6250916- (2)

PART I. SUMMARY AND RECOMMENDATIONS

AID 1020-1 (11-71) FACE SHEET — FINANCIAL SUMMARY

NONCAPITAL PROJECT PAPER (PROP)

PD-AAB-733-B1 ~~201~~ 196p.

PAGE 1 of ___ PAGES

I. PROJECT IDENTIFICATION

1. PROJECT TITLE: Sahel Food Crop Protection

APPENDIX ATTACHED: [X] YES [ ] NO

2. PROJECT NO. (A.O. 1043.3): 625-11-130-916

3. RECIPIENT (country): Central and West Africa Regional
[ ] COUNTRY
[X] REGIONAL ___ [ ] INTERREGIONAL ___

4. LIFE OF PROJECT: BEGINS FY 75 ENDS FY 78

5. SUBMISSION: [X] ORIGINAL May 28, 1975 DATE; [ ] REV. NO. ___ DATE

CONTR./PASA NO. ___

II. FUNDING ($000) AND MAN MONTHS (MM) REQUIREMENTS

A. FUNDING BY FISCAL YEAR	B. TOTAL $	C. PERSONNEL (1) $	C. PERSONNEL (2) MM	D. PARTICIPANTS (1) $	D. PARTICIPANTS (2) MM	E. COMMODITIES $	F. OTHER COSTS $	G. PASA/CONTR. (1) $	G. PASA/CONTR. (2) MM	H. LOCAL EXCHANGE CURRENCY RATE: $ US = ___ /U.S. OWNED: (1) U.S. GRANT LOAN	(2) COOP COUNTRY (A) JOINT	(2) COOP COUNTRY (B) BUDGET
1. PRIOR THRU ACTUAL FY												
2. OPRN FY 75	1100	341**	66	132	98	380	247	341	66			388
3. BUDGET FY 76	700	240	48	203	182	124	133	240	48			*
4. BUDGET FY 77	700	330	66	120	129	155	87	330	66			*
5. BUDGET FY 78	650	330	66	105	150	110	105	330	66			*
6. BUDGET FY												
7. TOTAL SUBTOTAL												
8. GRAND TOTAL	3150	1241**	246	560	559	769	572	1,241	246			

9. OTHER FUNDING (IN PUBLIC)

(A) KIND OF GOODS/SERVICES	(B) KIND OF GOODS/SERVICES	(C) AMOUNT

III. ORIGINATING OFFICE CLEARANCE

	TITLE	DATE
E. Gibson, AFR/DS D. Shallow, AFR/CMR	Co-Design Officers	6/18/75
W. A. Cole for W. Cheek, AFR/CMR	Director, AFR/CMR	

IV. PROJECT AUTHORIZATION

Waiver of AID source procurement requirements for vehicles is required to implement this project as proposed. Waiver requests will be submitted in accordance with applicable Manual Orders.

Commodity procurement approved for Code 935, Free World.

*Note: PP recommends 10 yr. project with phases of 4-3 & 3 years. This budget is for 1st phase of 4 yrs. for 4 countries. See Sect. IV for country budgets. Country contributions after FY 75 will be determined annually in preparing country Pro-Ags.

** Excludes direct-hire Project Manager funded elsewhere.

		DATE		SIGNATURE	DATE
AFR/DS	P. Lyons				
AFR/DP	E. Gibson		DAA/AFR	D.S. Brown	
CC/AFR	E. Krause				
PPC/DPA	A. Donally		AA/PPC	P. Birnbaum	6/20/75
AA/AFR	E. Butterfield	6/25/75	CC	C.L. Gladson	6/26/75

APPROVAL OF AID 1020-1 (VOL. 1)

Assistant Administrator for Africa Bureau	JUN 30 1975	John E. Lindley (Acting)	DA/AID	6/28/75

TITLE: AID AGENCY OFFICE OF INTERNATIONAL DEVELOPMENT

Sahel Food Crop Protection

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B. Project Development Team

1. Ernest F. Gibson, AFR/DS, Agricultural Economist
2. L. Stanley Peek, AFR/CWR, Chief of AFR/CWR/AGR
3. Donald D. Shallow, AFR/CWR, Entomologist, Agricultural Officer and Team Leader

C. Grantee

AID will enter into a bilateral project agreement on memorandum of agreement with the governments of each participating country through a PASA arrangement with USDA. Host governments administering agency will be the appropriate ministry or department under which the National Crop Protection Unit is organized.

D. Grant

1. Amount of AID assistance (See Part IV and Part VI Table IX)
2. Grantee Contribution (See Part IV and Part VI Table IX)

E. Description and Justification

1. Policy Objectives in the Rural Sector

There are six general policy objectives:

a. Increase rural incomes.

b. Wider rural income distribution.

c. Minimize dependence on food imports.

d. Increase exports.

e. Reduce risks in agriculture

f. Maintain and improve the ecological balance.

The Sahel Food Crop Protection project will help to meet all these objectives in general, but especially a, c, and e. Trade-offs

must be recognized and choices made. Increased rural equity, for example, as a prime early objective, requires that an effective system of farm inputs be installed, that farm credit be established, that a great deal of training be attempted and that a price policy be followed that not only attracts marketable surpluses but also influences farm production decisions as well. If rapid food self-sufficiency is to be attempted as a primary goal, pest control technologies will have to be introduced that give rapid and high returns to investment. What must be decided is the optimum mix of factors determining food production, including integrated pest management.

The principal agricultural problem which confronts the participating countries is that of simultaneously increasing food production and cash crop production. Hitherto, expansion of one meant the contraction of the other. If yields per worker and per unit of capital input can be increased, then these countries can have their food and cash crops, too! If AID is to work in the rural sector to promote food production on the one hand and equity on the other, it must seek to develop systems which reach the target group and help provide technologies acceptable to them.

A national food crop protection organization with capability to control insects and plant pests must come as part of applied and adaptive research, followed by adequate extension and farmer training. All year cropping is badly needed both to increase incomes and make better use of scarce resources; but more intensive farming increases pest populations. Such off-season cropping must include vastly improved pest management. Rice, wheat, maize, millet, sorghum, vegetables and fruit are all possibilities. A total crop program must be made available to farmers

in all circumstances where major agricultural physical resources exist. This would represent a considerable break from the historic emphasis on a single crop.

The project should strive to establish a wide variety of training programs, oriented toward farmers (focusing upon one or two problems at a time such as pest control), ones oriented toward local cooperatives, extension persons, local and regional administrators and, finally, national planners.

Donors could provide a very useful input to the extent they were prepared to participate in the design and performance of applied research, specifically oriented toward the target group of farmers. Important work remains to be done in the design and extension of minimum packages specifically planned for farmers under a wide range of alternative circumstances. Ecological problems pursuant to the extensive mono-cropping of the past decade should be studied and suitable plans designed to reduce environmental pollution.

New farm control methods for pests should be investigated. An attempt should be made to identify new technologies which do not place great demands upon cash to buy equipment, supplies, pesticides, parts, or fuel. The widest possible application of insect resistant varieties of food crops and farming practices such as early planting to harvest crops before pests emerge would seem to be an area where research would have high early pay-offs.

AID would be well advised to carefully consider supporting these countries in doing what they view as important. Placing emphasis on the particular constraints that these programs are likely to face may be a most useful activity. These areas are likely to be, once again, training

and management in operating a national food crop protection organization.

2. Logical Framework Narrative Synopsis

a. Program Goal - To increase the capacity for domestic agriculture production in each participating country, and to correspondingly reduce existing food deficits.

Measures of goal achievement can be obtained by comparing the amount of field and stored food crops loss due to pest infestations in the base year with losses incurred during succeeding time periods. Progress evaluation will be conducted at the end of each year during Phase I (four years) beginning one year after approval of country work plans.

Goal achievement is verified when field and stored food crop losses are incrementally reduced over a given time period. Basic statistical indicators will be derived from method demonstrations conducted on farm field sites in selected areas for selected food crops in each participating country. Areas will be selected on the basis of access and serviceability. Farm units will be selected on the basis of food crop produced, i.e., sorghum, millet, corn, rice, other cereals, and other food crops.

Assumptions include: Governments first priority to agriculture (food crop) production; Price policies are conducive to food crop production; channels are available to move on-farm production to local or major consumption centers on deficit areas; that protection inputs are available at prices affordable to local farm units; governments continue to support plant protection units; that crop protection practices are adaptable and acceptable to farmers; and that method and demonstration

exercises will be conducted as scheduled on rural farm sites.

b. Project Purpose: (1) To strengthen or establish the ability of plant protection units to combat plant pests within national boundaries, with an additional capacity to demonstrate, train, and assist local farmers in pest management; (2) to extend to farmers information on pest management practices which they will use to reduce pre- and post- harvest food crop losses.

Project purpose will be considered achieved when a fully staffed, equipped, and operating plant protection unit is developed in each participating country, capable of performing local small-scale demonstrations; and farmer field site demonstrations are regularly conducted in selected areas.

The means of verification will be obtained by determining the number of personnel trained and assigned to crop protection units or extension and agriculture services; the number of field agents or farmers trained in crop protection methods; the number of farmers or farm groups reached by extension or protection unit agents; and the number of demonstrations conducted at on-farm sites assumptions for achieving this purpose include: that personnel for subsequent assignment to crop protection units will be available for higher level academic training and middle and lower level practical training; that other personnel for subsequent assignment to crop protection units, extension or agriculture service systems will be available for middle and/or lower level training; that farmers or other village personnel will be available for middle and/or lower level training; that demonstrations will be conducted and replicated by farmers at on-farm sites; that

training sites and programs will be established; that trained personnel will devise and implement crop protection training and extension courses; and that farm units accept suggested protection measures.

c. Project Outputs - An established and functioning plant protection unit in each country with a mobile field service ("fire department units") capable of conducting large scale campaigns or field demonstrations; a cadre of personnel from crop protection units, extension on agriculture service agencies, and local farm communities, trained in the practical application of pest management methodology; and that regional and international linkages for sharing of research results, methodologies, and policies relating to crop protection is in place.

