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REGIONAL CO-OPERATION IN CEREAL PRODUCTION AND IMPROVEMENT*

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REGIONAL COOPERATION IN CEREAL PRODUCTION AND IMPROVEMENT (EASTERN AND CENTRAL AFRICAN COUNTRIES)

A. Present and future pattern of supply and demand

1. In the East and Central African countries* covered by this analysis, cereals furnish 60-75% of total calory supply. In 1967, the total area under cereals was 109,000,000 hectares; with total production of about 17,000,000 tons, the average yield was about 900 kilos per hectare. Other important food crops are grain legumes, especially valuable as protein producers, grown on 3.5 million hectares, with a total output of 2,000,000 tons, as well as root crops grown on about the same area, with a total production of 21.8 million tons.

2. Sorghum and millet, which occupy about 60 percent of the total area, are grown extensively in all the countries in the two sub-regions; they are, especially in the drier areas, the staple food of the population. Since 1948/52, production increased by over 60 percent as compared with an area expansion of 28 percent; this is reflecting a rise in average yields by 30 percent (from 580 to 742kg/ha).

3. The second important cereal is maize, which occupies about one third of the total cereal area. It is grown on a large scale in all countries and has, in recent years, gained in popularity as food, to a certain degree replacing sorghum. The rise in production by almost 50 percent was due to a corresponding increase in area, so that average yields remained at about 1,000 kg/ha. However, as a result of the considerably higher volume of production, exports from the Eastern sub-region (mainly Kenya and Zambia) increased considerably, from less than 20,000 tons (1961/63) to over 350.000 tons (1967).

4. Rice production is most important in Madagascar where it's share is more than 90% of the total cereal production. It is also an important crop in Congo-Kinshasa, Congo-Brazzaville and Gabon where it supplies about 30% of total cereal production. Over the last ten years, production increased by almost 90% due to an rise in average yields by over 50% (from 1,280 to 1,830 kg/ha) and an expansion of area by 30%. With demand rising steadily, net imports rose fivefold, from 26,000 (1961/63) to 130,000 tons (1966). Export from Madagascar, the only surplus country, fell from 47,000 to 40,000 tons during the same period.

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* See detailed list on page 8.

5. Wheat is grown only in Ethiopia, Kenya and Lesotho; in the two first countries it covers about 6% of the cereal area and in the last almost 25%. In all other countries (except possibly Northern Tanzania) ecological conditions are unfavorable so that wheat cultivation is uneconomic. Wheat is however consumed increasingly in all of the countries of the regions, especially among the urban population and imports rose from about 230,000 to 400,000 tons between 1961/63 and 1967.

6. Grain legumes are grown in all the countries. The total area of dry beans, dry peas, broad beans, chick peas, lentils, cow peas, pidgeon peas, bambara ground-nuts and some unspecified species is about 3,500,000 hectares. The largest producer is Ethiopia, followed by Kenya; grain legumes are also relatively important in Rwanda, Burundi, Uganda and in Congo-Kinshasa.

7. Further substantial increases of food production in both sub-regions will be necessary to meet future demand resulting from rising population, higher monetary income and improved standards of nutrition. In addition, output must be directed towards eliminating the main nutritional deficiencies which in most cases are due to insufficient protein consumption.

8. In order to meet projected future demand, overall cereal production would need to rise by about 2.5 percent per year until 1975 and by 2.9 percent per year during the subsequent decade. The resulting growth rates by major food crops are shown below:

Table 1 : 1962 production and supply objectives for 1975 and 1985 in Eastern and Central African sub-regions

Crops	Production Supply Objectives (million metric tons)			Growth Rates (% per annum)		
	1962	1975	1985	1962-75	1975-85	1962-85
Sorghum/Millet	5.0	6.5	8.4	2.0	2.6	2.3
Maize	4.6	6.7	9.2	3.0	3.2	3.1
Rice	1.6	2.5	3.2	3.7	2.5	3.1
Wheat	0.4	1.2	1.8	7.9	4.4	6.4
Other Cereals	1.8	2.5	3.0	2.4	1.9	2.2
Grain Legumes	1.7	2.2	3.1	2.3	3.2	2.7
Roots and Tubers	18.8	25.7	32.9	2.4	2.5	2.5

Note : These data are based on the IWP Provisional Study for Africa south of the Sahara. The supply objectives for the 7 countries (Botswana, Burundi, Lesotho, Mauritius, Rwanda, Somalia, Swaziland) not covered by the IWP study have been derived from the same growth rates as for the countries of the Eastern African Region.
For detailed country data see Tables (pages 9 and 10).

