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NONCAPITAL PROJECT PAPER

Country: AFRICA REGIONAL PROJECT NO. 698-11-130-176

Submission Date Original: August 1968

Project Title: Major Cereals and Legume Improvement

U.S. Obligation Span: FY 1969 through FY 1974

Physics Implementation Span: FY 1969 through FY 1974

Gross Life of Project and Financial Requirements:

U.S. Dollars	\$2,395,000
Prior through FY 1969	395,000
Balance through FY 1974	2,000,000
U.S. - owned local currency	0

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MAJOR CEREALS AND LEGUME IMPROVEMENT

AFRICA REGIONAL PROJECT NO. 698-11-130-176

A. Summary Description

Cereal grains are the staple diet of Eastern Africa: Ethiopia, Kenya, Somalia, Tanzania, Uganda, Malawi, Zambia, Congo(K), Rwanda, and Burundi. These countries are not self sufficient in the production of cereal grains, but they have the production potential to become net exporters of cereals. The poor genetic quality of the indigenous varieties, and the traditional crop husbandry practices inhibit the goal of increasing production to attain self sufficiency.

The purposes of this proposal are to:

1. Separate Eastern and Southern Africa from the Africa-wide Major Cereals Research Project (WOH-funded) and establish an Africa Regional Major Cereals and Legume Improvement Project.
2. Continue the basic research on improved varieties of cereals and improved cultural practices, expand the field adaptation trials to all the Eastern Africa countries, and include research on legumes in addition to cereal grains.

The Africa-wide Major Cereals Research Project (WOH-funded) was initiated in 1963 with basic research facilities for East Africa located at Kitale, Kenya, for maize; and at Serere, Uganda, for sorghums and millet. The facilities for West Africa are located in Nigeria.

The work on maize preceded that on sorghums and millet, and improved varieties of maize have been developed at Kitale. Except in Kenya, very limited field adaptation varietal testing of maize has been conducted in Eastern Africa.

Primarily because the basic maize research facility and staff are located in Kenya, the initial field adaptation trials and demonstrations were conducted there following development of improved seed. The result has been a dramatic increase in maize production for Kenya. Indigenous varieties under subsistence crop husbandry practices average 10-15 bushels per acre. The improved varieties grown with improved crop husbandry practices by small-holder farmers average 70-100 bushels per acre. The planting of improved seed in Kenya (mostly by small-holder farmers) increased from 400 acres in 1963 to 25,000 in 1967, with the Major Cereals Project largely responsible for the increase.

Using the planting materials and cultural methods developed at the Nitali research station, this project proposes to expand the program, with appropriate technical staff, to accomplish similar results in the other countries of Eastern-Southern Africa. Limited varietal field adaptation trials conducted in Tanzania, Zambia, and Malawi have shown very promising results.

AID will continue to support the project by adding to the present staff two agronomists experienced in varietal field adaptation and a plant breeder to do research on soybeans. These three additions are included in the FY 1969 Africa Regional CP.

The planned host countries contribution will be self-help actions in support of field adaptation trials and demonstration. The performance of individual countries in providing effective leadership and support for this project will determine continuing AID contribution and participation.

B. Setting or Environment

Food production in Eastern-Southern Africa has been increasing at about the same rate as population. Except during drought years, production is generally sufficient to satisfy the food needs of the people at traditional nutritional standards. However, as health facilities and medical services reach more of the population, and growth rate increases, crop yields will have to increase correspondingly, or chronic food shortages will develop in these countries.

The importance of higher-yielding varieties of cereals is underscored by two facts:

1. Cereals are preferred as the staple diet in Eastern-Southern Africa.
2. The indigenous varieties now in general use have such low yields that improved practices pay only if they cost very little, or increase yields enormously.

Therefore, the fundamental problem is to breed and/or select varieties with much greater yield potential than those now commonly used.