Magnitude of outputs are as follows: at least one African counterpart (on understudy if qualified individual is not available) assigned to each country project officer in each participating country; a selected number (see logical framework matrix for each country) of personnel trained from each participating country; building/office and training facilities required to support training program and house participants; and a comprehensive national plan developed for each country, identifying principal issues and constraints to be addressed by national crop protection units.

Verification will be determined by periodic assessments of each country's plan protection units work plans; examination of plant protection Records in each country; AID evaluation of regional program; and comparison planned versus actual plant protection unit's staffing patterns.

Assumption for achieving outputs are that: Host governments make available personnel and land required to establish and operate training program; that personnel trained will be assigned to crop protection units on extension and for agriculture service organizations; that national staffs as supplemented by project training inputs will be adequate to design and conduct plant protection programs and exercises.

d. Project Inputs: (1) AID will provide one direct hire project manager; through a PASA arrangement with USDA, three country project officers initially, and a Plant Protection Regional Training Officer with others to be provided as the project expands to other countries, (2) administrative and clerical personnel as required, and (3) logistical and administrative support (vehicles, equipment, supplies, material) for the project manager and staff.

AID will also provide higher level academic training in the U.S., third countries, or in participating countries for selected personnel. Demonstration chemicals, application equipment, blowers, sprayers, mining units, vehicles, supplies, materials, consultative services, and other operational support will also be provided.

Host Countries will provide personnel, buildings or office space, land for training and building facilities, operational budget, and required supportive services.

OICMA and OCLALAV will provide assistance in combatting international locust and grasshopper attacks, and in teaching insect control methods at regional training centers.

Other donors are expected to assist in areas of research and teaching.

See section A, Part IV, and Logixal Framework Matrix for each country for scheduling of type and quantity of project inputs.

A more comprehensive implemention plan for each country will be developed no later than 120 days after country project officers arrive in country.

Implementation and work plans; host country project agreements; and project evaluation plans will be used as means of verification.

Assumptions for providing inputs are: Project Manager, country project officers, supporting staff, and necessary logistical support can be provided on schedule and at planned funding levels.

Necessary equipment, supplies, materials, commodities as required are provided on schedule.

Host countries provide assistance, personnel, land, and other support as planned.

e. Regional Aspects of the Sahel Food Crop Protection Project - There are three distinct regional elements to this project; research, technical services, and a training program. In addition to the above three points, the participating countries have similar agriculture problems and constraints as well as similar agriculture goals - increasing agriculture productivity; especially food production.

1. Research - Presently no Central and West African countries have an integrated pest management research program for food crops. Some have cereal research stations located within their national boundries, but these stations are mainly components of an international organization, i.e., IRAT, WARDA, JP26, etc. Usually there is no pest control element; or if pest resistant varieties are involved, other elements of an integrated pest management system, such as cultivation practices or use of chemicals, are not. Under this project the Regional Project Manager will assist in the organizing of an interlinking network focussing on both field and storage problems of pest control. He will also be responsible for collecting and disseminating the results of applicable previous and current research to the participating countries. This information will also be made available to other neighboring countries and through the use of field trials.

2. Technical Services - Technical services will not only be available to the participating countries, but also to Mali, Niger, and Upper Volta. These other Sahel States will be able to request the services of the Regional Project Manager (entomologist), and later the Plant Protection Training Specialist and the Stored Crop Protection/ Plant Pathology Expert stationed in Dakar. The Country Project Officers (Entomologists) will first be available to the participating countries (interchangeable among the four countries for short periods) and then to other CWR countries for assistance in the officer's areas of competence, i.e., grasshopper and locust control; aerial application;

quarantine inspection; phyto-sanitary activities; fumigation of infested stores; post-harvest food crop protection; nematology; bird control; rice pests, etc. The project headquarters will assist the OCLALAV and OICMA regional organizations through the provision of technician services upon request, and in collaboration with the above two organizations and other West African countries develop an international survey and reporting network to predict the size and location of pest populations. Furthermore, stronger national crop protection units will enhance the regional early warning system by funneling information to OICMA and OCLALAV on pest occurances, size, and location; while in return becoming increasingly more capable of absorbing and acting on recommendations and strategies furnished by OICMA, OCLALAV, and other international organizations.

3. Training - Training for all levels of personnel will be provided on a regional basis. Two regional Plant Protection Training Centers are to be established in Senegal and the Cameroon. The centers will be available first for participants from participating countries; secondly other Sahel countries; and thirdly other CWR countries. AID will support these training centers through funds for construction and furnishing of dormitories (twenty student capacity), operations, scholarships and per diem funds in each country. In addition, the services of the Regional Plant Protection Training Officer will be available to develop the curriculum and train two instructors for each center. There will be courses for basic plant protection field service techniques for field agents and a middle level course for supervisors.

High level or academic training will be available with AID funds where pest control courses are available in African Universities, France, Canada, or the United States.

In summary, the regional aspects of the project will be directed from or through the AID Regional Project Manager by interlinking systems for research, technical services, and three educational levels.

PART II PROJECT BACKGROUND

A. History and Development

After several years of low food crop production in the Sahel States; the year 1974, with better rainfall, promised an almost average yield. However, reports of insect attacks commenced in April and increased rapidly from all countries through the crop harvests in November. This focused attention on losses caused by insects attacking food crops in 1974 but which have actually been occurring in varying degrees of intensity ever since farmers began cultivating food crops. These losses have been accepted as "normal" and no organized effort to control them was initiated by the colonial powers as had been done for commerical crops which were intensively cultivated for export of raw materials to the European markets.

The dramatic appearance of the several grasshopper species and the larval stage of a species of army worm in 1974 helped to mobilize activities of donor nations and world multi-donor organizations such as FAO, FED, and the EEC. The Office of Sahel Relief Operations (OSRO) which had been organized in 1972 and effectively conducted food distribution efforts in Sahel States through food and monetary contributions organized an emergency short-term food crop protection project. Several million dollars ($4,115,000), consisting of cash, application equipment, and mostly pesticides were pledged to OSRO by many donors. This effort was helpful and saved thousands of tons of food grains but due to the enormous area involved could not possibly save but a small portion. The area involved extends from 16° West longitude to 16° East, or a linear distance of about 1900 miles! which would be longer than the entire U.S. Pacific Coast

from Canada to Mexico and extending inland as far as the states of Arizona, Nevada, Utah and Idaho. There is no group of nations or an international organization that can effectively conduct a battle against insects over such a vast area. Such large scale campaigns are conducted by individual nations with trained plant protection units. The ultimate goal for plant protection responsibility lies in farmer motivation to perform simple but effective surveillance and control techniques using Integrated Pest Management systems. This means that in addition to chemicals, other methods are employed; cultivated practices, use of pest resistant varieties of food crops, biological control using one insect to attack another, spread of insect disease vectors, pheromones or attractants to lure insects to poisons or alter their life cycle by aborting metamorphosis.

In October of 1974, the A.I.D. Administrator and the Deputy Assistant Administrators for Africa on an inspection trip of the Sahel area observed at firsthand the great damage insects were inflicting on food crops. The situation was described in a series of cables to AID/W, which requested possible assistance in addition to that being provided on a short-term basis by OSRO. In response to a field request for help, the plant protection experts from A.I.D. and the United States Department of Agriculture concluded that it was too late in the harvest season for a massive airlift of pesticides, application equipment, vehicles, and possibly agricultural aircraft to apply pesticides over large areas.

A.I.D. gave about $100,000 for pesticides for emergency help. In order to help the Sahel nations develop a long-term pest control capability on food crops, a long-term project was proposed. It was unilaterally decided by AID/W that in order to get action started and possibly commence for a U.S. long-term

project to begin in FY 75, an informal international meeting, attended by donor nations and multi-donor organizations be organized to get a consensus on what courses of action for Sahel pest control should be taken. This meeting was held in Washington on December 11 and 12, 1974, and it was attended by five members of international organizations such as FAO, OCLALAV and OICMA, six bilateral donor nations' experts, ten plant protection experts from AID, USDA, and the University of California.

Analysis of the situation and conclusions were made which resulted in two unanimous recommendations for the NEAR TERM problem and the LONG-TERM REQUIREMENTS for plant protection. It was unanimously agreed "that it is absolutely essential for each country to develop its own institutional capability to maintain surveillance and control its crop pests."

The usual procedure for identifying a project rests with each AID field post. However because early belief was that such a project could only be considered on a regional basis and could include up to seven countries and because CWR field posts do not have the technical capability for designing a plant protection project, the Central West Africa Office of the Africa bureau was assigned the task of preparing the Project Identification Document (PID) for the entire program. The PID was written in AID/W and transmitted as a telegram to the six Sahel countries, the Cameroon, and the other major donors on January 13th, 1975.
All CWR field posts quickly responded with strong affirmative and enthusiastic replies for such a project in their respective countries and their host governments concurrences and requests to be included in the final project design.

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On the basis of the field responses, Africa Bureau agreed to proceed to the next step and prepare a Project Review Paper (PRP). Again, instead of each CWR field post completing the paper in collaboration with the Sahel States, it was prepared in Washington. The PRP was finally approved by the Assistant Administrator for the Africa Bureau on March 4, 1975, with the proviso that a Design Team be sent to all seven possible participating countries to collect data necessary to proceed to the final stage of preparing a Project Paper. Again, instead of having each RDO/CDO write its own country PP in close collaboration with the host governments for whom the projects are designed, a Design Team was organized to prepare a PP for the Sahel areas only. The Design Team included an Agricultural Adviser with training and experience in economic entomology, and an A.I.D. economist from the Development Support Office of the Africa Bureau. The Senior Agriculture Advisor for the AID Office of Central and West African Affairs accompanied the team to Paris for consultation with the French on the level of their plant protection inputs in the Sahel countries and then to Senegal for the first discussions with the Senegalese Government, USAID, and OCLALAV, which has headquarters in Dakar. The AID Technical Assistance Bureau Agricultural Pest Management Specialist, who is also an entomologist and Project Manager for several projects including those for the control of bats, rats, birds, nematodes, tsetse fly, and other pests attacking crops, livestock and man, met the team in Cameroon and participated in meetings with AID and host country officials there and in Chad.

