fourth regional centre concentrating on maize utilisation in composite flours may also be a future consideration of value (as well as sub-regional centres based on sorghum, millet and cassava).

The Mission offers the following general outline of the activities of the regional centres as a basis for thought and further development:

ACTIVITIES - aimed at stimulating and facilitating the development of national composite flour programmes:

Development

- o assistance in the organization and establishment of national committees for composite flour promotion and in the preparation of feasibility studies for national programmes including raw material supply requirements, marketing and price/subsidy relations for composite flour products;
- o advice on appropriate milling and baking equipment at village and industrial levels;
- o milling and baking methods utilising flours from local cereals and tubers for the potential commercial production of composite flours and products;

- o development of bakery recipes, as well as those reflecting traditional African food products, from composite flours;
- o screening for nutritional values and milling qualities of the vast varieties of cereals - especially sorghums - in collaboration with plant breeders.

Training

- o conduct of regional training courses in various aspects of composite flour technology;
- o conduct of regional "trainers' training" courses;
- o assistance in the organisation and conduct of national training courses;
- o 'ad hoc' training of, and advice to, technical and training personnel responsible for national programmes.

In particular, the training will include the following -

- o milling methods for the production of high quality flours suitable for blending into composite flours;
 - c baking methods for breadmaking, cakes, biscuits, etc. from composite flours;
 - o quality control methods for the milling and baking industries;
 - o equipment maintenance in milling and baking plants.
-

The Mission offers four Recommendations:

1. that the offer of Senegal, confirmed in writing, to host the Regional TCDC Development and Training Centre in Composite Flour Technology (Millet) based on the Project Proposal (forming the ANNEX in the French version of this Report) be accepted and financing sought;
2. that the offer of Sudan, being confirmed in writing, to host the Regional TCDC Development and Training Centre in Composite Flour Technology (Sorghum) based on the Project Proposal (forming the ANNEX in the English version of this Report) be accepted when confirmed and financing sought;
3. that a further mission to a selected number of the major cassava-producing states be organised as soon as possible to look into the feasibility of establishing a third such 'regional centre' to concentrate on composite flour development based on mixtures of wheat/cassava flours and make recommendations in this regard - noting the willingness of the Ivory Coast to host such a centre already strongly expressed to the Mission;
4. that particular attention be given the interests and needs of the regional grouping of nine Southern Africa Frontline States with regard to composite flour development - noting the willingness of Botswana, for example, to host a 'regional centre' in this field already strongly expressed to the Mission.

3. SUMMARY REPORT by COUNTRY

It should be noted that these country summary reports were incorporated in AGFI's UNDP Project Progress Report for the period ending December 1980 which was distributed to all UN member-Governments through the respective UNDP Resident Representatives.

3.1 KENYA

The purpose of the Mission's short visit to Kenya was to acquaint itself with the status of projects directly concerned with composite flours. Discussions were held with the Team Leader and several professional staff of KEN/78/016 "Sorghum and Millet Development" together with two of the staff of KEN/74/017 "Dryland Farming Research and Development."

The Team Leader KEN/78/016 had initiated steps to utilize certain sorghum varieties developed with wheat in composite flours. Contact with the major commercial miller in Kenya, who reportedly is experimenting with maize-wheat composite flour for breadmaking, had been made - as well as with the Kenya Industrial Research and Development Institute (KIRDI) which had agreed to use his projects sorghum(s) in composite flour development. His Project had sent KIRDI's Cereal Technologist to the Food Research Centre, Khartoum to carry out milling tests with Kenyan (soft) sorghums.

KIRDI was visited in company with the Team Leader KEN/78/016 and it was learnt that it had a composite flour project funded by the National Council of Science and Technology. Bakery equipment had already been purchased under the project, and a bakery technician was needed. The Team Leader KEN/78/016 was willing to cover the cost of such an expert from his project's consultancy funds. FAO Rome was advised of this by cable.

The Mission also brought with it to Kenya a draft 'Project Concept' for strengthening the Cereal Technology Section of KIRDI under the UN Interim Fund for Science and Technology for Development - which was first discussed with the FAO Country Representative. It was then discussed with KIRDI and the Team Leader KEN/78/016 during the aforementioned visit, favourably received, and left with KIRDI for followup.

A brief visit was made to GCP/RAF/024/DEN "Regional Dairy Development and Training Centre for English-Speaking Countries" to see an 'operational' regional centre for future reference. Its 'mobile Regional Centre' approach where the Centre's team of lecturers goes out to the groups to be trained in the cooperating countries was interesting, and has reduced course costs.

3.2 BOTSWANA

The great majority of Botswana's population of over 800 000 lives in rural areas and almost the entire population eats sorghum as its main food in the form of a porridge (Bogobe). However, as with all other main food crops, the country produces only a part of its sorghum needs - the shortfalls being made up by

purchases from South Africa. Similarly, a little wheat is grown but increasing volumes of wheat flour (Botswana has no wheat mill) are imported from South Africa principally for the five (modern) bakeries in the three largest urban centres. (A sixth bakery will soon operate in the fourth urban centre). Consumption of wheat bread is spreading from the expatriate urban to local urban and rural population.

Botswana is about to begin "ALDEP" (arable Lands Development Programme) aimed at self-sufficiency in basic grains and legumes; and the marketing and processing of grain crops (sorghum) is only one aspect of this programme to encourage the development of arable agriculture. Other components of the ALDEP programme are water and fencing developments, credit, marketing, input supply (including implements and machinery repair and servicing), physical infrastructure, technology packages and financial incentives.

About one-third of the population is estimated to suffer from malnutrition, and in May 1980 a "Permanent Inter-Ministerial Food and Nutrition Committee" was set up.

With a basic liking for sorghum (and maize) in the population - and its desire for bakery products of wheat being stimulated - sorghum/(maize)/wheat products should find acceptability tastewise and pricewise as long as the prejudice against 'other-than-white' bread can be overcome.

Sorghum milling for porridge (coarse) or bread (fine) is now being successfully done with the village-level equipment recently developed by the Rural Industries Innovation Centre (RIIC) and the International Development Research Centre (commonly referred to as the "Botswana mill") at three locations - Pitsane, Kanye, Gabane. At Gabane, "Pelagano Village Industries" (PVI) is also making bread with up to 30% sorghum added to wheat in a manually-operated bakery and it is selling its product locally. As soon as it receives its licence it intends to sell composite flour bread and biscuits through its already-organised hawker and vendor network in Gaborone and area.

PVI is willing to have its mill and composite flour bakery serve as a starting point for the development of a 'national composite flour programme'. It would also consider hosting a 'regional development and training centre in composite flour technology' - but this is for later consideration.

Botswana is one of the regional grouping of nine Southern Africa Frontline States formed in 1979 to promote economic co-operation and development coordination among themselves.

There is definite interest in such a programme with the Ministry of Health (MOH), the Inter-Ministerial Committee referred to above, PVI, the Botswana Technology Centre and Rural Industries Promotion (under which RIIC falls) and interest with the Ministries of Commerce and Industry (MCI), Agriculture (MOA) and Finance and Development Planning (MFDP). Composite flour products as a nutrition vehicle interest MOH and there are local legumes, etc. that can be incorporated for particular target groups.

At the final meeting with MFDP, MCI, MOH, MOA the Mission was requested to provide Terms of Reference for a:

- o Bakery Expert for PVI (Short-Term, Urgent) and a
- o Project Preparation Mission (to assist in drawing up a 'national composite flour programme')

and these were drafted and forwarded to FAO Headquarters through the Office of the UNDP Resident Representative in Gabrone.