The basic genetic germ plasm for maize, and to a lesser degree sorghums, has been developed which produce yields four or more times greater than the average yields prevailing in tropical Africa if the improved varieties are used in combination with improved crop husbandry practices.

The progress and findings to date in the project have been very encouraging. Improved strains of sorghum have been selected from local types. Yield increases of 100 per cent or more above the locally used indigenous varieties have been obtained and the development of sorghum hybrids is well advanced. The Kenya Seed Company is currently evaluating the seed production capabilities of the available lines, but extensive use of these new hybrids will require a much greater effort in field adaptation trials and demonstrations throughout the area than has yet been undertaken.

The most promising lines from the world millet collection of over 2,000 varieties are being evaluated for yield, insect and disease resistance, and other desirable characteristics, and are being increased and tested.

Inter-varietal hybrids of maize are currently in extensive use in Kenya. These involve local improved varieties in combination with Central American types from similar ecological regions. The resulting hybrids have given yield increases 50-100 per cent greater than local improved varieties and 25-30 per cent greater than conventional hybrids first released in Kenya, in 1963. The following table shows the acreage of improved seed planted in Kenya:

<u>Year</u>	<u>Large-scale Mechanized Farmers</u>	<u>Small Farmers</u>	<u>TOTAL Acres</u>
1963	390	10	400
1964	28,200	1,800	30,000
1965	54,700	20,100	74,800
1966	62,900	37,800	100,700
1967	130,300	134,700	265,000

Extensive demonstration plots in Kenya have conclusively shown that substantially increased yields resulted from the use of improved seed, proper crop husbandry practices and fertilizer in the following descending order of importance:

1. Time of planting
2. Spacing and plant population
3. Variety and genetic make-up
4. Cultivation and weeding
5. Fertilization

The average yield per acre increases in direct proportion to the application of these individual practices in the same descending order. Thus, there is a direct correlation between the level of basic husbandry practices and production. Production increases from the application of fertilizer only in direct proportion to the level of the basic crop husbandry practices in combination with the fertilizer.

Explicitly inherent is the basic necessity and contribution of the improved seed. However, the program was presented to the farmers as a completely new package program of required husbandry practices and inputs, rather than just the substitution of improved seed for indigenous seed in the traditional crop husbandry practices. Primarily due to the demonstration program, the acreage planted to improved seed by small-holder farmers is managed much better than the acreage planted to indigenous seed. Under favorable conditions, yields up to 100 bushels per acre have been obtained compared to traditional yields of 12 bushels. The Kenya Seed Company, a commercial enterprise, now handles all aspects of maize seed multiplication. The parental types, as well as hybrid seed, are produced under contracts with local farmers. Hybrid seed distribution is handled through farmer associations and cooperatives.

Improved corn varieties from the regional project facilities in Kenya have been disseminated for limited trials in Malawi, Ethiopia, Uganda, Tanzania, Congo(K), Somalia and Sudan. Such trials need to be greatly expanded if an impact is to be made on increasing cereals production in Eastern-Southern Africa.

The Rockefeller and Ford Foundation the United Kingdom, and Canada will continue their support of major cereals research in East Africa. The Foundations are currently supplying a geneticist, two agronomists, and fellowship funds for training East Africans. The United Kingdom is providing funds for major cereals research to the East African Community, and Canada has supplied two scientists for wheat research.

To date, the project has been engaged primarily in plant breeding and testing under experiment station conditions. The only significant out-reach has been in Kenya, where 265,00 acres of improved seed were planted in 1967, half of which was planted by small-holder farmers. The goal is to continue support for basic breeding research and encouragement for further expansion of field adaptation trials throughout Eastern-Southern Africa.

C. Strategy

Most of the Eastern Africa countries have engaged in cereals breeding work for several years and have shown interest in farmer demonstration (out-reach) activities and seed multiplication and distribution. AID has direct-hire, contract, or PASA agricultural personnel qualified to advise and maintain surveillance on out-reach activities in these countries between consultation visits of the project specialists.