To the extent possible, the CWR office has followed the Planning, Budgeting, Accounting and Reporting (PBAR) system approach in order to

The primary purpose of the first Regional Insect Control Project as in this project, was to build in each nation the capability of combating locust outbreaks in localized areas before they could reach cultivated farm lands.

The secondary purpose was to build an institutional organization that was capable of motivating farmers through the building of a field extension service to demonstrate to farmers the worthwhile insect control activities on all crops.

The project was flexible and had from five to twelve participating nations at various times. Their capabilities for conducting pest control campaigns were varied and to reach a stage of proficiency in pest control

took different periods of time for the various nations, as will happen in the Sahel.

Some nations could use aerial units for applying pesticides with aircraft. Therefore, pilot and mechanic training schools were established in seven countries with U.S. assistance, and the nations purchased their own aircraft for these aerial operations.

As a result of this coordinated international effort, the locusts were eventually attacked in their primary breeding grounds of Ethiopia. Swarms escaping from Ethiopia crossed the Red Sea to the Saudi Arabia peninsula, they bred another generation and scattered as far as Bangladesh. As improved techniques of survey, outbreak predictions, and application techniques were developed it enabled the countries to intensify efforts into the previously inaccessible desert locust primary breeding grounds in Ethiopia. The successful conclusion of this project in 1965 to reduce losses from insect attacks and raise agricultural production through mutually beneficial activities on a regional basis is an important example of what can be accomplished by coordination and collaboration between similarly afflicted countries, the United States, and other donors and regional organizations.

This new project for the Four Sahel countries, most of which are at a stage of development similar to that of the Middle East countries when the Regional Locust Control project was initiated, is based on the same

principles but does not, at least include at this time, establishing individual aerial units. Some areial application capabilities will be provided by OICMA and OCLALAV to Combat Desert Locust, African Migratory Locust and the Weaver Birds.

Extension must become organized to deal with community actions when these are necessary, but the growers must be prepared to carry out the actual plant protection themselves. Governments cannot possibly mobilize sufficient men, equipment and materials to protect all fields at the time optimum for protection.

Problems in Prior Experience

A major bottleneck or "gap" in agricultural crop protection is extension. The plantation areas, or those in which the government or colonial powers had a vested interest as export commodities have many of the answers. An important concern is to motivate the small or peasant farmers who are living on a subsistence basis. Extension is an important link in the improvement of peasant agriculture. The larger grower benefits most from commercial crop plant protection. Under the Insect Control project that the U.S. sponsored in the Middle East, services become equally available to the small farmer. Growers must be educated to recognize signs and symptoms of pest damage, become aware of the losses being caused, and be taught means of dealing with pests. This educational work should be the most important work of the extension service.

Critics of this view would agree that it does little good to protect one field from pests if neighboring fields are left unprotected, and for this reason Government must step in and carry out plant protection itself.

For some pests community action is necessary. For others, such as stem borers of rice, sorghum and millet, individual plantings can be properly protected regardless of the existence of adjacent unprotected fields.

CRITERIA FOR COUNTRIES SELECTED TO PARTICIPATE IN THIS PROJECT

A primary objective of the field trip was to determine which countries would be selected for particpation in the Sahel Food Crop Protection project. AID's financial and technical input constraints; host country capability to provide operational and budgetary support, manpower needs, and commitment to improvements in food production; and the level and possibility of other donor support in the area of food crop protection were all taken into careful consideration. Although the project is needed in all countries of the Sahel. The major factor in the selection of the Cameroon, Chad, Mauritania. and Senegal was the lack of other donor activities in these countries in the protection of food crops. The Canadian development assistance agency (CIDA) has undertaken the creation and building of a food crop protection unit in Niger, amounting to $3 million in the first phase and $3 million additional in the second. The Government of Niger has committed $2 million and another $700,000 in local currency for the FY 1975 budget. It is not likely that they could support or absorb another project in plant protection. The Niamey project has been in existence for about five years, and is rapidly approaching the point wherein the Nigerien counterparts will be able to operate and maintain equipment and supplies, and service the major food production areas. The major weak point in the project is the lack of an effective and functioning extension organ to reach and educate the small farmers, who grow most of the food crops, in simple protection practices. CIDA is now in the process of designing a similar project for Upper Volta, and has received an official request from the Malian Government to implement a comparable project in Mali.

Given the extent of actual and planned CIDA assistance in Niger,

Upper Volta and Mali, and those countries capabilities to absorb more projects, and AID's financial, technical, and administrative constraints; (Agency probability of implementing and providing the necessary and appropriate inputs on a timely basis for seven countries, as opposed to four or three) the team felt that of the seven countries studied, Cameroon, Chad, Mauritania and Senegal were the logical first choices. Senegal and Cameroon offer the greater potential in absorptive capacity, availability of manpower needs, and facilities for incountry training requirements; with Chad and Mauritania demonstrating a lesser potential in the areas indicated above. Officials in all four countries expressed a high degree of enthusiasm and interest in the project proposal. The Senegalese and Cameroonian officials are prepared to identify training candidates and locate incountry training facilities as soon as possible after completion of project agreement. It appears that Mauritania and Chad (whose lower level training requirements will be filled in Senegal and/or Cameroon) could not at this time identify and make available qualified candidates for longer-term, higher level training but will do so as early as possible. In the meantime they will recruit and make available candidates for lower level training in simple crop protection practices, and operation and maintenance of pesticide application equipment and machinery. In addition, the Chiefs of the Senegal and Cameroon Crop Protection Units, as well as the Director of Agriculture Services and the Cabinet for Rural Development in Senegal; and the Director of Agriculture Service in Cameroon, projected a greater definitiveness in their ability to provide local resource support (administrative and regulatory; physical training facilities; and

manpower requirements) and in their commitment to increasing productivity in the food crop sector. The Senegalese and Cameroonian authorities also appeared to have a clearer understanding of the scope and magnitude of the proposal, the value of intended outputs, and the appropriateness of the project in attaining increases in food production.

C. Other Donor Assistance

Every effort has been made to confer, collaborate and coordinate with other donors activities; even before the conception of this project. The Multi-Disciplinary Study Team for Crop Protection went to Senegal, Niger, Mali, Ghana, Nigeria, Kenya, Tanzania and Ethiopia, during October and September of 1972 and held technical discussions with heads of research organizations responsible for research and control work in the Sahel. These included the U.K. through COPRA, France through INRAT, O.A.U., I.I.T.A. ICIPE, WARDA, OCLALAV, OICMA, FED, and others. The "History and Development of the Project" section of this paper explain that one of the main reasons the "Sahel Crop Pest Management Conference" was convened in December 1974, was to build communications between all donors to prevent "overlap" of activities.

The French Ministry of Cooperation officials discussed the Pest Control Project at the above meetings with AID, in Washington, and at the Technical Assistance Projects meetings in January 1975.

This was followed by another meeting in Washington in February of 1975 with the officials of Canadian International Development Assistance (CIDA) to discuss collaboration on the Medium and Long-Term Sahel Food Crop Protection Projects. At that time AID asked for reciprocal coordination from CIDA and requested their assistance in establishing liaison with past research and control projects conducted by them in Upper Volta and Niger.

On March 6th and 7th, 1975 the Project Design Team, on its way to the Sahel, met in Paris with Ministry of Cooperation officials who are responsible for the francophone countries' plant protection research a control projects in Africa.

The U.S. has assumed the lead in initiating coordination with other donors for medium and long range plant protection projects. The Office of Sahel Relief Operations (OSRO) was given leadership for short term emergency insect control projects during 1974 when serious invasions in Sahel Countries by grasshoppers and army worms occurred. OSRO funds were provided from several nations and much of their effort has initiated levels of assistance for recipients which were finally determined in April 1975 after a series of meetings in Washington, Dakar, and Rome. The donation of supplies equipment and operating expenses has created awareness of the pest problems in the individual countries. It has also emphasised the necessity of collaborating between all donor and recipient states for Sahel Food Crop Protection.

Office of Sahel Relief Operations (OSRO)

During the later months of 1974 OSRO contributed $100,000 for pesticides to combat grasshoppers in areas of those Sahel countries which plant "river recession crops."

In 1975 OSRO has made grants totalling $4,000,000:

Pesticides	$2,580,000
Vehicles	820,000
Equipment	150,000
Operation Budget Support	200,000
Aerial Spraying	190,000
Contingency	260,000
	$4,000,000

These funds were divided between seven Sahel countries including Gambia. The vehicles, equipment and any pesticides remaining after the 1975 control campaign will be a welcome addition to the Sahel countries medium-term food crop protection campaign's. It is significant that these funds are to be used only to control insects on food crops.

In addition, the United Nations Energy Organization granted Chad $400,000 for pesticides and $1,900,000 for fertilizer solely for cotton production.

Depending upon rainfall during the 1975 Sahel Food Crop year, it is planned to disband OSRO. Each country has or is going to establish and fund a plant protection organization to reduce food crop losses from insects.

France

French activities for Crop Protection are concerned primarily with research and control on commercial crop pests. They have established and supported for many years research centers for specific commercial crops such as cotton, coffee, cocoa, and fruits. There is a network of fifteen IRAT research stations in Francophone countries of Africa serviced by ten

protection specialists. A team of four grasshopper specialists arrived in April 1975 to work for four years in Niger and Upper Volta. They will do research on survey and prediction systems for grasshoppers population forecasts. The French sometimes train country nationals to eventually man the pest control research centers, but since most work has been on commercial crop no research entomologists for food crops are available.

ORSTOM, a French group for conducting research overseas has been heavily financed for research on commercial crops.

REGIONAL PEST CONTROL ORGANIZATIONS

The French were instrumental in establishing OCLALAV in 1963 for nine Francophone states of Africa and also contributed funds for equipment, pesticides, and operational expenses since then. OICMA was founded in 1952 by Belgium, France, and the U.K. for 20 countries.

These two regional plant protection organizations implement surveillance in their areas of operation and particularly in areas not normally covered by national services. They maintain operational bases and stocks of insecticides, fuel and control equipment. They usually take control of any infestations discovered directly by them and of any others where their help is requested by the countries' national services. They attempt centralization and processing of information and from this provide a series of forecasts and information on acridial infestations, recognition of different species and an assessment of infestations both in their own area of operation and in countries with national teams. Some in-service training is provided.