B. Present status of food crop production

9. Due to slow urbanization and industrialization, the great majority of the population in these countries is engaged in agriculture. Agricultural holdings are generally small and are farmed at the subsistence level along traditional lines of shifting cultivation and mixed cropping without effective soil preparation, fertilization, water and weed control, and without using seeds of high yield potential. As production is mainly for personal consumption rather than for the market, there is little incentive to use improved varieties and expensive inputs to increase production and improve quality. Under this system of farming, increased production is generally directly related to expansion of cultivated area. However, as the stock of good land is becoming scarce, food crop production is expanding into marginal areas of low productivity and rainfall, thus impinging on grazing land and increasing the risk of erosion. If this is allowed to go unchecked, the average yield will decline and production become stagnant.

10. In most of the countries there is a fraction of area under modern farms of varying sizes where crop yields have been appreciably raised by improved production methods. For instance the average yield of maize in Kenya in 1967 was 880 kg/ha from 1.6 million hectares of small subsistence holdings, whereas the average yield from 58,000 ha in the modern sector was 2,430 kg/ha. However, even in Kenya, where farming is relatively more advanced than in other countries because of the considerable research and development carried out in the recent past, the modern sector of agriculture is too small to make a major contribution to total domestic production. Therefore, in order to meet the food and nutritional requirements of a rapidly growing population, and to achieve a faster rate of growth in the economy, it is imperative to convert a steadily increasing part of subsistence farming into a modern sector which will employ efficient production techniques and cater for market economy.

C. Prospects of increased production of basic food crops

11. The stagnation in the production of cereals, grain legumes and roots and tubers is due to the primitive methods of farming (using unselected planting material), processing and marketing. Although well managed large farm units can utilize land, labour, equipment and other investments more economically and are better suited to planned production and marketing than small holdings, there is only limited scope for expansion of this type of farming due to the scarcity of good land for further increases of crop area and the dependence on agriculture of a great majority of the population as the only source of employment, lack of capital and managerial skills, and inadequacy of trained manpower to efficiently carry out mechanical operations necessary for large-scale farming units. Therefore the increase in production in the foreseeable future will have to come from small holdings using modern methods of crop production.

12. As it has been already pointed out, production has expanded into marginal lands of low productivity. This trend must be reversed to provide enough grazing land for increasing the number of livestock required to meet the demand for animal products and to reduce losses caused by erosion. Well established forests will provide timber for domestic use and export. However, this would mean that future increases in production would have to come from the present crop area, and shifting cultivation - which exploits natural soil fertility - would have to give way to stable cropping patterns. But intensive development and utilization of the arable area to increase production and raise the productivity of land and labour would require an integrated approach to research in all aspects of crop production, storage, processing and marketing.

13. There is limited information on the capabilities of different soil types found in all the countries. The scattered information available in individual countries is neither coordinated with other countries nor related to other agro-ecological factors. Therefore soil capability surveys must be intensified and coordinated to determine the cropping potential of different soil types with a view to establishing priorities for the gradual conversion of subsistence farming into modern agriculture. These surveys should be supplemented by agro-ecological information.1/ Coordinated research is required to determine the most efficient and economic crop rotations and cropping intensities for different soil types and under different soil moisture regimes. Much more needs to be done to develop a package programme of agronomic practices to raise yield. This would require well-coordinated and comprehensive research on various factors of food crop production such as tillage practices, time and methods of planting, plant density, fertilization, control of diseases, insect pests and weeds, etc. Trials on maize in Kenya have shown that yield can be doubled by early planting, increased plant population and weed control. Dissemination of this type of information among the farmers requires an intensified extension service manned by properly trained and motivated field staff. Mechanical implements and hand tools adapted to relatively small farming units are urgently required for carrying out field operations quickly and efficiently. Development and testing of the equipment should be coordinated on a regional basis.