Given such a 'national composite flour programme' the expressed offer, in principle, of Government to host a regional development and training centre becomes more feasible. It may be desired that such a centre primarily serve the group of nine Southern Africa Frontline States (Angola, Botswana, Lesotho, Malawi, Mozambique, Swaziland, Tanzania, Zambia, Zimbabwe).

3.3 TANZANIA

Shortages of Tanzania's main cereals - wheat and maize - continue. Sorghum, millet and cassava are produced in even lesser quantities and their consumption restricted to their areas of production. The costs of importing wheat, maize and rice continue to rise.

Maize flour may be added to wheat flour to extend it; there are good milling varieties of sorghum the production of which could be increased - and sorghum flour combined with wheat (or wheat/maize) flour. Millet and cassava flour may also be used as additives or extenders, and flours from legumes added to any of these to give more nutritious composite flours for specific target groups.

Senior Government officials expressed interest in the above composite flour possibilities from the standpoints of increased food self-sufficiency, reduced foreign exchange expenditures, a food "flexibility" and thus greater food security and as "vehicles" for delivering nutritional requirements.

There are four separate composite flour activities in the country:

- o the Food Science and Technology Department of the University of Dar-es-Salaam at Morogoro is starting a project - "Promotion of Home and Commercial Utilization of Sorghum" (supported by the International Development Research Centre);
- o the Tanzania Food and Nutrition Centre (TFNC) continues to work with wheat/sorghum and wheat/cassava composite flours for bread;
- o the National Milling Corporation (NMC) is installing a large new sorghum mill at Dodoma to market the flour alone and also as a composite flour with wheat for breadmaking. (supported by FAO);
- o the Small Industry Development Organisation (supported by the International Development Research Centre) will install the new village-scale sorghum mill; which has proven successful in Botswana

(the "Botswana Mill"), at Kilosa. This mill, 1/10th the price of the new Dodoma mill, may prove the more efficient of the two. It is small, can be operated on a batch or continuous basis, and is thus suited for local replication for village use.

TFNC, it is hoped, will see that "composite flours" have a place in the coming national Food and Nutrition Policy and next Development Plan.

However, communications and coordination between and among these four-mentioned activities could be strengthened and other approaches taken to give far greater progress in a shorter time towards the development and commercialisation of composite flour products.

The ability to produce and test market composite flours beyond the laboratory level lies with NMC and the private bakers. The technical guidance necessary, in general, lies with TFNC and the Food Science and Technology Department in Morogoro -- but the technical and marketing requirements of 'product development' needed to translate the experimental results into commercial operation may be lacking. The "years" now said to be required for composite flour development due to lack of adequate pilot baking and other laboratory facilities could be slashed by co-operation with existing small, commercial bakeries.

At the final meeting with Government two alternative proposals were suggested as follows:

- o formation of an 'inter-ministerial (national) composite flour committee' based on the Ministries of: Planning & Economic Affairs, Health, Agriculture and Industry to develop, coordinate and manage a national composite flour programme

(Note a "Sorghum Promotion Programme" exists under TFNC which might readily be expanded into such a committee);

OR

- o a specific mandate from the highest Government level possible be given TFNC to develop an action-oriented national composite flour programme in collaboration with the other interested Ministries (above) and bodies.

Should outside assistance be necessary contact with FAO and AGFI was suggested. The composite flour experience in Sudan, Senegal and elsewhere might advantageously be drawn on through such programmes as TCDC, etc.

3.4 UGANDA

Government officials made clear to the Mission Uganda's willingness to host a regional development and training centre in composite flour technology.

Visits were made to the key institutions concerned with cereals such as the Uganda Grain Milling Corporation (UGMC) at Jinja and Serere Research Station, as well as a tour of Uganda's "cereal belt."

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UGMC is a grain milling (three wheat mills), breadmaking, animal feed complex which used to use imported wheat. Its bakery is large (two lines - 100 000 loaves daily) and modern. The Mission was impressed by the Serere Research Station's breeding and seed multiplication programmes for sorghum and finger and bullrush millets - but no test milling facility is available to check milling quality and give prompt and better direction and definition to its programmes. From the cereal belt tour Uganda's potential to increase cereal root and tuber production, as well as legumes including soybeans, was obvious. Her annual wheat requirement is 30-55 000 MT whereas production is only 3 000 MT. Foreign currency restrictions have substantially reduced wheat imports - Government intends to continue importing wheat/wheat flour for bakery products. Therefore the significance of a composite flour programme to Uganda, in parallel with its programme to increase production of cassava, sorghum, millet maize, etc. is clear. However, there is no composite flour programme as yet nor established institutions involved in 'food science and technology'. There is, though, a move to revive the former National Food and Nutrition Council.

At the final meeting with Government the Mission recommended that the following proposals - aimed at establishing a 'national composite flour programme' - be given urgent consideration, noting that it feels the programme should concentrate on wheat + sorghum products first as the technology is well established; then wheat + millet, wheat + cassava, etc. as experience and acceptability grow:

- o provide a sorghum test milling facility for Serere Research Station to guide its programmes in order to have a steady supply of the right quality of sorghum in sufficient quantity as soon as possible;
- o install a test baking facility (medium size oven) and pilot sorghum mill at UGMC to determine the specifications for commercial baking with UGMC's existing bakery, and for the other facilities proposed below;
- o install commercial sorghum milling and baking facilities at urban centres in the sorghum-producing areas.

The capacities of these various facilities must all be planned from the first - selected to arrive at a "balance": wheat flour milled at UGMC for its own use as well as for the other bakeries; sorghum flour milled at these centres for their own use, and one or more of them supplying UGMC as well;

- o the proposed "National Food Technology Centre" outlined by FAO for Government in 1968 should have its needs reappraised in light of the changed present and future needs of the country.

It should have a Cereal Technology section developed on a priority basis to take on the development and training aspects of the national programme;

- o install baking facilities in other urban and village centres.

These would be supplied wheat and sorghum flours (separately or already combined) from UGMC or one of the other centres as transportation and distribution economics dictate.

The first four proposals could proceed simultaneously under a co-ordinated national programme. As they develop, the needs and details of the last proposal will become clear.

As the 'national composite flour programme' develops Governments' offer to host a regional centre becomes more feasible.

3.5 SENEGAL

One of the objectives of the current economic development plan is food self-sufficiency: cereal imports are about 400 000 MT annually, costing CFAF 22 billion in 1978 which represents around 50% of the trade deficit. Wheat is the main cereal imported: 157 000 MT valued at CFAF 5.9 billion in 1978.

The Souma variety of millet comprises 80% of the cereal produced and is well accepted by the population. This liking for millet products means the large scale marketing of wheat/millet composite flour bakery products only requires sufficient raw materials, composite flour production and the training of bakers.

The 'national cereal policy' aims at increasing production and reducing imports and the Institute of Food Technology (ITA) Dakar, assisted by FAO, developed 'millet bread' ('Pain de Mil') (70% wheat flour + 30% millet flour) and 'Pamible' (85% + 15%). ITA then trained the 240 bakers in the country in the technique of baking with composite flour. To ensure consumer acceptability the Government decided to begin with 15% millet flour (Pamibl ) and increase over time to 30%. It made Pamibl  production and sale obligatory by decree No. 79-665 of 7 July 1979. In the last few years Senegal has used 68 000 MT of baking (wheat) flour. Using 30% millet flour in Pain de Mil means reducing wheat imports annually by 20 400 MT of flour (or 27 000 MT grain) corresponding to a saving of about CFAF 1 billion (US\$ 4 million) in foreign exchange or CFAF 500 million (US\$2 million) for Pamibl . ITA is also developing the techniques of baking products other than bread: cakes (50% wheat flour + 50% millet flour) biscuits (20% + 80%), commercially produced "couscous" (100% millet flour) and soya-enriched flour for weaning foods.