OCLALAV

This regional organization has the primary responsibility for control of the desert locust and the weaver birds. OCLALAV assets total over $1.5 million. It has many operational bases and equipment throughout the Sahel

with headquarters at Dakar, and Senegal. Although it is not officially responsible for grasshoppers, it has demonstrated some ability and willingness to conduct campaigns in areas accessible to its equipment and spray aircraft against grasshoppers. OCLALAV has offered a few courses in plant protection techniques for the Sahel States. A plant protection training course was given in French at Dakar under FAO auspices in February 1975 for 25 participants from 12 countries. It has a radio network to facilitate communications in the region. With external emergency assistance, OCLALAV could only treat 20,000 hectares for grasshopper control in 1974, because they could not move ground equipment and machinery into position after the rains started in July.

This organization suffers from a chronic shortage of funds.

OCLALAV Finances to 1974
(1,000's of CFA Francs $1.00 = 210)

Country	1966 - 1974 Pledges	Amount Due
Cameroon	25,000	0
Ivory Coast	154,000	144,000
Dahomey	105,282	92,282
Upper Volta	20,000	0
Mali	280,000	243,000
Mauritania	40,000	10,000
Niger	70,000	35,000
Senegal	70,000	70,000
Chad	102,445	95,945
	866,727	690,227

The pledges for nine years amount to almost 867 million CFA ($4,127,000) of which over 690 million ($3,287,000) has not been paid! Unless member nations make their pledges good, this truly regional organization will become defunct.

Organisation International sur le Criquet Migrateur Africain (OICMA)

This regional organization has the responsibility to monitor and to mount campaigns in 20 member countries against the African migratory locust. In the Sudano-Sahelian zone it coordinates its activities with those of OCLALAV. The two organizations can use their equipment, pesticide supplies and personnel in emergency grasshopper control if they are not engaged against the locusts; however, since OICMA is also short funded the combined resources are inadequate to meet needs. The administrative headquarters for OICMA is Bamako, Mali. The principal research and control base is located at Kara, Mali, approximately 400 kilometers northeast of Bamako. A satellite base is being established at Maiduguir, Nigeria, with a secondary base at Garoua, Cameroon. They have assets of over $1,500,000 but have an annual shortage for operating costs.

Each country visited was not satisfied with the services they received from OICMA and OCLALCV and many were planning to discontinue contributions. The French, at the Paris meeting, indicated an unwillingness to further support the organizations financially because of their inability to move equipment and supplies and effectively conduct a campaign against grasshoppers and other insects besides the Desert Locust or the Weaver Birds. A study of these two organizations was made by a USDA team of experts in July, August and

September of 1974 and recommendations were made for improving this operation by more contributions for replacing worn our vehicles and equipment and developing improved techniques.

5. Food and Agriculture Organization (FAO) - West Africa Plant Protection Activities

Countries Covered	Headquarters	Particulars	Experts
OCLALAV member countries	Dakar, Senegal	Desert locust research	1 Desert locust officer
Senegal	Dakar	Horticulture development	1 Plant pathologist
Upper Volta		Cotton phyllodis	1 Entomologist
OICMA member countries	Bamako and Kara Macina, Mali	Research of African migratory locust	1 Project Manager 1 Insect ecologist 1 Plant ecologist Part-time meteorologist
OCLALAV member countries and Sudan	Dakar	Grain eating bird control	1 Project Manager 1 Animal ecologist 1 Bird control specialist
OCLALAV member countries	Nájamena, Chad	Grain eating bird control	1 Project Manager 1 Animal ecologist 1 Bird control specialist

In addition, a training course in Crop Pests and Desert Locusts jointly sponsored with OCLALAV as mentioned above was held in Dakar beginning 17 February 1975 for a period of 5 weeks. A similar course was held in 1974 in Nairobi for English-speaking countries of Africa The above-mentioned course for the French-speaking West African countries will be repeated in 1976 and 1977.

6. The West African Rice Development Association (WARDA), with headquarters in Monrovia, Liberia, has included crop protection research in its program to increase rice production in 13 West African countries.

7. Canada. CIDA has established and funded a large, food crop protection and plant quarantine program in Niger. A team is now in Upper Volta designing the same type and size project. They have been requested to establish the same type of project for protection of cereal grains in Mali. These programs are described in detail in other sections of this paper and

explain why the three countries were not recommended by the Design Team to be included in the AID Food Crop Protection Project.

8. United Kingdom, COPR of ODM has been working closely with the regional locust organizations and has other projects on birds, grasshoppers and termites in Africa such as the one at the University of Ibadan.

9. United States.

In recent years, assistance has been limited to the grasshopper outbreaks, through donations to OSRO. Some food crop production projects like the Cereals Production Project in Niger and the Seed Project in the Cameroon have included crop protection activities by developing resistant varieties, farmer packages for increasing production that includes integrated pest management, and training extension personnel in insect central techniques The U.S. has been supporting for several years the WARDA project for increasing rice production in West Africa. Research for integrated pest management systems is an integral part of the project and results are available to many African nations.

Several research stations which the U.S. has been strongly supporting; such as those in East Africa, Nigeria and other locations, have been developing better strains of Sorghum, millet, and maize which include resistance to insect and disease attacks.

We are assisting these regional research projects to coordinate activities by building an inter-linking network for systematic planning and distribution of research results to benefit farmers.

PART III PROJECT ANALYSIS

A. Economic Analysis

The most reliable and detailed statistics on harvest losses are those published in the U.S. These reports have become more comprehensive as a result of broader and more accurate surveys being conducted. The data is collected by survey and detection stations strategically located throughout the U.S., which regularly inspect a certain number of farms chosen because of their representative cross-section (e.g. a set of farms representing both similar and dissimilar growing conditions). This method of collection, in association with regular loss analysis, has produced estimated values which closely approach the real values. As might be expected, comparable data from the participating countries does not exist for aggregate agriculture production - and especially for cereal food production. Other elements of an exercise of this nature would normally include: (a) crop losses following the appearance of new plant diseases and pests, or insects; (b) results of experimental tests; (c) analysis of all-risk crop insurance schemes; and (d) indirect crop losses. These are in addition to the central focus of this analysis, which is direct food crop losses. As alluded to earlier, the wide range of variations in statistical estimates for aggregate agricultural output; yields; cultivated area; and market prices in the participating countries is well documented in existing literature. However, it is assumed that the data base used in this analysis is representative

of actual conditions, and as such, sufficient for intended purposes (keeping in mind that the analysis as presented in this paper is illustrative) designed to indicate attainable conditions in conjunction with certain protection activities - rather than as a matter of fact.

1. Macro economic - effects of pest, disease, and weed infestations on the field production of selected food crops.

The influence of plant diseases, insetts, pests, and weeds on agriculture production has been recorded in the very earliest historical documents preserved and handed down through the centuries. In many cases (see Curshman, bibliography) locust invasions have proven to be the cause of famines. A case in point is reported to have occurred during the year 873 when huge swarms of locusts appeared in Germany, France, and Italy; spreading as far as Spain. The outbreak of famine was confined to localized regions in Germany as the locusts appeared just prior to harvest. When they arrived in other regions, the farmers there had already gathered the harvest. Similar experiences were reported to the design team during the field study for this project.

The present day recurrent shortages of food in the Sahel countries of Africa are due in part to the heavy food crop losses caused not only by pest and insects, but plant diseases and, especially weeds. Apart from catastrophic infestations such as has occurred in parts of the Sahel during the past crop year, loss estimates to our knowledge have not been made in these countries for different crops, different areas, on different causal factors. In this analysis, the available data will to the extent possible be summarized and evaluated without regards to weight of very considerable uncertainty factors (figures published by the USDA for crop losses in the U.S. are always accompanied by a reference to possible sources of error). In any event it is certain that the losses are of considerable quantity. and involve huge sums of money. The losses to selected crops in the U.S., as summarized in USDA Agriculture handbook 291, "Losses in Agriculture", are as follows:

	Diseases %	Nematodes %	Insects %	Weeds %
Corn	12	3	12	10
Grain Sorghum	9	-	9	13
Rice	7	-	4	17
Wheat	14	-	6	12
Soybeans	14	2	8	17

When one considers that the loss to potential yield in the U.S. even with generally effective protective measures, exceeds in many cases 30% or more, the validity of the loss estimates compiled for the participating countries becomes more apparent. In collecting information for this project, the design team focused on four principal crops; millet, sorghum, maize, and rice. These crops, especially millet and sorghum and to some extent maize, are the major cereals grown by the small farmers in the participating countries for domestic consumption. Damage estimates due to pests, diseases, and weeds were compiled for each of the major crops in all four countries. Loss estimates for all causal factors; pests, disease, and weeds are as summarized below in percentages for 1974: and in Table III, Part IV, and in Annexes.

	Cameroon Range (%)		Chad Range (%)		Mauritania Range (%)		Senegal Range (%)	
Millet & Sorghum	27	57	29	60	27	55	27	55
Maize	33	69	33	69	33	69	33	69
Rice	20	42	20	42	20	42	20	42

A brief note of the above table shows that losses range from 1/5 to 1/3 of recorded production when using low estimates. High estimates indicate losses in the area of 2/5 to 3/5 of actual production. Given the present lack of protective measures in the production of food crops, and considering the losses experienced by U.S. farmers, the high estimates for the participating countries are likely to be an under-estimation of real damages. Given the above, coupled with the fact that stored, or post harvest losses were not included, the estimates of high losses are extremely conservative.

a. Millet and Sorghum - millet and sorghum of numerous species and varieties are extensively grown in the relatively arid regions of the participating countries (See table V); and is a traditional staple for a major portion of each country's populace, especially those small farmers who fall within the category of rural poor. The farming practices of the farmers are generally very simple. In areas where rain-fall can be expected during certain periods of the year, cultivation is relatively more intense, with subsequent higher yields than in areas where rain-fall is rare, but where flood - recession cultivation is primarily employed on or adjacent to river banks.[1/] The average (pre-drought) yields for millet/sorghum in the participating countries are as follows:[2/]

[1/] except in Mauritania, where yields under flood recession cultivation exceed yields from rain-fed cultivation because of the sporadic and irregular occurance of rain-fall.