An intensified Eastern-Southern Africa Regional approach has built-in advantages for efficiency and cooperation. The ecological environments of the cooperating countries have many common characteristics favorable for the production of maize, millet, and sorghums which are produced traditionally in all. A regional approach can achieve uniformity and coordination in field testing within and among the countries, duplication of varietal development and testing can be minimized, and results can be changed and analyzed systematically. A regional approach also will permit country-by-country application of common principles for program organization and management.

In summary, the regional approach will capitalize on research results and developmental work that is accruing from a concentrated research effort currently being carried out in Kenya and Uganda. Field adaptation trials in the other Eastern-Southern Africa countries will provide a basis for making research more broadly applicable and thus lead to greater food production.

This proposal is to provide additional manpower and logistic support for the new Africa Regional Project conducted under a PASA with the U.S. Department of Agriculture. This project will also continue to be conducted in cooperation with East African Community (EAC) and its subsidiary organization EAAFRO (East African Agricultural and Forestry Research Organization).

Since its inception in 1963, the project has concentrated on breeding improved varieties of maize, millet, and sorghum adapted to African conditions, utilizing improved crop husbandry, fertilization, and disease and pest control practices. The project has progressed sufficiently to be able to provide planting materials and technical assistance to the cooperating Eastern Africa countries to conduct field adaptation trials of the improved seed varieties to identify the varieties best adapted to local conditions.

The project technicians will consult with local planners, institutions, and AID missions in the cooperating countries. Plans and programs will

be designed and carried out for extensive varietal field adaptation testing. Trials will also be conducted to determine the combination of crop husbandry practices best suited to each locality of a country. Following this, demonstrations will be conducted by small farmers to furnish practical visual proof that the small farmer can finance and implement the new package program and obtain the increased production.

Expansion of field adaptation trials to cooperating countries will start in FY 69. The estimated AID cost to achieve the additional activities proposed here is \$2,395,000 for FY 69-74. The USDA will provide:

- 1 Biochemist 6 years
- 2 Geneticists 6 years each
- 3 Agronomists 6 years each
- 1 Entomologist 6 years
- 1 Soil Scientist 6 years

plus short-term consultant service as required.

The proposed three additional personnel will enable all of the specialists presently provided (see paragraph VI), or to be added to the project, to make more frequent consultative trips to cooperating countries. Visits to other countries, or even within Kenya, by the USDA advisors now on duty are restricted because of the time that must be spent on their breeding activities.

Some host country leaders have been identified, and others can be identified when the project intensification begins and formal arrangements are reached. However, the past interest evidenced by each of the countries in cooperating with this project gives reasonable assurance that all countries will assign satisfactory leadership.

The proposal will: establish or strengthen institutional arrangements and the institutions themselves for carrying out basic genetic research, and field adaptation (applied) research trials. It will provide the personnel to carry out formal plans with each country to replace the ad hoc relationships now existing in most cases.

The project has interdependent relationships in each country with other activities, i.e., provision of fertilizers and other production inputs, agri-

culture, extension, credit, feeding programs for poultry and livestock, and marketing services. Capital investment will be required for short-run importation, or long-run manufacture of fertilizers, agricultural chemicals, and improved implements; for facilities and equipment to establish seed industries; and for credit. The expanded project will encourage countries to examine these needs and to arrange support.

D. Planned Targets, Results and Outputs

1. The targets are to:

- a. Negotiate agreements and develop work plans as appropriate;
- b. Continue the basic research for genetic quality;
- c. Expand and intensify the varietal field adaptation trials of the improved seed developed in the on-going project to identify the varieties best adapted to local environments of the cooperating countries.
- d. Arrange systematic training of staff for each country in the technical and management discipline pertinent for each activity.
- e. Conduct continuous evaluation of progress in achieving the objectives and targets of the project.