At the millers' level a price 'balance' is achieved by subsidising millet flour and selling at less than cost - and taxing the imported wheat - the wheat tax balancing the millet subsidy. This policy promotes millet production.

The Senegalese officials met stressed the Government's commitment to composite flours as a basic policy and felt, in principle, it would be prepared to host a 'regional development and training centre in composite flour technology' (with the accent, obviously, on millet utilization).

It must be noted that Senegal, by virtue of its long background in composite flour product development is an African leader in this field. Further, that ITA's experience in composite flour development and training makes it the logical host for such a regional centre.

Subsequently, at the Government's request, the Mission Leader returned to Dakar in March/April 1981. During his visit agreement was reached on the Government's and ITA's obligations with respect to the proposed regional TCDC centre (ANNEX to the French version of this Report), and by letter No. 1937-MPC-/DFP/El. dated 6 April 1981 the Government confirmed its willingness to host the regional centre.

The Government and ITA also agreed to consider hosting a regional TCDC workshop on composite flour development in early-1982. Aimed at both decision makers and technical personnel in millet-producing countries which will participate in the regional centre, it will also serve as introduction to the regional centre, a forum for discussion of their needs and thus development of the centre's programme, and lay the basis for the proposed 'advisory committee' for the centre.

3.6 UPPER VOLTA

The national diet is based on sorghum and millet and production self-sufficiency is achieved every second year on average.

The national grain and food policy is permanent self-sufficiency, and the integrated rural development operations, "West-Volta" and "East-Volta", are moving in this direction. Both projects should eventually develop a permanent cereal surplus and permit export.

Wheat and flour-wheat imports (27 000 MT in 1970, 50 000 MT in 1978) are small compared to the other countries visited. Increasing at a rate of 8% annually from 1970 to 1978, imports per head were 5 kgs in 1970 and 8 kgs in 1978 with a lower rate of increase (6%) during the period. Nevertheless, the foreign exchange required contributes to the country's trade imbalance: CFAF 650 million in 1976, almost two billion in 1978.

In order to reduce these expenditures the Grands Moulins Voltaïques (GMV) launched the "Bleghe" operation (30% sorghum flour + 70% wheat flour) in 1974, including the bakers' training. "Bleghe" was readily accepted by the consumers though its volume was a little less than the 100% wheat bread loaves (at the same weight).

The Bleghe operation stopped in 1975 because of lack of sorghum at a lower price than wheat. Nevertheless, Bleghe remains an important experience for the future.

GMV is located at Banfora in the south on the Abidjan-Ouagadougou rail line; Banfora region is known as the "cereal basket" of Upper Volta. GMV has the (only) wheat mill (capacity: 120 MT/day), a maize mill (capacity: 40 MT/day) and the sorghum-millet mill (capacity: 30 MT/DAY).

GMV, with its Biagho experience, is the best base for a national composite flour programme. In this case the programme could depend less on technical capability than the availability and regular supply of the raw materials, sorghum or maize, at a lower price than wheat. It is hoped that the West-Volta rural development projects will solve that supply problem in the near future.

At the final meet the Mission proposed the following for Government's urgent consideration:

- o establishment of a Composite Flour Promotion Committee made up of, among others, representatives of: Ministères du Plan, de l'Agriculture, de l'Industries (ODIA), de la Santé, du Commerce (ONAC) et des institutions comme l'ONACER, l'ICRISAT, le CILSS, le Syndicat Patronal des Boulangers et le Syndicat des Ouvriers Boulangers.

The Committee will determine and direct composite flour research, development and commercialisation:

- o a tax on wheat and wheat flour imports for baking and a temporary subsidy on sorghum flour for baking - with the subsidy balancing the tax;
- o establishment by GMV of a special sorghum supply channel - reducing management, transport, and other costs;
- o getting up a Composite Flour Promotion Pilot Bakery (CFPPB) at GMV.

Non-exhaustive 'terms of reference' suggested for the CFPPB:

- a) carry out baking trials and develop suitable recipes
- b) conduct acceptability and marketing tests (first in Banfora and proximity);
- c) if necessary, establish proper specifications for composite flour storage;
- d) establish further CFPPBs in other urban centres, or utilise existing commercial bakeries in those centres to disseminate the Banfora experience;
- e) calculate the composite bread cost price factors and compare them with those of wheat bread and prepare an 'economic paper' on composite flours in Upper Volta;
- f) train the bakers throughout the country in composite flour baking technology;
- g) prepare the 'project document' to launch the large scale commercialisation of composite flour products;
- h) prepare and present later a research programme on various composite flour products incorporating local flours: biscuits, cakes, noodles, couscous, weaning foods, etc.

Government officials pointed out the need to establish a 'food technology institute' in Ouagadougou - but the Mission did not have time to assess this need.

The West African Community (CEAO) - comprising Ivory Coast, Mali, Mauritania, Niger, Senegal, and Upper Volta - had been active in promoting composite flours for bakery products in 1977 and 1978, and the Mission made efforts to discuss this area of common concern at CEAO Headquarters, Ouagadougou. Unfortunately the officials directly concerned were not available. Please note, however, the comments on CEAO's activities in the following country report on the Ivory Coast.

3.7 IVORY COAST

The national diet constitutes "attieke" made from cassava, "foutou" made from taro and plantain banana; it is complemented by some local dishes based on rice, maize and - to a lesser degree - millet and sorghum. Bread consumption continues to increase. The rural population (62%; 5.1 of 8.2 million inhabitants) provides most of these crops with the exception of wheat. The bakery-pastry industry (218 ovens), biscuit and noodle (spaghetti) industry, utilise increasing quantities of wheat to follow the national demand which is dominated by bread, and which is growing rapidly: 12 kg of bread per inhabitant in 1972, 22 kg in 1978 with an average annual growth rate of 10.6%. In fact, the quantity of bread per actual consumer is much larger, since less than 30% of the population buys bread daily.

Wheat imports have increased accordingly: 100 000 MT in 1970, 142 000 MT in 1973, 183 000 MT in 1978 and - in 1978 - led to a foreign currency expenditure of about CFAF 6 billion (US\$ 30 million). The Grands Moulins d'Abidjan (GMA), soon to be joined by a new wheat mill in San Pedro (Société Moulin du Sud-Ouest - MSO), produces annually 130-135 000 MT of wheat flour out of which 100 000 MT is baking flour (MSO's capacity will reportedly reach 40 000 MT of wheat flour in 1985).

The Ivory Coast is now the second largest wheat importer in West Africa (after Nigeria). The trade figures, which showed an average annual favourable balance of CFAF 22 billion between 1968 and 1971, now show a deficit; food imports, especially wheat and wheat products, contribute very significantly to that deficit.

Foreign currency savings through use of composite flours in breadmaking could be, on the basis of 100 000 MT of baking flour a year, CFAF 1.25 billion for use of 30% local flours in bread, 830 million for 20% and 415 million 10%, according to the 1978 price. These foreign currency savings are quite enough to justify the investment required in establishing a 'national composite flour programme'. Such a programme would, however, face the following potential problems:

- o regular supply of local flours
- o local flour costs vis à vis the price of wheat flour
- o transport costs
- o marketing
- o training of bakers

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The Ivory Coast has some experience in the composite flour field. In conjunction with the pilot cassava processing at Toumodi the new Société Ivoirienne de Technologie Tropicale (I2T) carried out composite bread trials - 10-15% of cassava flour with wheat flour - successfully. In addition the first trials carried out by the former Institut de Technologie et Industrialisation des Produits Agricoles Tropicaux (ITIPAT) together with Société Buhler (Switzerland) showed that it was possible to incorporate 10 to 15% maize flour specially milled for that purpose with wheat flour without reducing bread quality.