[2/] Data compiled from Sahel Mid-term Program Project Paper for Senegal, and from the 1975 DAP Report for Cameroon, Chad, and Mauritania.

Country	Crop	Recorded Yield (kg/ha)	Potential Yield (kg/ha)	Loss Differential (kg/ha)
Cameroon	Millet/Sorghum	650	1,007	357
Chad	Millet/Sorghum	475	760	285
Mauritania	Millet/Sorghum	350	542	192
Senegal	Millet/Sorghum	500	775	275

The loss differential, defined as the quantity realizable if losses had not occurred, could be dramatically reduced through the introduction of effective protective measures, dependent upon the number of hectares cultivated and the size of the family unit. A 50% reduction in damages would have negated the need for external grain donations and imports of food grains to meet domestic production gaps in Chad and the Cameroons, and would have reduced Senegal needs by some 1/4. In Mauritania, the ratio of population to cultivatable land (given yield factors), would not mathematically allow such spectucular results.

	External Donor Grain Needs (1974 - 1975)	Cereal Imports	Base Year
Cameroon	1/	159,000 MT	1972
Chad	25,000 MT	2/ 11,000 MT	1973
Mauritania	75,000 MT	91,000 MT	1973
Senegal	40,000 MT	338,000 MT	1973

1/ not available

2/ incomplete

SOURCE: CWR Drought Desk and Table IV, Statistical Annex

Between July 1974 and July 1975, external grain donations to all Sahel countries totaled some 332,000 MT.

b. Maize and Rice: These two cereals, while not as extensively grown in the Sahel as is millet and sorghum, are the next most important grains produced domestically in the participating countries In Senegal and Mauritania, and to a lesser extent in Chad and the Cameroons, rice is very important as a staple. Except for the Cameroons, Rice imports exceed in quantity all other cereal imports (see table IV). The losses and potential for rice and maize in the four countries are as indicated below:

	Production		Losses		Potential Production	
	Rice	Maize	Rice	Maize	Rice	Maize
	(000 MT)		(000 MT)		(000 MT)	
Cameroon	-	350	-	241	-	591
Chad	30	-	13	-	43	-
Mauritania	-	-	-	-	-	-
Senegal	50	20	21	14	71	34

SOURCE: Table VI, Statistical Annex

c. Causal Factors: In all countries, and for all crops surveyed except for rice, weed caused losses matched or exceeded losses caused by pests or diseases (see table III). Some 45% of total losses for all crops was directly attributed to weeds, with maize, millet and sorghum most affected. The second most important cause of losses to all crops were pests which caused approximately 36% of estimated losses, the effects distributed equally among all crops, except in Chad where millet and sorghum were more severely affected by pest damage than were other cereal

crops. Disease caused losses were less severe than all other causes, being responsible for some 19% of total damage. Disease affected the yield of maize more than any other cereal, followed by millet, sorghum, and rice.

2. Micro economic - Economics of Pesticide Use

a. Economics of pesticide use and optimum dosage

The extent to which pesticides, herbicides, fungicides, or insecticides will be used by farmers depend largely on the margin of profit they will obtain from its use. The economic optimum treatment is that which gives the largest net profit in the prevailing cost-price situation. The optimum application is not the one which maximizes the yield, but will usually be smaller than the treatment which gives maximum yield. The factors which determine optimum treatment and economics of pesticide use are:

1. Expected increase in production from each increment of pesticide applied.
2. Cost per unit of pesticide and cost of application.
3. Price per unit of output.
4. Additional cost, if any, involved in marketing, etc.

Data on Item 1 is best obtained from application experiments in cultivators fields to test different levels of treatment. By fitting a suitable response curve to the yield data obtained at different levels of pesticide application, the responses coresponding to different rates of pesticide application can be estimated. From the response curves thus fitted the optimum dosage can be determined for a given set of costs and prices. For example, if we find that response to optimum dressing

in a particular agro-climatic region is as illustrated below:

OPTIMUM PESTICIDE TREATMENT AND THE ECONOMICS OF PESTICIDE USE, MILLET AND SORGHUM CROPS

Region/ Country	Optimum Treatment	Response to Optimum Treatment	Net Profit	Profit on Investment
1/ Cameroon	20 kg/ha BHC	357 kg/ha	4,147 CFA	124%
2/ Chad	20 kg/ha BHC	285 kg/ha	3,775 CFA	113%
3/ Senegal	20 kg/ha BHC	275 kg/ha	4,950 CFA	150%

Note: Price of 1 kg of millet or sorghum - 1/ 21 CFA, 2/ 25 CFA, 3/ 30 CFA cost of 1 kg of BHC - 1/ 152 CFA, 3/ 150 CFA.

Optimum treatment (all crops) dependent upon type, strength and toxicity of chemical; soil ecology; level and type of weed, pest or insect species infestation, and nature of disease.

The example used above assumes 100 percent control of causal factors.

If in fact trials indicate a 50 percent effectiveness in control then the optimum treatment and response would be as follows:

Region/ Country	Optimum Treatment	Response to Optimum Treatment	Net Profit	Profit on Investment
Cameroon	20 kg/ha BHC	179 kg/ha	409 CFA	12%
Chad	20 kg/ha BHC	143 kg/ha	225 CFA	7%
Senegal	20 kg/ha BHC	138 kg/ha	840 CFA	25%

In calculating the margin of profit above, only the cost of pesticide sprayer, duster and the price of output have been taken into account. The optimum treatment is assumed as given. The margin of profit will be further reduced if account is taken of labor costs, other cost of pesticide application, and additional harvesting and marketing costs. Incremental and total costs of labor and application will differ with the method of pesticide application, the area treated, and the potential yield. It is further

assumed that the response in yield is due to pesticide treatment, and not attributal to other factors, such as improvement of soil cultivation, fertilization, seed varieties, etc. These factors, should be allowed for in evaluating mean responses from experiments, and should be allowed for in calculating the net profit to the farmer. It is generally difficult however, to make precise estimates of such uncertainties. The overall effect of these various factors is to reduce both the optimum dressing and the net profit attributable to pesticide application.

b. Response in yield to pesticide treatments.

Experiments on the responses corresponding to different levels of treatment in the selected countries have not been conducted for food crops. It is necessary that the project manager's work plan include farmer field method and result demonstrations to determine response curves with different levels of dressing, for selected food crops, in different agro-climatic zones, using different pesticides, and with different methods of application. Once this basic data is collected and processed, a more precise cost of benefit ratio and optimum treatment estimate can be obtained for different regions and crops in each country. An indication of possible results can be demonstrated however by a comparison of yield increases obtained in other developing countries around the world where conditions are of a similar nature.

In Ceylon, Grist[1/] reported that chemical weed control increased rice yields by 19%. Angladette compared the yields obtained by different methods and found that a wooden harrow produced yields 36% above those obtained by "incomplete control." In Madagascar, experiments using

1/ All references are listed in Bibliography.

different pesticides to control the stem borer produced additional yields ranging from 6 to 91%. Other experiments in Madagascar showed that careful weeding by hand increased yield some 122%. In fields sown by broadcasting, herbicide applications gave a yield increase of 95%, and weeding and hoeing resulted in yield increases of 63% and 48%, respectively. The chief weed of sorghum/millet is Striga. In Sudan, tests showed that chemical controls increased yields by 50%, and in Kenya, treated seed gave a 71% increase in clean grain yield over untreated seed. In Dahomey, rust-resistant varieties of corn and increased yields by 30% to 50%, Leconte (1959). Tests of herbicide applications in Rhodesia increased yields from 900 kg/ha to 3810 kg/ha.

There is no room for any reasonable doubt that hybrid seed, fertilizers, weed control, and insect control have made more or less simultaneous contributions, and there is no reason why anyone should try to claim all or even a major part of the credit. In fact, there is an abundance of evidence that they may be mutually interdependent in a sort of symbiotic relationship. Without the support of pest control, the use of fertilizer may be futile, and conversely, without the use of hybrid seed and fertilizer, the yields may be so low as not to outrun the cost of insect, disease, and weed control. We know from data obtained on experimental plots that insect control has been a significant factor, but unfortunately, we have not developed data constantly or in sufficient volume to permit valid statistical evaluation of our contribution.

On the basis of voluminous data, however, one may question the validity or the assumption that all of the values attributed to weather can be properly credited to meteorological conditions alone. Temperature, humidity, and rainfall affect insects, as well as plant development, and the populations of many of our most destructive insect pests rise and fall with changing meteorological conditions. Anyone familiar with agriculture in the Midwest is aware of the disastrous chinch bug outbreak that accompanied the drought in 1933-34 the great grasshopper plague of the drought year 1936, and the combined attack by these two pests in 1947, but perhaps only a practical field entomologist would be aware of the unusual insect problems of so-called lesser or minor drought years, e.g., chinch bugs and corn borers in 1944 and 1945, and the lesser but combined outbreaks of grasshoppers, armyworms, chinch bugs, and corn borers in 1953, '54, and '55. While it may be difficult or even impossible actually to isolate and evaluate the portions of reduced yield due to each factor, it seems incomplete to credit it all to weather, as if the insects did not exist. This is particularly true when many etomologists, hundreds of country farm advisers, and thousands of farmers are aware that fields or parts of fields protected from the insects produced fair crops, while adjacent unprotected planting produced little or nothing. In any event, a minimum reduction in current losses must be realized in order to meet the expense of protection inputs. Given the present costs, our calculations indicate the requirements be

as follows for Millet and Sorghum:

	Minimum Reduction in Current Losses	Resulting Increase in Yields
Cameroon	41%	146 Kg/ha
Chad	43%	126 Kg/ha
Senegal	36%	99 Kg/ha

B. Technical Analysis: Entomology

(1) Insect Pest Problems and Potential for Pest Management

Most major insect species have been identified in the Sahel countries However, there are in some areas affecting food crops; complexes of insects that are completely understood. As new crops are introduced and large areas brought under cultivation, careful studies to determine the damage potential of insects are essential. Virtually all agricultural crops are faced with a complex of serious pest problems and losses on crops are generally high, and as mentioned later below usually beyond tolerable levels.