2. Other objectives of the project are:

- a. To facilitate the exchange of materials and information among the cooperating countries.
- b. To screen the world collection of maize, sorghum, and millet varieties for resistance to disease, insects, birds, and other pests that damage these crops in Africa, and for other desired characteristics.
- c. To arrange for uniform trials of promising varieties and hybrids in participating countries, including trials at different fertility levels.
- d. To advise breeders as to methods, objectives, and opportunities in improving maize, sorghum, millet and legumes.

- e. To develop high-yielding and disease-resistant varieties of those major crops for different areas.
- f. To coordinate fertilizer trials with the grain crops in different areas, with particular emphasis on balanced, heavy fertilizer applications.
- g. To coordinate existing, and to initiate new, breeding programs designed to develop improved varieties and hybrids of maize, sorghum, millet and legumes.
- h. To determine the important diseases affecting these crops and develop control measures through the use of fungicides and the development of resistant types.
- i. To determine the geographic distribution and severity of the principle insect pests of cereal and legume crops in Eastern-Southern Africa; to determine the resistance or tolerance of available germ plasm material to various insect species; to assist plant breeders to incorporate resistance into approved hybrids or varieties; and to develop other control measures.
- j. To determine those soils management factors which contribute to maximum production of the three crops. Research is to include the inter-relationships of population density, nutrient requirements, climatic conditions, and management practices.

E. Course of Action

The Biochemist, one Geneticist, one Agronomist, the Entomologist, and the Soil Scientist are already in East Africa as a part of the original Africa-wide Major Cereals Research project. Two additional Agronomists will be recruited to conduct field trials of plant material developed in the research program. One plant breeder (Geneticist) will be recruited to do research on soybeans in Malawi. With the arrival of additional staff we can anticipate expansion of field trials to test the adaptability of improved varieties and hybrids released from the Kenya, Uganda, and Malawi stations to representative localities in each country.

The proposal made here has already been tried and proven successful as a part of the Africa-wide Major Cereals project. This PROP pro-

vides for three additional staff members and establishes a separate project for Eastern-Southern Africa. The positive results described earlier will be expanded to include additional crops and areas of production emphasis. All countries participating in the project have given full support, and much of the success achieved in the past can be attributed to their emphasis on increased cereal production. Their extension services in particular have played, and will continue to play, a significant role in getting new varieties and ideas adopted.

Training programs will be carried out for technical and management staff of participating countries through:

1. Regional seminars in Kenya for top and middle level personnel.
2. Short courses in individual countries, primarily for middle and lower level personnel. Specific types of training would be for field inspectors and equipment operators.

F. Research Component

Evaluation would be accomplished through regular and special reports by the USDA leaders and supplementary comments by AID missions and AID/W offices. The USDA technicians, as professional scientists, are fully experienced in analytical research in their fields of specialization and would apply this competency to the results of this project.

NONCAPITAL PROJECT FUNDING (OBLIGATIONS IN \$000)

COUNTRY: Africa Regional

Project Title: Major Cereals and Legume Improvement

PROP DATE
Original
Rev. No.
Project No.

Mo/Day/Yr
8/19/73

693-11-120-176

Fiscal Years	Ap	L/G	Total	Cont ^{1/}	Personnel Serv.			Participants		Commodities		Other Costs	
					AID	PASA	CONT	U. S. Agencies	CONT	DIF U. S. Ag	CONT	DIF U. S. Ag	CONT
Prior through Act. FY													
Oper. FY 69	TC	G	395	-	-	245	-	-	-	85	-	65	-
Budg. FY 70	TC	G	400	-	-	275	-	-	-	60	-	65	-
B + 1 FY 71	TC	G	400	-	-	275	-	-	-	60	-	65	-
B + 2 FY 72	TC	G	400	-	-	275	-	-	-	60	-	65	-
B + 3 FY 73	TC	G	400	-	-	275	-	-	-	60	-	65	-
All Subs.	TC	G	400	-	-	275	-	-	-	60	-	65	-
Total Life			2,395	-	-	1,620	-	-	-	385	-	390	-

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