This composite flour experience is strengthened by the attendance of Ivory Coast experts at the following (composite flour) seminars organised by the African Community (CEAO):

- o Bamako seminar (1977) to look into raw material production problems
- o Niamey Seminar (13-17 December 1977) to promote the concept of composite flours. This seminar recommended the establishment of a pilot bakery in each member-state
- o Bakers Training Seminar (January 1978) at ITA Dakar on milling and baking technology.

Interest in composite flours is easily seen at CEAO sub-regional level, and very evident in the Ivory Coast at the Ministries of Economy, Finance and Plan; Agriculture, Commerce, Public Health and at institutions such as I2T, SODEPALM, Yamoussokro Bakery School, etc. The Central Laboratory of the Ministry of Public Health sees composite flours as a vehicle to increase the nutritive value of bakery products by adding high protein flours from legumes.

Senior officials made clear Governments desire to host a regional development and training centre (concentrating on cassava flour in combination with wheat flour) and the Mission made the following proposals for Government's urgent consideration:

Phase One - 1981

- o establishment of a Composite Flour Promotion Committee (CFPC) by the Ministère de l'Economie des Finances et du Plan (Direction Generale de l'Activité Industrielle) with, among others, representatives of the following:

the Ministries of Agriculture, Commerce, Public Health as well as such institutions as I2T, Office de Promotion de l'Entreprise Ivoirienne (OPEI), the Syndicate des Boulangers, the Institut de Recherche en Technologie (in process of being established), the Ecole de Boulangerie-Pâtisserie de Yamoussokro and GMA.

The Committee will determine and direct composite flour research, development and commercialisation:

- o 12T Assistance to Yamoussokro Bakery School to:
 - carry out cassava/wheat flours breadmaking trials to determine appropriate recipes;
 - carry out acceptability tests in Yamoussokro and area;
- o 12T prepares for CEPC the required documentation for consideration approval and establishment of a Composite Flour Promotion Pilot Bakery (CEPPB) in Abidjan.

Phase Two - 1982-83

The CEPPB, operational as of January 1982, will have basically the same non-exhaustive 'terms of reference' as those proposed for the Upper Volta CEPPB (see 2.6 above).

A two-year period (Phase two) is indicated as this is felt adequate for pre-commercialisation operation.

3.8 GHANA

It was evident that there is increasing interest in composite flours, but activity is at the research level in the Food Research Centre (FRC) and the Department of Nutrition, Food Science and Technology (University of Ghana, Legon) - both of which have produced scientific papers on various aspects of composite flour development.

During the main meeting at the Ministry of Industry, Science and Technology - with FRC also represented - it was emphasized to the Mission that Government was aware of the value to Ghana of composite flours, and that the research and development work going on must be commercialised as rapidly as possible. The major limiting factor at present is the low production of both cereals and cassava - below consumption requirements.

At this meeting the Mission suggested the formation of a committee to develop collaboration among, and effect coordination between - FRC, the Department of Food Science and Technology, and the Tema Food Complex Corporation - as a basis for the eventual launching of a 'national composite flour programme'.

3.9 CAMEROON

Food crops are well diversified in Cameroon: millet and sorghum in the North, maize mainly in the West and North-West, plantain banana, cassava and yam mainly in centre-South. Other crops are available in small quantities such as macabo-taro, rice, sweet potatoes, etc. Production is sufficient to meet demand and some quantities are even exported to neighbouring countries. However, Cameroon remains the largest wheat importer in the five-country UDEAC grouping (Union Douaniere et Economique de l'Afrique Centrale).

Wheat and wheat flour imports have doubled between 1970 and 1978, from 53 000 MT to 103 000 MT, requiring a hard currency expenditure of CFAF 4 billion in 1978. The number of bakeries increased from 42 in 1968 to 140 in 1980, and the annual bread consumption now averages 8 kg per inhabitant.

At this consumption rate Cameroon will spend CFAF 10 billion (at the 1978 price) to pay its projected wheat imports in 1990.

Starting in 1973, Société pour le Développement du Blé (SODEBLE) has successfully grown certain wheat varieties at Ngoundéré in the centre-North. From January 1980 SODEBLE has provided 80 MT of "Cameroon wheat" to the Société Camerounaise des Minoteries (SCM) - Cameroon's only wheat mill - in Douala. The objective is to progressively replace imports by local production.

SODEBLE is also carrying out soya production tests. Government's plan is to incorporate 3-5% soya flour with the wheat flour in bread to improve the nutritive value.

Some 10 years ago, the President of the bakers' association (Syndicat Patronal des Boulangers du Cameroun) (Eichler) made bread with 30% cassava flour + 70% wheat flour. The results were acceptable but not followed up.

Two agro-industrial projects, maize (West) and cassava (East) could supply the local flours for a national composite flour programme. On the basis of a present consumption of 55 000 MT of baking flour/year (77% extraction), composite bread with 30% maize and/or cassava (or sorghum) flour would reduce wheat imports by 21 400 MT for a foreign exchange saving of about CFAF 850 million, increasing to 2 billion in 1990 (at the 1978 price).

The 1979-1986 Plan of Operation of the "Office Cerealier de Garoua" includes a breadmaking programme based on composite flour (30% sorghum, millet or maize flour + 70% wheat flour). The "Office" has already requested a baker-consultant from FAO.

A national composite flour programme will face certain problems:

- o local flours at higher prices than wheat flour
- o raw material production and difficulty of regular supply
- o transport problems
- o bakers' training

However, the officials met were most interested in the composite flour concept, and agreed with the Mission that the above problems could be solved by appropriate policies and action.

Cameroon is willing to host a regional development and training centre.

At the final meeting the Mission proposed the following for Government's urgent consideration:

- o establishment of a Composite Flour Promotion Committee made up of, among others, representatives of:
 Directions de la Planification, de l'Industrie, Ministères de l'Agriculture, de la Santé, Délégation Générale à la Recherche Scientifique et Technique, la Société Camérounaise des Minoteries, le Syndicat Patronal des Boulangers, la Chambre de Commerce, l'Office Céréaliier de Garoua.
 The Committee will determine and direct composite flour research, development and commercialisation;
- o establish three Composite Flour Pilot Promotion Bakeries (CFPPBs) to develop and market composite flour products: one at Garoua using millet and sorghum, in conjunction with millet and sorghum milling facilities. (This project is already in the Plan of Operation of the "Office Céréaliier de Garoua"); one in the West together with the maize mill which is under consideration; one in the East together with the cassava flour mill which is also under consideration.

During the period prior to the start of the two agro-industrial projects which will include the maize and cassava flour mills referred to above, small village mills could be installed to serve the CFPPBs.

Non-exhaustive 'terms of reference' suggested for the CFPPBs are basically the same as proposed for the Upper Volta CFPPB (see 3.6 above).

3.10 SUDAN

Sudan is Africa's second largest sorghum producer but further, its millet and cassava production is also of some significance, and FRC will be developing composite flours from these. FRC also has a grant from the International Development Research Centre to compare various sorghum dehulling systems for operating, technical and economic efficiency and identify that system most suitable for village use.