There are several factors which favor development of food crop pest management in the Sahel. With the possible exceptions of cash crops such as cocoa, peanuts, cotton, and coffee, the relatively small amounts of insecticide used have not resulted in massive upsets of beneficial fauna as is the case in so many areas of the world. Also, in most areas the farms are small, diversified and somewhat isolated; factors which do not lead to ecosystem instability. To date, consumers are not so sophisticated as to demand produce free of insect damage or presence. An adequate food supply at low cost is more important than produce appearance thus

putting a reduced demand for insecticide use. Likewise the subsistence farmer cannot afford fertilizers and insecticides despite his need. This places a premium upon non-chemical methods of pest management -- e.g. crop rotation, host-free periods, host plant resistance, crop residue destruction, early and late planting or maturing varieties.

There is some attention being given to integrated pest management, but with the exception of a few people, mostly in international centers, e.g. IITA and cocoa research institutes, little is done.

There is great need for research on non-chemical methods of pest control. Modifying time of planting for example, is promising for control of sorghum midge and several other pests; stalk destruction to reduce carryover of the stem borer species so damaging and commom to millet, sorghum, maize and other crops is important. There are host-plant resistance studies at IITA in Ibadan, Nigeria (AID Major Cereals Project) and in Zaire plus in a few other places. In general, however, new varieties being developed, e.g. by IRAT, have no entomologist checking them on a continuing basis for increased (or decreased) susceptibility to pest like stem borers and shoot-flies.

(2) Losses to Insects and Other Arthropods

Very few cases of losses caused by insects have been quantified, but it is apparent, that in many years losses are beyond tolerable levels on most crops in virtually all areas visited. Losses may be total in cases of mass invasion of migratory locusts, mainly the African migratory locust and desert locust, and only constant monitoring and application of prompt-control measures by various organizations prevent occasional widespread devastation from occurring. Complexes of termites are noted as pests of many crops, the amount of damage being largely unknown. Perhaps

equally or even more serious is the destruction of soil organic matter. An unidentified "spike" or earworm has caused significant losses in millet production throughout the Sahel for the last five years.

Stored product insects are extremely serious in all areas visited. In some dry areas losses in storage at the farm level under traditional small storage conditions are considered acceptable; losses are greater in more humid areas. In commercial storage losses are consistently high. It should be noted that cereals stored for consumption in the off-production season may be heavily infested but because of the general food shortages there is no differential in price between infested and non-infested stock. Thus there is inadequate incentive to maintain clean stored products.

(3) Insecticide Use and Problems

Clearly crop production could be substantially increased if insecticides were applied properly. In all countries little is used with exception of some seed dressing, some on stored products and some subsidized use on cash crops. Farmers producing at the subsistence level simply cannot afford insecticides, fertilizers, etc. at the present time (or in the foreseeable future). Many do not deal in money to any extent, but only barter and trade the commodity for their necessities.

Because little insecticide is used, pesticide resistance is not a serious problem at the presentation. It is suspected in a few cases but not confirmed in any reasonable way. There is no monitoring of population levels of insects at the farmer level in determination of need for pesticide application. Only in very few cases on major cash crops are approximate

economic thresholds of pest populations necessitating treatment established.

The organochloride insecticides are normally the chemicals of choice where insecticides are applied. Heavy reliance is placed upon BHC. There is no discernible effect on the environment from use of this compound, presumably due to relatively small total amounts applied and its low toxicity and short residual effect. Stem borers are a serious problem throughout Africa and DDT is the insecticide of choice. The general feeling throughout countries visited is that there is a need for compounds such as the organochlorines because of their relatively long residual on the crop, their comparative safety in handling, and because they are less expensive. A few locations, like IITA, are working with shorter-lived organophosphorous and carbamate insecticides; in fact, their use is suggested in quite a number of areas.

In very few cases have pest problems changed radically or have pest complexes been altered from widespread and repeated applications of insecticides. In Senegal, the experiment station thought it had insect and disease problems under reasonable control but increased irrigation and better agronomic practices have forced them to resume plant protection research. We suspect this applied mainly to experiment station plantings, however.

Some research on biological control has been done in Africa by the French and British, but certainly more is needed, although it continues at a low level. The French, for example, plan to import stem borer parasites. Other importations of exotic biological control species have been made but a great deal more basic research is needed to identify

what is present and what might be useful to import. It is our feeling that this is particularly important on the basic food crops as much more attention has been given to the important cash crops. The French said they were going to increase input here, however. For example, they said that in Senegal there is fairly effective biological control on millet midge if planted at the proper time but that there were no indigenous parasites of sorghum midge.

(4) General Insect Pests.

There are many insect pests which are common to the Sahel countries. Stem borers, for example, are serious pests throughout, but as species vary somewhat on host plants attacked, they should be considered in the discussion of individual countries. There are over insec pest complexes, however, which can be discussed best in this general section.

(a) Migratory locusts. The ages-old problem of massed swarms of migratory locusts leaving devastation throughout their flight pattern from remote breeding sites is well recognized. This is an international problem as the swarms cross country boundaries in flights often of many hundreds of miles. The two predominant species involved are the historically notorious desert locusts, *Schistocerca gregaria*, and the African migratory locust, *Locusta migratoria*.

(b) Grasshoppers. Numerous grasshopper species occur in large populations throughout African areas. The variegated locust, *Zonocerus variegatus*, was particularly evident in western Africa. Abundant evidence of feeding on many types of

vegetation not usually preferred occurred in 1974. Feeding is common on foliage and fruit but is noted as being particularly damaging to seedling crops with plant death common. Little is known apparently regarding population abundance and economic damage.

Plant Pathology

Losses from plant diseases is heavy in all countries. Programs for controlling these diseases varied greatly among the countries. Their efforts are mainly devoted to research on the cash crops and to teaching. Thus while some countries have made a start in training local personnel in plant pathology, the priorities for their services seem to have been placed on cash crops and teaching, with little effort being devoted to controlling diseases on food crops.

One disquieting note is the reluctance detected in some countries to share information on pest control of crops with other countries that may be their competitors in the market. A freer flow of information among countries would result in more efficient utilization of limited resources by reducing duplication of efforts and by more effective planning of experiments based on information obtained in more than one country

In some of the countries there is great interest in expanding vegetable, fruits and floral crops for export, primarily to the European market. Diseases are particularly abundant on these crops and may be expected to flourish when acreages of these crops are planted. Successful production of these crops will necessitate a sound program of disease control.

Nematology

African countries have serious nematode problems that need attention as part of an overall pest management program. For the most part, there is less knowledge concerning the role of nematodes in crop production than that which is available for insects and plant diseases. Plant-pathogenic nematodes are by nature debilitating organisms, rarely killing plants outright. Because of their subtle nature, they often go unrecognized, or the damage they cause is attributed to other causes. Specific nematode problems have not been identified or correlated with crop losses and consequently little attention is being given to this group of organisms. The group at Dakar, working at the ORSTOM laboratory, are doing an excellent job but they can only do so much. The nematologist in Ghana has been on the job for several months and his facilities and other resources for work are very meager but improving. The International Institute of Tropical Agriculture at Ibadan has a very competent nematologist and the program there holds considerable promise. At the Universities in Nigeria the nematologists are getting programs underway and need additional resources for effective work.

In general the needs are great in most countries for additional scientists trained in nematology. Even a recognition of the problems is dependent upon a person trained for survey and diagnostic work. Once this is done, then information on control already available from other parts of the world can be put to use. Such information includes the use of clean planting stock, resistant varieties and crop rotation schemes where applicable. Furthermore, trained scientists are urgently needed to initiate long and short term research projects designed to gain in-

formation on local problems essential to development of effective control measures.

Weed Science

Agriculture in the countries visited is primarily subsistence with few monetary inputs or improved methods and with little capital return. Weeds are one of the major deterrent factors in expanding agricultural production. Any program such as weed control or increasing fertility levels must be integrated into a total system. At present there is abundant rural labor to handle most weed problems in a subsistence agriculture economy, given the labor shortages during planting and harvesting. However, this picture could change or be changed

by increasing the number of hectares each farmer is to handle. Controlling weeds by hand limits the number of hectares he can till; and if this number is to be increased from the current 1-3 hectares to even 5-10 hectares, improved weed control practices are necessary. Cultural practices such as cultivation using animal power is one of the first steps. The use of chemicals (Herbicides) for weed control can perhaps be considered in the early critical stages (up to 1 month after emergence of the crop) to allow a farmer to till or seed a larger area.

In plantation areas (coffee, cocoa, and cotton) extensive use of herbicides is being made with good success. Here there is capital input as well as capital return that will allow for improved methods. As more industry and urbanization develops and the need for increased agricultural production by fewer people becomes necessary, weed control programs will become more important in food and feed crops. However, large scale mechanized programs and the widespread use of herbicides for weed control does not seem feasible with no industry to use the labor if it is removed from agriculture. Current agricultural programs must be set up to use labor under the existing conditions in these areas.

In certain areas if the current production practices of mixed cropping is changed and more mechanical clearing is done, the damage produced by soil erosion in open land will necessitate the use of herbicides which do not disturb the soil.

The two major weed problems observed in the countries visited were nutsedge, Cyperus esculentus and Cyperus rotundus, and witchweed, Striga hermontheca, and other species. There are many broadleaved species that infest the cropped area, however, these are controlled by hand. Hand

labor while reducing the population and perhaps reducing competition has not been successful in effectively controlling nutsedge or Striga.

More complete surveys of the weed problem in most areas and cropping patterns are necessary with a consideration of species that are predominant problems in each ecological zone or cropping system and the competitive nature of the populations. It would be most important to know the level of population of nutsedge and Striga that will actually produce yield reductions. The information that is available on weed competition from other parts of the world may not be applicable in the tropical areas because of differences in weed species and growing conditions. It is important in the development of a weed control program to establish the level of population that will be economically competitive.

It is felt that the first consideration for the control of Striga in millet, sorghum, and cowpeas in the areas of subsistence agriculture should be host plant tolerance. Again it is necessary to establish what levels of infestation are competitive. The use of trap crops in rotational systems should also be considered. However, in many areas which are semi-arid and where millet and sorghum are the major crops, there is at present little opportunity to make minor changes in cropping patterns to combat Striga.