14. Well-adapted crop varieties with high yield potential and good quality seed are essential to make economic use of purchased inputs and improved cultural practices. Although unselected varieties at present grown can survive harsh climatic and cultural conditions, these are unresponsive to higher standards of crop husbandry. Some improved varieties of wheat, maize, sorghum and millets have been developed in East Africa under the auspices of EAAFRO, and have given appreciably higher yields than local varieties. This work should be intensified and extended to other countries

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1/ For example see the technical report, "A Study of the Agroclimatology of the Highlands of Eastern Africa", prepared under the FAO/UNESCO/WMO Inter-agency Agroclimatology Project.

through coordinated trials, exchange of breeding material and cooperative breeding programmes. Although grain legumes are essential to improve the nutritional quality of the daily diet, little research has been done to improve the domestic species or to introduce more productive varieties. Trials in Malawi have shown that yield of soya can be increased up to 40% by selection and innoculation. Roots and tubers (cassava, yams, sweet potatoes) have been similarly neglected. Therefore cooperative research breeding programmes should be initiated to improve yield and quality of grain legumes and roots and tubers.

15. A considerable portion of production is lost in the field and in storage, through lack of effective pest control measures and poor storage facilities. As diseases and insect pests recognize no frontiers it is vital that research on pest biology and control measures should be carried out on a regional basis.

16. Attention should also be given to develop new finished products acceptable to local tasted from different cereals, grain legumes, and roots and tubers, with a view to increasing consumption and stabilizing prices. For instance, it has been experimentally shown that 20-25% of good quality sorghum can be mixed with wheat without adversely affecting the quality of bread. Similarly, maize flour can be enriched by soybean meal. However, this would require intensive research in the field of food technology. Economic aspects related to production, transportation, and marketing of food crops should be fully investigated with a view to providing price incontives for farmers to increase production while maintaining consumer prices at a level that would help in increasing consumption.

17. In East and Central African countries some action to increase food crop production has already started and the latest production estimates indicate that these activities have been fruitful. However, the increased production has been only keeping pace with demand at a low level of consumption, especially that of protein-rich grain legumes. To meet the future demand of balanced food at a level essential to maintain a healthy body, action programmes to increase production of basic food crops would have to be stepped up at both national and regional level.

18. Regional cooperation in research on cereal breeding has been tried with some success in three East African countries (Kenya, Uganda, Tanzania) through the East African Agricultural and Forestry Organization (EAAFRO) by concentrating main research activities on a few large research stations (wheat and maize in Kenya at Njoro and Kitale respectively, and sorghum and millet in Uganda at Serere), while sub-stations in the three countries carry out uniform adaptability trials. Efforts have been recently made by the Rockefeller Foundation to expand uniform maize trials to some of the other countries in the region. Little research on breeding high yielding varieties of grain legumes and roots and tubers has been carried out, except some adaptability trials on introduced soybean varieties in Malawi, Ethiopia and Kenya are also participating in the activities of the FAO Near East Wheat and Barley Improvement and Production Project.

D. Proposals for integrated research and development projects for improvement of basic food crops

19. Most of the countries in the two sub-regions are characterized by broad ecological similarities and grow the same species of cereals (maize, sorghum and millets), and grain legumes, while wheat production is mainly limited to a few countries (Ethiopia, Kenya, Tanzania and Lesotho). As a result the dietary habits of the people and farming systems in all the countries are generally similar. There are, of course, local variations in topography, rainfall and soil conditions, which limit the general use of some crop varieties and agronomic practices, but these variations within one country are quite often duplicated in several countries. For instance, there are low and high rainfall zones in several countries requiring varieties either resistant to drought or water-logging. Each country has some kind of research organization but top priority is always given to crops which are major source of export earnings. As the number of well-qualified scientists is limited in such countries, research on food crops is either neglected or carried out by personnel provided under bilateral or multilateral assistance. For instance, in Kenya this help is provided by Canada (for wheat at Njoro) and Rockefeller Foundation (for maize at Kitale), in Ethiopia the Institute of Agricultural Research has been established with assistance from the UNDP/SF, while in French-speaking countries technical personnel is provided by the "Institut de Recherches Agronomiques Tropicales - IRAT".

20. To carry out the type of research essential for improving yield and quality of basic food crops would require a large number of technical personnel and expanded research facilities. These short-comings can be overcome by cooperative research programmes and by concentrating major research effort on a limited number of well equipped and staffed institutes. Some research institutes are already well-established and could serve a large number of countries in the two sub-regions, while others could be established through joint financing and outside assistance. Although this applies to all activities suggested in preceding paragraphs, it is particularly important in plant breeding which requires multidisciplinary staff consisting of breeders, entomologists, pathologists, agronomists and food technologists, and a longer time to select high yielding and well adapted varieties. Moreover it should be stressed that development of new crop varieties should be closely linked with the evolution of improved crop husbandry techniques.