FRC's bakery produces 2 500 loaves of 20% sorghum and 1 500 to 2 000 buns of 15% sorghum daily, and is involved in training industry's bakers. Commercialisation of composite flour products - bread probably at 10% sorghum initially - will have commenced by end-1980 and this will complete the justification of Sudan as a regional centre. At least six industrial projects are underway, approved/financed or under discussion to install sorghum mills - alone or in tandem with flour mills - to produce baking quality sorghum flour:

- o the "Sudanese Development Corporation" signed an agreement with United Milling Systems A/S, Copenhagen in October 1980 for a 2 MT/hour "UMS Compact Mill" for sorghum at Wad Medani;

- o the new "Arab Mills" is currently installing wheat (70 MT/day) and sorghum (100 MT/day) mills (Roncaglia and Schule equipment respectively) in tandem under the same roof in Khartoum North;
- o the "Co-operative Association" is moving ahead on a wheat mill/sorghum mill/bakery complex in Khartoum North;
- o the "Food Industries Corporation" very recently applied to the World Bank for a loan to establish a combination wheat (160 MT/day)/sorghum (40 MT/day) mill unit;
- o a loan has just been approved by the Industrial Bank of Sudan to "The Production and Industry of Dura Co.Ltd." for a 2.5 MT/hour sorghum mill (Schule) installation in Gadaref - with the resultant flour aimed, in part, at use with wheat flour in composite flour products;
- o there is a willingness on the part of USAID to fund a sorghum mill at an existing wheat mill.

Based on 1980 wheat imports of 500 000 MT - twice that of 1979 - an annual saving of about US\$ 14 million can be calculated replacing only 10% of the wheat flour with sorghum flour. Wheat imports are forecast at 2 000 000 MT in 1990.

The Government of Sudan made clear to the Mission its ready willingness to host a regional centre for Africa to serve in particular those countries whose principal crop is sorghum (dura). The logic and desirability of basing such a centre in Sudan, as for Senegal, is evident to start with from the long and successful background in composite flour development work of its Food Research Centre in association with FAC, its personnel, facilities and experience in training. As mentioned above, it also has an interest in developing composite flours based on its large millet and cassava production. Further, its millet production and activity therewith will form a basis for even closer bonds with ITA Dakar.

The Mission Leader returned to Khartoum in June 1981 and reached agreement with Government and FRC with respect to the proposed regional TCDC centre (ANNEX to the English version of this Report). Confirmation in writing of the Government's willingness to host the regional centre is expected momentarily.

Agreement was also reached on FRC hosting a regional TCDC workshop on composite flour development 7-12 December 1981. Participants will come from the sorghum-producing countries which will participate in the regional centre, and its aims, etc. will be as indicated for the similar workshop under Senegal.

In addition, the Technical Director and Head, Cereals Department ITA Dakar will participate in the FRC Khartoum workshop.

4. REGIONAL CENTRES - "FEASIBILITY" and "APPROACH"

The Resolution calls on the Mission to look into the "feasibility" of strengthening existing centres to serve regional needs. In this context (positive) feasibility means there is a "need" which can be satisfied in the manner desired.

A large part of this Report establishes well the need for such centres (its "Introduction", "Conclusions", "Summary Reports" on the country visits and "Training Needs". There are only two existing centres in Africa which are strong enough in personnel, facilities and experience to assist others.

Thus we have this ever-increasing need to increase the production of indigenous cereals (as well as roots and tubers) - two centres experienced in the utilization of flours from the two main cereals, millet and sorghum, the application of which will stimulate production - and a willingness on their part and their Governments to share this experience.

The Mission Leader's discussions with several potential funding bodies following completion of the Mission's travels made clear their continuing reluctance to fund infrastructure - especially physical. Conversely, funding "people development" is still of major appeal - as is "TCDC".

Thus the Project Proposals for the two centres (ANNEX) which have been discussed and accepted by Senegal (formally) and Sudan (verbally) have the following common basic elements:

- o the host country/institution contribution is only that which exists;
- o the donor contribution is principally for financing of training of participating country personnel at the Centres - and to move Centre personnel out to the participating countries for organised and ad hoc training and advice;
- o to the greatest extent possible Centre personnel will handle African enquiries and requests - backed up, as necessary, by AGFI and, in turn, by FAO and/or UNIDO;
- o the foregoing dictates a focal point for coordination and liaison, as well as support, and this is also proposed as AGFI's role. Requests for assistance received by one party will be referred to the other - and individual or joint action, if merited, agreed upon. Similarly, requests for assistance received by FAO or UNIDO will be referred simultaneously to the concerned Centre and AGFI, with comments/advice if desired.

In time, it is logical that AGFI's coordination, liaison and backup role will diminish and disappear.

The workshops (one scheduled for December next at FRC Khartoum, the second planned for early-1982 at ITA Dakar) are for the participating countries of the respective Centre, and as said, will, in part, serve as fora for discussion of the Centres' roles and programmes.

AGFI's consideration of composite flour development has also led to the realisation that while the potential savings in foreign exchange through use of composite flour was the main spur to the October 1979 CAMI Resolution, of more importance is probably the stimulus to indigenous production of cereals, roots and tubers that composite flour development can give, with its direct relation to increased food self-sufficiency and security.

The Proposals for the two centres are essentially the same including Period: 5 years and Donor Contribution: \$1.5 million -- and therefore it was not felt necessary to include both with the English and French versions of this Report. Thus the Proposal for the centre in Sudan forms the ANNEX to the English version Report, and that for Senegal the ANNEX to the French version.

5. ESTIMATES of TRAINING NEEDS

The major areas for the Regional Centres to assist in training are of course in the 'milling' of millet and sorghum (and cassava and maize later) and in the 'baking' of composite flour products.

The approach to estimating bakery training needs was to calculate the average number of the population per bakery in the nine countries for which statistics on bakeries could be obtained. Using this average number calculate the (theoretical) number of bakeries in the remaining major sorghum - and millet - producing countries to participate in the two Regional Centres. The average annual growth rate of new bakeries was assumed, with some reason, as five per cent. Then it was assumed that one 'bakery technician' per bakery would be trained.

While this approach is perhaps not very refined it is felt it gives fair average working figures since the total number of countries considered was 21 out of which the bakery statistics are known for nine - almost half the total. Further, it could be argued - and may be - that two bakery technicians, on average, per bakery should be trained. Which would double the needs figures.

The result of this calculation is that the bakery training need in the countries participating in the regional centre proposed for Senegal will reach 1 100 trainees in five years; and for Sudan 700.

The approach to estimating the milling training needs was to calculate the additional volume of course grains (sorghum, millet and maize) to be milled in Africa in 1985 based on the estimates in "Agriculture: Toward 2000"*. Then, taking the annual capacity of a medium size mill, ascertain how many mills would have to be installed by 1985 to handle this volume. Finally, assuming that perhaps 10 technicians per mill would require training, the training needs in the countries participating in the regional centre proposed for Senegal and for Sudan are about 1200 each in about five years time.

In new installations the equipment supplier generally does some training as part of the contract. This may be at 'engineer' or senior technical level, rather than technician level. For existing equipment being (more) fully utilised there would not be such training. The (above) medium size mill will, of course, in practice, be replaced in part by smaller, village scale and large scale mills. However, the order of the number of technicians to be trained will remain the same. Admittedly, the figure of 10 technicians per mill is purely an estimate - and could be a bit smaller or higher. In any case it will be significant.

* FAO publication C79/24 July 1979.

Very clearly it will take some years for demand or need to approach these figures. They are the potential training targets, though. The rate at which they are approached is dependent directly on the Governments' resolve to increase the production and local utilisation of indigenous cereals, roots and tubers and use their flours in new and traditional foods, and in composite flour bakery and allied products.

The order of the potential training needs indicates the probable necessity to move early on to 'training the trainers' from participating countries, who then will train the larger numbers in a regular manner on their home ground.