Studies on the ecological shifts in weed populations as cropping systems or rotations change or in current continuous mixed cropping programs are needed to establish what future problems and control programs will entail. If herbicides are brought into these programs there will be shifts in weed populations similar to what has happened

in other areas using herbicides continuously for several years. While ecological shifts have not occurred widely under current production practices some are apparent. The shift a year or so after the slash and burn procedure from primarily a broadleaf infestation to a grass problem primarily guinea-fowl or itch grass, Rottoboellia exaltata, is evident.

The use of herbicides in Africa is very limited. As indicated earlier, use is primarily limited to plantation type crops. Residues of herbicides on crops, in soil and water are not a problem. Research to provide information for the future would be valuable for that time that extensive shifts in cropping systems involved extensive use of herbicides.

There is no work on the integrated systems from the standpoint of the problem of weeds serving as a host for other pests. It is felt that pest management must be a package program tied closely to total production systems.

Research on weed control at experiment stations is quite limited. However, at present it is more important that the production type agronomists or crop specialists be concerned with weed problems as it involves a complete cropping pattern. There are programs at the experiment stations (IRAT, IITA) where herbicides are being evaluated. It is felt that presently it is more important to find a place for proven chemicals in current and changing cropping systems than to evaluate new chemicals.

Bird Depredation

Toward the Savannah part of central Africa, bird depredation

represents the most serious plant protection problem. This includes an area of apprximately 20% of Africa and the seriousness of the problem is intensified by the drought and general lack of available food. The main problem is associated with Quelea; however as new crops are introduced and developed, other birds are becoming of increasing importance. At present the most serious economic loss is that of millet and sorghum. Estimates of annual devastation range from complete losses in certain valleys of Senegal to millions of dollars of losses in Sudan. It is generally agreed that it will be impossible to implement many of the programs associated with the "green revolution" until bird depredation can be brought under control.

Summary

In attaining the objective of reducing pre and post-harvest crop damages due to the causal factors described above, major technical constaints were considered in designing the project. The first major constraint is of an economic nature. Given the producer price of food crops, the technology of new inputs must result in a reduction in the unit cost of food crop output. The second major constraint in attaining project objectives is the ability of project components to influence the cultivation practices of the target group.

Recognizing these two major constraints, a package of integrated management practices has been proposed which primarily represent rather minor adaptation of existing practices. Due to the simplicity of the package, dramatic increases will not occur immediately (except in cases where chemical treatment is involved). The value of its use is to make

demonstrable incremental changes which create a willingness among farmers to further adopt other technological practices. As research produces new technological innovations, a favorable cultural environment will be available with identifiable channels of distribution. A major responsibility of the project manager will be to collect and identify new technology applicable to host country conditions. The primary package of practices include the following elements:

1. Cultural controls - encouraging the manipulation of planting dates; plant spacing; residue destruction; interplanting; crop rotation; prompt and thorough weeding; trap crops; etc.

2. Host Plant Resistance - encourage the use of pest and disease resistant seed varieties, ensuring that the resistance factor for one pest on disease will not be predisposed to attack by another.

3. Biological Controls - when and where applicable, introduce the use of new pathogens, and the utilization of indigenous pathogens; introduction of supplemental food or alternate host; use of natural enimies.

4. Selective use of pesticides - treatment of crop seeds with fungicides and insecticides to increase resistance to disease and pest; storage and protection of food grains; use of selective pesticides as a complement to other control measures; or in lieu of other methods when deemed necessary by spatial, temporal, environmental, economic, or other considerations.

This package of practices has been kept simple by design and will emphasize the use of non-chemical controls where feasible. The underlying principle of integrated pest management is known as the "dirty

field" concept. In other words, pest populations can be tolerated and should be allowed at levels, that have no significant effect on crop yield. The mere presence of an insect pest is not a threat of economic damage. If a pest is completely eliminated, many of the regulating factors (i.e., predators and natural enemies) of the eco-system will also disappear. If the pest reinvades the eco-system in the absence of these critical regulating components, as it is almost certain to do, the pest management system could no longer function as a self-generating process. Integrated pest management is thus defined as the utilization of all suitable techniques to reduce or maintain pest populations at or below levels which would cause injury of economic importance to agriculture.

As stated earlier, the first major constraint is of an economic nature. This is a subject about which it is very difficult to make definitive statements: it is easy to determine what is spent during a given period on chemical commodities, but it is not easy to determine the precise returns we accrue from this expense. This is because there are few, if any, satisfactory statistics on the value of the crop saved by pest control practices. The damage that occurs in spite of these expenses is fairly easily determined, but to determine what loss would have been inflicted if no chemical controls had been used is almost impossible except in experimental tests.

The first and most important basic element in integrated control systems is the principle of economic thresholds. An economic threshold in this context is the level at which damage can no longer be tolerated and, hence, the level at or before which it is desirable to initiate

deliberate protection activities. The determination of these thresholds is prerequisite to the development of any system of pest management for two main reasons: first, one must know the level of pest populations below which damage is tolerable, and thus define the ultimate objective of the control system; and, second, one must know the level above which new emergency elements of the integrated program must be applied or invoked to avert significant injury and an outbreak of the pest organism.

To obtain this information, a clear picture of the complex economics associated with the production of the crop of interest is vital. First, one must know the general economic picture and then determine what might be called the economic degrees of freedom. In other words, we must determine the margin of profit on which the farmer is operating so that the amount he can afford to lose to the depredations of pests can be assessed. Second, and against this background, one must determine how much can be afforded for protection against this level of loss. For example, if a grower can afford to lose X hundreds of dollars per acre to pests and still turn a reasonable profit, he can afford up to, but not exceeding X hundreds of dollars for protection of his crop. If he can be protected for less than this amount, the difference will be added to his profit. This knowledge defines the problems of scientists and sets the limits on the cost and value of the management systems we can develop.

It is difficult to determine these economic thresholds and levels of tolerance because of the great number of factors involved and because many of the factors are economic and not readily available to or assessable by animal and plant scientists. And, it is axiomatic that the threshold levels will change constantly with changing economic and

environmental conditions; they themselves are dynamic, and this adds weight to the arguments in favor of multifaceted flexible control systems.

There have been few analyses of the economics of crop production relative to pest problems, and principles rarely have been developed and limits clearly defined. Consequently, it is not unusual for more to be spent to control a pest than the value of the commodity the pest could destroy, or, even worse, for a helpful insect to be destroyed at considerable cost. Moreover, as mentioned earlier, the application of a pesticide to destroy a major pest may well upset balances to such an extent that new minor pests are created, which in turn require still more money to control. This sort of synergism strains the boundaries of even the most liberal margin of profit, and yet can only be clearly exposed by a detailed analysis of the economics of crop production in relation to pest control.

On the basis of the available fragmentary evidence, it may be concluded that economic-threshold levels are almost invariably higher than expected. Too frequently, the visual threshold, the population level at which individuals of the pest species are obvious, is synonymous with the action threshold, and both equated with the economic threshold. The action threshold is the level of pest population at which action must be taken to prevent the population from rising to the economic threshold where significant damage occurs. Ideally, it would be desirable to have control systems that are so effective and self-perpetuating that the necessity for action is avoided. Most systems, however, will probably require periodic action, and hence the determination of the action and economic threshold becomes of supreme importance.

Studies of the economics of crop production in relation to pest control lead to determining against a known economic background the damage levels that can be tolerated with each crop of interest. This total loss is assignable to the entire complex of pests attacking the crop, and one must take another step to determine the real and potential damage limits assignable to each major pest within the entire complex. These assignments depend not only on the economic framework of production, but also on certain biological attributes of the pests themselves. These are the attributes that determine whether the pest is a direct or indirect one, and whether it has the ability to increase rapidly.

It is difficult to determine the level of economic injury. Often this is assumed to be the level at which significant numbers of pests are destroying important quantities of produce, but in most cases this is a subjective determination. It has proved remarkably difficult to document the harmful effects of even quite notorious pests, and our very natural assumption, that if a pest destroys a fruit or feeds on a tree it is causing economic injury, is not always supported by the facts.

It is even more difficult to determine the economic thresholds of most pests on most crops. This requires the prediction, which is usually beyond our competence at present, of the probable consequences of continued increases in populations if controls are not applied. The gathering of data to permit prediction is one of our most pressing research needs.

The assignment of individual damage levels and potentials to each pest attacking a given crop leads to the final step in considering the array of pests that confronts us. This is to rank the common species in their order of importance. This may be only to single out the most important for

intensive research, especially if all we can hope for is the development of an integrated control system in its most narrow sense - that pertaining to a single species. If one intends, however, to attempt to design a system against all major pests in an ecosystem, ranking pests is more important; on it depends the establishment of priorities for research, and also it is by this means that the dependency of the status of one pest on that of others can be revealed.

Once the economic status of the pests occurring in an ecosystem has been determined, studies on their ecology must be developed. These have two purposes: prediction and manipulation. The main value of being able to predict future trends in the population levels of pests is that it enables one to apply control measures to prevent rises above the economic-injury level. Most pest management programs will be complex interwoven systems with a number of major components. Pest populations will certainly not be eliminated in these programs, but rather will fluctuate at low levels generally acceptable to us. From time to time, these fluctuations will approach the economic-injury level. If we panic and apply vigorous extra measures, we may permanently disrupt the system. Therefore, we must be able to predict with confidence the future population trends so that we will add new components to the system only when required to dampen potential outbreaks; and we must select components in this regard that have a minimal disruptive influence on the system as a whole. When danger is past, these components should be dropped from the system until again required. This kind of prediction is particularly important after a satisfactory system has been developed - in the operational phase of the study.