21. The main research station located in each ecological zone should be linked up with a network of sub-stations in countries of similar ecological conditions. The sub-stations would undertake cooperative agronomic experiments and adaptability trials of breeding material and select varieties and adopt cultural practices best suited to their local conditions. The main stations would also provide in-service training to the personnel from the local stations. As more trained staff become available, some of these local stations could also become major centres of research. Main stations may either specialize in one or more crops or become truly multi-crop and multi-disciplinary institutes depending on the circumstances.

Plant breeding work should be closely linked up with one or two centrally located and well-equipped food technology and processing laboratories which should test the quality of new varieties and develop new food products from different cereals and grain legumes.

22. Soil capability surveys would require well-staffed laboratories equipped for modern soil testing techniques. Although the results of surveys will apply to the development of agriculture as a whole, they will have an immediate bearing on the production of basic food crops. This will also apply in the case of research on farm implements, pesticides, storage, etc. Therefore it is proposed that investigations on these aspects should also centre on the main food crop research stations and programmes should be carried out on a regional or sub-regional basis.

23. The essential element of cooperative programmes is coordination of activity through the planning of common projects, exchange of material and information, and personal visits. It is proposed that under the auspices of the Scientific and Technical Research Committee of the Organization of African Unity, a Research and Development Council for Cereals and Grain Legumes should be established. It would include representatives from all the countries and would function as a policy-making and financing body for various regional or sub-regional projects. Two technical committees (one for cereals and one for grain legumes) should, under the overall direction of the Council, carry out the following responsibilities:

(a) To arrange a survey of on-going projects in all the countries, and develop joint programmes on various aspects of cereals and grain legumes on a regional or sub-regional basis.

(b) To select from the existing institutes those best suited to serve as major research and coordinating centres on an ecological basis, and to develop new institutes on a multicountry basis through contributions from participating countries and financial and technical assistance from outside.

(c) To stimulate research activities, establish guidelines for new programmes and ensure their successful execution in all member countries through the appointment of a Project Coordinator for each crop, and through frequent meetings of the participating scientists to discuss the annual programmes and progress.

(d) To advise member countries on the establishment of sub-stations for adaptive research and on initiating large-scale development projects as a result of the research findings.

24. Although in a regional programme of this kind all cereal crops should be taken into account, a geographic concentration of effort in the case of certain crops would appear desirable at present. It is, therefore, suggested that the work on wheat should be concentrated on Kenya, Ethiopia and Northern Tanzania, where reasonable ecological conditions for wheat production exist, and that the remaining countries interested in wheat cultivation should concentrate on surveying suitable areas in their territories followed by experimental plantings for feasibility study. Rice is another crop which requires a special study before it is expanded to all the countries. However, it would be undesirable to establish a separate technical committee for each cereal crop (wheat, rice, maize, sorghum, millets) because it would be too rigid to future expansion of production of different cereals. Flexibility is essential for promoting cereal crops best suited to each ecological zone. However, under the overall supervision of the Cereal Technical Committee, research institutes and scientists working on individual cereal species would be linked up through cooperative programmes.

25. The situation in the case of grain legumes is very different from that of cereals. There is hardly a research institute working on the improvement and production of different species of grain legumes in the region. Indigenous varieties are low yielding and efforts to broaden the gene pool by introductions from outside have been ineffective. Therefore work has to be started by introducing and testing exotic genetic materials and by initiating improvement programmes to develop high yielding varieties. As grain legumes species are more sensitive to climatic conditions and to photoperiodism, it may be desirable to establish three multi-country research centres accroding to agro-climatic requirements. One such project for Malawi, Lesotho, Swaziland and Botswana is already under active consideration for financial and technical assistance from UNDP/SF. Efforts shoudl be made as early as possible to prepare similar multi-country projects, one for East African countries and another for Central Africa. In addition local stations should be established or strengthened in each country for adaptive research.