WHEAT IMPORTS INTO AFRICA

AAGR : Average Annual Growth Rate in %

	Q U A N T I T Y				A A G R				V A L U E				A A G R		
	1 0 0 0 M T				U S \$ 1 0 0 0 0 0 0				1 0 0 0 0 0 0				1 9 7 0 - 7 8		
	1 9 6 5	1 9 7 0	1 9 7 5	1 9 7 8	1 9 7 8	1 9 7 0 - 7 8	1 9 7 5 - 7 8	1 9 6 5	1 9 7 0	1 9 7 5	1 9 7 8	1 9 7 8	1 9 7 0 - 7 8	1 9 7 5 - 7 8	
Africa	4089	4673	9224	13425	14.1	13.3	299	327	1874	2161	26.6	4.8			
Algeria	274	340	1576	19132	24.1	6.6	21.7	25.3	385	349	38.1	-3.2			
Angola	48	94	97	83	-1.5	-5	3.3	7	20	13	9	-13.3			
Benin	5	10	7	63	25.8	108	.5	.7	.5	8.8	37.2	80.3			
Burundi	3	12	7	13	10	22.9	.4	1	2.4	4	18.9	12.5			
Cameroon	31	53	66	103	8.6	16	2.5	4	15	20.6	22.7	11			
Cap Verde Is	3	4	5	5	2.8	0	.4	.4	1.6	1.1	13.4	-11.7			
Cent Afr Rep	5	9	10	4	-9.6	-26.3	.6	1	2.7	.9	1.3	-30.6			
Chad	2	9	9	15	6.6	18.5	.5	1.5	2.7	3.3	10.3	6.9			
Comoro Is	2	2	2	3	5.2	14.4	.2	.1	.4	.6	25.1	14.4			
Congo	16	23	39	64	13.6	13	1.6	1.6	8.2	12	23.6	13.5			
Egypt	2078	1232	3404	5220	19.7	15.3	142	65.6	663	71	1	2.3			
Ethiopia	26	71	-	109	5.5	-	1.5	5.1	-	15.4	14.8	-			
Djibouti	5	7	7	11	5.8	16.2	.4	.7	1.2	2	14	13.5			
Gabon	6	1	57	25	49.5	-24	.6	-	5	5.1	-	-5.2			
Gambia	2	4	2	10	12.1	7.1	.2	.3	.4	1.6	23.2	56.7			
Ghana	51	85	84	173	9.6	28.4	5.5	7.2	19.8	35.7	22.1	21.7			
Guinea	22	17	23	30	7.3	9.2	.6	1	3.4	4.2	19.6	7.3			
Guinea Bissau	-	6	1	9	5.2	108	-	.5	.4	1	9	35.7			

ECA/CML.6/INR/WP/9

TABLE 1

	Q U A N T I T Y						V A L U E						
	1 0 0 0 M T						U S \$ 1 0 0 0 0 0 0						
							A A G R						
	1965	1970	1975	1978	1970-78	1975-78	1965	1970	1975	1978	1970-78	1975-78	1975-78
Ivory Coast	64	100	79	183	7.8	32.3	5.3	7.5	12.6	31.7	19.7	36	
Kenya	10	3	82	92	53.4	3.9	.8	.3	11.4	14.8	13	9.1	
Lesotho	14	35	35	62	20.9	21	4	10	4.7	8	-2.7	19.4	
Liberia	5	8	10	16	9	16.9	.6	1	2.7	4	18.9	14	
Libya	136	238	501	556	11.2	3.5	8	15	119	113.8	28.8	-1.5	
Madagascar	26	34	15	61	7.5	59.6	3	2	3	9.7	21.8	47.8	
Malawi	13	21	19	11	-7.7	-16.6	.8	2	4.2	2	0	-21.9	
Mali	20	16	48	25	5.7	-19.5	.8	1.3	9.2	4	15.1	-24.2	
Mauritania	12	7	14	68	32.9	69.3	1	.4	2	10.2	49.9	72.1	
Mautitiis	46	63	80	64	0.2	-7.1	3	4.1	16.6	12	14.3	-10.2	
Morocco	312	414	1383	1641	18.7	5.8	20	29.2	254.5	220.2	28.7	-4.7	
Mozambique	50	74	116	138	8.1	5.9	2.7	5	25.5	23.5	21.3	-2.7	
Niger	2	7	6	21	14.7	51.6	.2	.8	1	4	22.3	58.7	
Nigeria	56	267	407	1109	19.4	39.6	9.8	22.3	39.4	259.5	35.8	42.4	
Port Guinea	2					-	.1						
Reunion	12	13	1	19	4.8	166.8	1	1.4	.5	5	17.2	115.4	
Zimbabwe	90	57	12			-	5	4	2				
Rwanda	2	11	10	7	-5.5	-11.2	.1	1.3	3	2	5.5	-12.6	
St Helena	.4	.4	.7	1	12.1	12.6			.1	.2		26	
Sao Tome ETC	2	3	3	4	3.6	10	.2	.2	.6	.8	18.9	10	
Senegal	61	113	104	157	4.2	14.7	5.3	8.5	22	29.5	16.8	10.2	

	Q U A N T I T Y					A A G R					V A L U E					A A G R				
	1 0 0 0 M T					1 9 7 0 - 7 8					U S \$ 1 0 0 0 0 0 0					1 9 7 0 - 7 8				
	1 9 6 5	1 9 7 0	1 9 7 5	1 9 7 8	1 9 7 8	1 9 7 0 - 7 8	1 9 7 5 - 7 8	1 9 6 5	1 9 7 0	1 9 7 5	1 9 7 8	1 9 7 0 - 7 8	1 9 7 5 - 7 8	1 9 6 5	1 9 7 0	1 9 7 5	1 9 7 8	1 9 7 0 - 7 8	1 9 7 5 - 7 8	1 9 7 8
Seychelles	1	2	2	3	3	5.2	14.4	.1	.2	.5	.7	16.9	11.8							
Sierra Leone	20	37	25	21	21	-6.8	-5.6	2	3.5	5.7	4.7	3.7	-6.2							
Swaziland	23	31	31	46	46	5	14	1.6	2	5.4	8.8	20.3	17.6							
SP Sahara	.5	.7	.7	.3	.3	1.6	4.5													
Sudan	131	229	124	238	238	2.9	32.4	9	15	23	52.7	17	31.8							
Tanzania	48	32	159	85	85	12.9	-18.8	4	2.6	34.7	12.9	22.1	-28.1							
Togo	7	15	.3	15	15		268	.7	1		2.6	12.6								
Tunisia	180	454	265	551	551	2.4	27.6	12.7	34	59	76.7	19.7	25.2							
Uganda	32	26	1	17	17	-5.1	157	2.7	2	.1	3.8	6.3	236							
Upper Volta	11	26	13	50	50	8.5	56.6	1	2	3.6	9.7	21.8	39.1							
Zaire	79	116	104	117	117	0.1	4	7.6	9	21.6	25	13.6	5							
Zambia	30	107	160	102	102	-0.6	-13.9	2	6	19.4	13	10.1	-12.5							

- Source: FAO 1972, 1975, 1977 and 1978 Trade Year Book

- AAGR: Average Annual Growth Rate in %

T A B L E II

MAIN AFRICAN SORGHUM PRODUCTION

1978

	1 000 MT		Kg. per capita
Nigeria	3 800	*	52
Sudan	2 400	*	138
Upper Volta	621	*	95
Ethiopia	611		20
Uganda	520	F	42
Niger	361		72
Tanzania	250	F	15
Kenya	221		14
Mozambique	200	F	20
Rwanda	160		35
Somalia	130	F	38
Ghana	120	F	11
Burundi	110	F	26
Malawi	110	F	19
Benin	75	F	22
Botswana	55	F	71
Lesotho	50	F	39