1. Eastern African countries
(included in IWP Study on Africa south of the Sahara):

Ethiopia Kenya Madagascar Malawi Tanzania Uganda Zambia

2. Other Eastern African countries:

Botswana Burundi Lesotho Mauritius Rwanda Somalia Swaziland

3. Central African countries
(included in IWP Study on Africa south of the Sahara:

Cameroun C.A.R. Chad Congo-Brazzaville Congo-Kinshasa Gabon

Table 2 : Total supply of cereals for 1962 in thousand tons

	Wheat			Maize			Sorghum + Millet			Rice		
	Pr.	Imp.	Totl.	Pr.	Imp.	Totl	Pr.	Imp.	Totl.	Pr.	Imp.	Totl.
Ethiopia	260	6	266	682	-1	681	1,082	-3	1,079	-	2	2
Kenya	100	-12	88	1,111	-14	1,097	320	-2	318	15	2	17
Madagascar	-	24	24	86	-2	84	3	-	3	1,354	-47	1,307
Malawi	-	7	7	714	-20	694	-	-	-	6	-3	3
Tanzania	14	27	41	495	54	594	1,008	4	1,012	78	-	78
Uganda	-	20	20	187	-9	178	655	-3	652	5	9	14
Zambia	1	22	23	435	10	445	256	1	257	-	3	3
Sub total	375	94	469	3,710	18	3,773	3,324	-3	3,321	1,458	34	1,424
Botswana	-	-	-	6	-	6	258	-	258	-	-	-
Burundi	7	-	7	92	-	92	118	-	118	3	-	3
Lesotho	51	-	51	130	-	130	55	-	55	-	-	-
Mauritius	-	37	37	-	46	46	-	-	-	-	68	68
Rwanda	2	-	2	72	-	72	129	-	129	-	-	-
Somali	-	14	14	33	44	77	60	-	60	-	17	17
Swaziland	-	-	-	32	-	32	16	-	16	6	-	6
Sub total, others	60	51	111	365	90	455	636	-	636	9	85	94
Total East Africa	435	145	580	4,075	108	4,228	3,960	-3	3,957	1,467	51	1,518
Cameroun	-	22	22	210	-	210	319	-	319	11	8	19
C.A.R.	-	4	4	33	-	33	25	-	25	3	-	3
Chad	2	4	6	9	-	9	650	-	650	27	1	28
Congo (B)	-	15	15	5	-2	3	-	-	-	4	1	5
Congo (K)	2	69	71	222	65	287	43	-	43	68	45	113
Gabon	-	6	6	2	-	2	-	-	-	1	5	6
Total, Central Africa	4	120	124	481	63	544	1,037	-	1,037	114	60	174
(a) Grand total	439	265	704	4,556	171	4,772	4,997	-3	4,994	1,581	111	1,692

Table 3 : Supply objectives of cereals for 1975 and 1985, in thousand tons

	1975				1985			
	Wheat	Maize	Sorghum/ Millet	Rice	Wheat	Maize	Sorghum/ Millet	Rice
Ethiopia	394	898	1,349	-	585	1,134	1,821	-
Kenya	132	1,329	379	31	209	1,800	508	48
Madagascar	40	135	4	1,900	63	133	6	2,253
Malawi	13	1,067	-	6	20	1,455	-	9
Tanzania	78	806	1,372	123	128	1,050	1,748	182
Uganda	33	263	822	22	52	339	1,061	34
Zambia	44	749	374	5	72	1,163	478	8
Sub total	734	5,247	4,300	2,087	1,129	7,074	5,622	2,534
Botswana	-	8	334	34	-	11	436	-
Burundi	14	130	153	4	21	175	200	5
Lesotho	100	184	71	-	154	248	93	-
Mauritius	72	65	-	97	111	88	-	118
Rwanda	4	102	167	-	6	137	218	-
Somali	27	109	78	24	-	147	101	80
Swaziland	-	45	21	9	-	61	27	10
Sub-total others	217	643	824	134	292	867	1,075	163
Total, East Africa	951	5,890	5,124	2,221	1,421	7,941	6,697	2,697
Cameroon	42	280		38	76	378	543	69
C.A.R.	10	45	34	17	17	60	45	26
Chad	14	22	840	34	30	43	1,025	52
Congo (B)	19	4	-	8	28	5	-	12
Congo (K)	128	450	66	200	224	780	97	344
Gabon	10	4	-	15	17	8	-	24
Total, Central Africa	223	805	1,364	312	392	1,274	1,710	527
Grand total	1,174	6,695	6,488	2,533	1,813	9,215	8,407	3,224