Source: FAO 1978 Production Yearbook

* = unofficial figure

F = FAO estimate

T A B L E I I I1978MAIN AFRICAN MILLET PRODUCTION

	<u>1-000 MT</u>		<u>Kg.per capita</u>
Nigeria	3 100	*	43
Niger	1 091		218
Mali	1 035	F	164
Senegal	795	*	148
Egypt	656		16
Chad	580	F	134
Sudan	520	*	30
Uganda	489	F	39
Upper Volta	404	*	61
Cameroon	370	F	46
Zimbabwe	220	F	34
Ethiopia	207	*	7
Togo	117	*	46
Zambia	80		15
CAR	40	*	19
Gambia	24	F	42
Mauritania	30		19

Source: FAO 1978 Production Yearbook

* = unofficial figure

F = FAO Estimate

TABLE IV

MAIN AFRICAN CASSAVA PRODUCTION1978

	1 000 MT		Kg. per capita
Zaire	12 512	F	467
Nigeria	10 844	F	150
Tanzania	4 076	F	242
Mozambique	2 450	F	246
Ghana	1 850	F	168
Angola	1 700	F	252
Madagascar	1 322		159
Uganda	1 1000	F	88
CAR	940		443
Burundi	936	F	220
Cameroon	831	F	103
Ivory Coast	700	F	93
Kenya	620		41
Benin	600	F	180
Congo	532		364
Guinea	500	F	105
Togo	485	F	191
Rwanda	437	F	97
Liberia	272	F	156
Gabon	107	F	199
Comoros	85	F	265
Eq. Guinea	51	F	147

Source: FAO 1978 Production Yearbook

* = unofficial figure

F = FAO estimate

T A B L E V
MAIN AFRICAN MAIZE PRODUCTION

1978

	1 000 MT		Kg per capita
Egypt	3 197		80
Kenya	2 350	*	155
Nigeria	1 450	F	20
Malawi	1 400	*	222
Zimbabwe	1 400	*	215
Ethiopia	1 079	*	35
Tanzania	1 000	F	59
Zambia	850	F	160
Uganda	660	F	53
Zaire	487	*	18
Mozambique	400	*	40
Angola	400	*	59
Morocco	390	*	20
Cameroon	350	F	43
Ghana	350	F	32
Ivory Coast	325	*	43
Guinea	320	F	67
Benin	250	F	75
Togo	151	*	59
Lesotho	100	F	78
Swaziland	90		171
Botswana	45	F	58

Source: FAO 1978 Production Yearbook

* = unofficial figure

F = FAO estimate

P R O J E C T P R O P O S A L

for the
TRANSFER of TECHNOLOGY AMONG
DEVELOPING COUNTRIES
(TCDC)

on
C O M P O S I T E F L O U R S

TITLE: Regional TCDC Composite Flour Development and Training Centre (Sorghum).

COOPERATING COUNTRIES: Sudan and the principal sorghum-producing Anglophone countries in Africa - Nigeria, Ethiopia, Uganda, Tanzania, Kenya, Somalia, Ghana, Malawi, Botswana.

At a later stage Sudan and the principal millet-producing Francophone countries in Africa - Upper Volta, Niger, Mozambique, Rwanda, Burundi.

At a later stage Sudan and the principal millet-producing Anglophone countries in Africa - Nigeria, Egypt, Uganda, Cameroon, Zimbabwe, Ethiopia.

Also at a later stage Sudan and the principal cassava-producing Anglophone countries in Africa - Nigeria, Tanzania, Ghana, Cameroon, Kenya.

NOTE Senegal has agreed to host a similar Regional TCDC Centre based at its Food Technology Institute (ITA), Dakar but concerned principally with millet (with wheat). Sudan also has a significant production of millet - thus cooperation and collaboration between these two countries in this area and those principal sorghum - (and even millet -) producing countries can develop to their mutual benefit.

NATIONAL INSTITUTIONS INVOLVED:

Food Research Centre (FRC)
Ministry of Agriculture, Food and Natural Resources
(Agricultural Research Corporation)
Ministry of Industry

IN COLLABORATION WITH: FAO/ECA Advisory Group on Food Industry Development in Africa (AGFI)

DURATION: Five years from July 1982

<u>COSTS:</u>	A. Donor contribution	US\$ 1 500 000(p.6)
	B. Counterpart contribution	
	Buildings	500 000 (present cost)
	Equipment	130 000 (original cost 1978)
	Personnel	70 000
		US\$ 700 000(p.7)

BACKGROUND: Imports of wheat to Africa rose at an average annual volume increase of 14%; and an average annual value increase of 26% during the period 1970 to 1978. In 1978 wheat imports reached 13.4 million metric tonnes costing over US\$ 2 billion. 60 to 80% of these imports are used in the manufacture of bakery products.

For at least 15 years FAO has worked in association with many developing countries in Asia, Latin America and Africa - and work has also gone on in a few developed countries, notably Britain, Holland and Canada in bilateral association with several developing countries - on incorporating flours from such locally produced cereals and tubers as sorghum, millet, maize and cassava with wheat flour to produce bakery and other food products. The resulting products can now be said to have been widely accepted.

The advantages of composite flour products over those from 100% wheat flour are several, and all or most apply to every African country with increasing wheat imports yet growing cereals or tubers suitable for producing flours for composite flour use:

- o reduction of dependency of local bakeries and associated industries on wheat imports leading to savings in foreign exchange;
- o increased utilisation of indigenous production and incentive to produce;
- o increased industrial investment and thus employment;
- o increased food 'security' in times of scarcity of (imported) wheat or reduction in production of a particular cereal or tuber crop used for composite flour*;
- o serve as a convenient 'vehicle' for improved nutrition by the addition of flour(s) from proteinacious legumes, etc;

Against the above background the African Ministers of Industry (AMI) unanimously adopted the following Resolution at its Fifth Conference at ECA Addis Ababa on 20 October 1979:

"3(v) Regional Development and Training Centres on Composite Flour Programmes

The Conference of African Ministers of Industry

Taking note of substantial continuing expensive increases in imports of wheat and wheat flour into Africa during the last ten years, the availability of cheaper non-wheat grains and roots, tubers (sorghum, millet, cassava) in African countries, and the progress made in the utilisation of indigenous non-wheat flours from these grains and tubers in breadmaking, especially in the Sudan and Senegal, in co-operation with FAO

* As composite flours can successfully be made from one or more indigenous flour-producing products - a lack of one can be made up by an increase in another.

1. Calls upon FAO and ECA, in cooperation with UNIDO, to undertake a feasibility study on the strengthening of existing composite flour development and training centres to serve regional needs - one for East and Southern African countries, the other for West, Central and North African countries;
2. Requests FAO and ECA, in cooperation with UNIDO, to compile technological processes for the production of composite flours utilising indigenous grains such as sorghum, millet, maize and cassava and make these available to member States as soon as possible."

The FAO/ECA Advisory Group on Food and Agricultural Industries Development in Africa (AGFI), based in the Joint ECA/UNIDO Industry Division at ECA Headquarters participated in the discussion leading to the Resolution at the Sixth Meeting of the Follow-up Committee on Industrialisation in Africa immediately preceding the Fifth AMI Conference - and at the Conference itself.

The action called for in the Resolution is consistent with the "Activities" of the UNDP-financed, UNIDO-Associated, AGFI Project. Part 1. of the Resolution aimed at two of the three priority areas of AGFI action - cereal (composite flour systems) processing and (related) training. Thus it was considered an AGFI mandate and the three professional members of the Project formed the Mission core which carried out the feasibility study in 1980 which, following the offer of the Government of Sudan to host such a Regional Centre, resulted in its Recommendation that one of the Centres be based at FRC Khartoum.

It may be noted that action on part 2. of the Resolution - the compilation of a 'technical compendium' on composite flour experience - had already been started by the Food and Agricultural Industries Service, FAO Rome. This will be a valuable basis for the training material for the Regional TCDC Centres.

The Project is a logical follow-up to UNDP/FAO/SUD/75/009 "Research and Development of Wheat and Sorghum Products for Industrial Applications" which was handed over to Sudan in August 1979, and FAO/SUD/001/PFL "Development of Sorghum Products for Industrial Application" which was handed over in June 1980. Both were based at the FRC and have assisted in developing its facilities and staff to their present state where they are able to serve regional as well as national development and training needs in composite flour technology.

The logic and desirability of basing a centre in Sudan is evident to start with from the long and successful background in composite flour development work of the Food Research Centre in association with FAO, its personnel, facilities and experience in training.

Sudan is also Africa's second largest sorghum producer but further, its millet and cassava production is also of some significance, and FRC will be developing composite flours from these. FRC also has a grant from the International Development Research Centre to compare various sorghum dehulling systems for operating, technical and economic efficiency and identify that system most suitable for village use.

- 37 -

FRC's bakery produces 2 500 loaves of 20% sorghum and 1 500 to 2 000 buns of 15% sorghum daily, and is involved in training industry's bakers. Commercialisation of composite flour products - bread probably at 10% sorghum initially - will have commenced by end-1980 and this will complete the justification of Sudan as a Regional Centre. At least six industrial projects are underway approved/financed or under discussion to install sorghum mills - alone or in tandem with flour mills - to produce baking quality composite flour.

Based on 1980 wheat imports of 500 000 MT - twice that of 1979 - an annual saving of about US\$ 14 million can be calculated replacing only 10% of the wheat flour with sorghum flour. Wheat imports are forecast at 2 000 000 MT in 1990.

FRC and AGFI have agreed to hold a seminar or workshop on composite flour development at FRC December 1981 for the co-operating countries, in part, to introduce the Centre and discuss its development and training programmes.

PURPOSE: To stimulate programmes to increase the production and utilisation of indigenous cereals, roots, tubers and legumes in traditional, new and modified food products in cooperating countries and especially the development of national composite flour programmes for bakery products.

To improve through development, practical training, demonstration and advice the competence of cooperating country personnel concerned with the production, development and utilization of flours from these indigenous food materials.

WORK PLAN: The Centre will be located at FRC Khartoum (Shambat) which already possesses building facilities, equipment and personnel which will form, in kind, its contribution to the Centre.

The Director of FRC will also be "Director" and the Head, Cereal Section, FRC will be "Deputy Director" for the Centre. "Administrative Officer" for the Centre will be one of FRC's senior personnel in its Administration and Finance Division.

FAO will provide a "Technical Adviser", one of who's main duties will be assisting in laying out, organising and conducting the training courses and related details.

FAO and/or UNIDO will provide the other specialised Consultants as and if required by FRC to enable it to carry out its regional duties.

These personnel will be "on call" rather than based in Sudan and drawn on as required. For example, they may be based at AGFI Addis Ababa, ITA Dakar, FAO Headquarters, or elsewhere. They may be drawn from multilateral or bilateral sources.

The Centre will be supported by, and work closely with, AGFI. Regional courses will be planned with AGFI's assistance, which will also seek the outside lecturers etc. Requests for assistance falling within the scope of the technical and linguistic areas of the Project received by one party will be referred to the other - and individual or joint action, if merited, agreed upon and action taken as speedily as possible. Similarly, requests for assistance received by FAO and UNIDO will be referred simultaneously to the Centre and AGFI, with comments/advice if desired.

An Advisory Committee comprised mainly of representatives of the cooperating countries, perhaps on a rotational basis - plus representatives of FAO, ECA and UNIDO - will be established to provide a regular forum for discussion of the Centre's functions.

In the area of 'development' the activities foreseen are -

- o advice on appropriate milling and baking equipment;
- o milling and baking tests utilising materials for the potential commercial production of composite flour products;
- o development and test baking of composite flour recipes.

In the area of 'training' the activities foreseen are -

- o conduct of regional training courses in various aspects of cereal and composite flour technology;
- o conduct of regional "trainers' training" courses;
- o 'ad hoc' training of, and advice to, technical training personnel responsible for national programmes;
- o assistance in organising and conducting national courses.

The regional courses (if at FRC) will be of one to three weeks duration; a maximum of 12 participants per course with up to three places for nationals of the host country in each; a maximum of three courses annually.

One or two visiting lecturers and one or two visiting technicians for each course will be sought. If possible they should come from the cooperating countries and (thus) fit into the TCDC, 'teach the teachers' and 'train the trainers' concepts.

The Donor Contribution is shown on page 6.

The Counterpart Contribution is shown on page 7.

An evaluation of the Project should be carried out after the first two years of full operation.

Annual progress reports and a terminal report will be written by the Centre in collaboration with AGFI and submitted to FAO and ECA for transmission to the donor(s) and cooperating countries.

ESTIMATED OPERATING COSTS IN US\$

A. Donor Contribution

First Year
1982/3

Project Operational

10 Personnel Services

Technical Adviser 4 m/m per year	US\$	26 000
Consultants 8 m/m per year (miller,marketing expert,etc)		44 000
	Sub total.	70 000

20 Official Duty Travel

Includes above, three FPC Staff and visiting lecturers		
Ad hoc travel of cooperating country personnel between their countries		50 000

30 Contractual Services

Printing lecture notes, reports etc. at \$50 per participant		5 000
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40 General Operating Expenses

Communications, hospitality, miscellaneous		5 000
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50 Supplies and Materials

Office supplies, books for participants at \$50 per participant, protective clothing, etc.		5 000
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60 Equipment and Furniture

Annual maintenance, replacement and spares		15 000
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80 Fellowships, Grants and Contributions

Fellowship		12 000
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Travel and stipend of cooperating country participants to three regional courses annually for, say, two weeks each and one meeting of the Advisory Committee for one week annually		78 000
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Total US\$ 250 000

For the four following years approximately 10% has been added annually to arrive at a total estimated operating cost for five years or

US\$ 1 500 000

NOTE 1) A 'minibus' and a station wagon - at, say, \$30 000 - will be required. FPC would be responsible for their operation and maintenance;

2) 'Honoraria' to FPC lecturers, as they presently receive from the University, is to be considered.

It is expected that both these items can be 'accommodated' within the above budget - the vehicles in the first year while training activity is still building up.

Counterpart Contribution

- (i) Buildings and equipment estimated at \$ 500 000 (present cost)

Grain Technology Department

Offices (three)
Milling Lab. + store
Analytical Lab. + ash muffler room
Baking Lab.
Pilot Mill
Pilot Bakery + stove
IDRC Project Room

Lecture Room

Chemistry Lab

Library and Documentation Centre

- (ii) Equipment estimated at \$ 130 000 (original cost 1978)

- (iii) Personnel estimated at \$ 70 000

Assume all Grain Technology Department and administrative personnel occupied with three regional training courses at FRC or outside Sudan at a current cost of US\$ 10 000 annually for a period of 1 1/2 months.

Allowing for an increase of approximately 15% annually in wages and salaries and increased activity the total for five years comes to approximately that shown above (\$ 70 000).

Total estimated counterpart contribution for five years is

US\$ 700 000
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