Manipulation is also basic to the establishment of such systems. One must be able to determine the factors in a crop ecosystem that affect pest

numbers, or that have the potential to do so, select those with the greatest usability, and so manipulate the ecosystem as a whole that their regulative effect will be maximized. When this has been done, when the most value is being obtained from natural factors of the ecosystem, one may find that the pest populations of interest are reduced to tolerable levels without further action on our part. If not, one can then think in terms of adding new components to the ecosystem that will complement those already present to produce the levels of pest abundance that one requires. In the rational and organized development of integrated control programs, this step-wise progression in research from determining important environmental factors through manipulation to maximize their effectiveness to the addition of supplemental components is essential. The second major constraint has been identified as the ability of project components to influence the cultivation practices of the target group. Although the specific actions necessary to enhance this process must be decided on a country basis (and within country on a regional or area basis), certain general criteria can be outlined for all countries as a unit even though present extension services and crop protection activities vary in form, intensity, and magnitude from country to country. Our primary effort will be directed through the existing extension services system by providing middle and lower level training in crop protection activities. Middle level training for personnel assigned to regional level (arrondissement) positions in the crop protection units and/or extension services will be available at planned regional training centers in Senegal and Cameroons, or/and at the USDA six month plant protection course in the U.S.A. In Senegal, the existing facilities of the National School of Rural officials at Bambey will be available for both

middle and lower level training. Funds are included in this project for the creation of 3 to 6 month courses in plant protection for both levels. The Director of Agricultural Services, United Republic of Cameroon, has agreed in principle to the creation of similar regional training facilities in Yaounde, and theuse of facilities at the University of Cameroon, Yaounde. This center would train participants from Chad and the Cameroons in middle and lower level crop protection practices. Funds for this center are also included in the project. At both training centers, 3 to 6 month programs of short courses, including conduct of surveys and field demonstrations, operation of equipment, chemistry of pesticides, toxological effects, and safety and environmental control methods will be developed. The largest training component is designed for lower level field staff, both male and female. Since in all countries, most food crop production is the responsibility of females, the inclusion of female particpants will be actively sought. The lower level training of field agents is considered to be of utmost importance as these personnel provide the direct link to farm cultivators. Village level staff are usually part-time and receive compensation only during certain periods during the crop year when their labor and services are required. Their training will be conducted through on-farm demonstrations and for a selected group, at regional training facilities in the Cameroons and Senegal. The type and duration of demonstrations and training for country specific problems will be developed by the country technician in collaboration with the regional project manager and host government officials. The services of a USDA Consultant for design of curriculum for all levels and types of plant protection activities is available under the PASA agreement. Generally, however, the type of training

furnished will depend upon the level at which the field agent will be working and the amount and kind of training previously received. Some higher level training will be essentially acade for Master's or Bachelor's (and in some cases Doctoral) degrees in U.S. or at equivalent third country training institutions. Areas of study will depend upon the staffing requirements of the crop protection units in each participating country. In Senegal for example, the organizational plans call for five divisions in the crop protection unit. Officials assigned to head these divisions would receive training appropriate to the function of their divisions. In any event, the existing field services and agricultural policies of the participating countries will form the parameters within which the training output will be implemented. Efforts of the extension system in crop protection activities will be directed toward those farmers cultivating food crops, notwithstanding other crop cultivation or geographic area.

C. Social Analysis:

Any program to be effective in a development country should be adapted to the culture of the target group. The target group in this project being rural small farmers engaged in the cultivation of food crops, especially millet, sorghum, maize, and other cereals, but not excluding vegetables and other food crops grown for domestic or on-farm consumption. Programs designed without regard for the farm culture and mentality will likely be regarded as foreign and not as readily received.

(1) Socio-Cultural Feasibility: The target group in all countries produce primarily for on-farm consumption, with any surplus available for sale within a very limited marketing area. The profit aspect is secondary at best, and the availability of food crops for market is dependent upon

the positive (or negative) difference between planned and actual output. Under normal conditions excess to on-farm needs are at best marginal as traditional land, labor, and technological constraints and patterns have not been capable of surplus production. If the farmer finds at harvest that his output exceeds subsistence requirements, he may decide to supply a portion of the surplus to local markets, reserving the remainder for next year's planting and other contingencies. If on the other hand, the farmer's subsistence needs exceed on-farm output, he will become a market consumer - using past savings, credit, or pledging future production. A recent development due to the drought has been a shifting of emphasis from cash crop production to food crop production. The yield from the new land brought into cultivation has not produced anticipated amounts of additional output due to the lower fertility on the one hand, and the presence of pest and disease on the other, among other factors. This project will not attempt to redirect this trend, but will enhance this effort by assisting in on-farm reduction of losses caused by pest and disease. The problem of social disruption is not at issue here as no fundamental changes in socio-economic structures is intended. Farmers were interviewed about their perception of this proposal, and in all cases responded affirmatively. Since field demonstrations will be conducted by field agents who are members of the local villagers and tribal groups, farmer resistence is not considered to be a strong factor. Commercial farmers are accustomed to pest control programs. In terms of investment costs, our economic analysis indicates that given present prices, with other factors remaining constant, the use of insecticides is practical.

In all countries, the farm family is the primary production unit, with an extended family responsibility through matriarchial or patriarchial

lines. In almost all instances, the land is owned by the tribe or group, but parceled out to individual families (or in some cases individuals) for cultivation. Again, the nature of this project is such that land tenure patterns are not at issue, as the focus at the farm level will be on cultural controls, complemented by other chemical and non-chemical measures. No new organizational changes will be introduced. Our efforts will be simultaneously applied through demonstration and practical training at the farm, village, and arrondissement level; and by academic and applied training for selected regional and national government officials. Farm plots to be used for demonstration purposes will be selected by the farmers, or their chosen representatives. We should, however, consider the question of time allocation and proper motivation for project acceptance. The motivation factor for this project is inherent and revolves around two themes typical of all farm populations in the participating countries: 1) the desire to produce in quantity an amount sufficient to meet perceived familial needs, and 2) minimization of the risk factor. Crop protection measures as developed for this project address both issues by assisting the farmer in ensuring that his inputs will not be negated by uncontrollable disease and pest infestations, and by minimizing this risk, promoting the realization of potential output given soil fertility and other factors. Time studies for farmers in participating countries have not been conducted to our knowledge. As stated earlier, farmers in all countries have shifted more land into the cultivation of food crops, and as a consequence, more time and labor is allocated to food crop production. It is known also, that since food crops are usually cultivated by females (and males dependent upon total area planted) incremental time and labor units are provided by women, as well as men. Under conditions

where survival is the goal (and all subsistence farmers are concerned with this) time and labor are provided as necessary to ensure survival. This is exactly the situation existing in the rural areas of the participating countries. Under these conditions, additional time and labor will be forthcoming. Once crisis conditions are no longer present, crop protection measures become time and labor saving devices.

(2) Income Distribution and Employment Effects: Equally as important as the output and income increases which can be expected as a result of project activities are the distribution and employment effects among individuals or groups, and to some extent, among regions and sectors. At the primary level, project activities will be directed to assisting small farmers in rural areas who cultivate food crops for subsistence needs in the first instance, and supply local markets when surpluses are available. Under adverse conditions, this same individual may become a local market consumer rather than supplier. Through demonstrations and training in methods and techniques, farms and inviduals selected by village and tribal leaders will become the conduit for conveying information and practices designed to assist in the protection of field and stored products from pest and disease damage. The highlight of this process occurs when comparisons are made of yields from stands employing protection measures as opposed to yields from stands not employing protection measures. Initially the farmers employing these practices will benefit in terms of an increase in yield from food crops (subsistence of survival) and if a surplus exists, increase in cash income from market sales. As more farmers adopt protection practices and more food crops become available, the benefits will pass to the consumer in the form of lower prices and availability of food products. Employment effects of

this project will, at the farm level, spread labor requirements more evenly throughout the growing season, as certain measures should be employed periodically throughout, the crop year (pre-planting to post-harvest). At the farm level, employment generation effects are minimal if not neutral, although additional labor will be required at harvest if output does increase considerably over a number of farm units, with resulting additional labor requirements for transport and marketing. On the other hand, if the transport and marketing sectors are operating at less than full capacity these sectors would be able to absorb the additional output without expansion of factor magnitude.

D.	Policy	See Section B thru E, Part IV
E.	Financial	See Section A, Part III
F.	Administrative	See Section B thru E, Part IV

PART IV Project Implementation

A. General

1. Establish and staff a Sahel Food Crop Production project headed by a Regional AID project manager with a country project officer (Entomologist) stationed in each participating country as a counterpart to appropriate Ministry of Agriculture officer and a Regional Pest Control Training Officer stationed in Yaounde.

2. Provide liaison on an intra- and inter-regional basis for administrative and operational matters interlocking with goals of regional organizations such as FAO, OICMA, OCLALAV, Food Crop research stations and other agencies interested in the development of agricultural resources of the Sahel.

3. Provide leadership in developing viable plant protection organizations in each country through:

a. Advising on designing, staffing, and training the national Plant Protection Extension Unit.

b. Advising on sound administrative management practices, including staffing, planning, budgeting, and evaluation.

c. Identification of professional and practical training needs on the short and long-term. Provide for or conduct short courses, field demonstrations, and other needed in-country training.

d. Encouraging and assisting in the development of effective survey, and control systems.

4. Provide technical assistance in plant protection operations as follows:

a. Identify species, direct and conduct surveys for teaching-counterparts how to determine major insect problems,

assess population and incidence levels for treatment purposes, and develop simple systems for estimating crop losses.

b. Determine and carry out demonstrations of the safest, most effective and economical methods of pest control for each country and crop, integrating chemical, cultural, and biological methods as indicated. Give special attention to post-harvest pest problems.

c. Provide instruction in pesticide safety including protection of applications and impact on the non-target environment.

d. Identify major research needs and assist in establishing programs to address such needs.

e. Provide technical advice, consultation, and collaboration with regional organizations and other donors operating in the area.

f. Introduce regulatory philosophy to assist countries in guarding against introduction of exotic plant pests.

g. Provide progress reports on activities of the project, by country and by region, at designated intervals.

B. Specific Plans to Achieve Project Purposes.

1. The project will be initiated in Senegal, Mauritania, Cameroon, and Chad with the Country Entomologist in Senegal covering the crop area in Mauritania, as well as conducting the project activities in Senegal. (See Part II, Section 1 for Project Background and Country Selection Criteria).

2. The Sahel Food Crop Protection Project Manager will establish headquarters in Dakar, Senegal. A copy of the Staffing Pattern Action

Request (SPAR) has been completed and approved by the Personnel Management Office of AID/W which fully explains his duties.

The Regional Pest Control Training Officer stationed in Yaounde will work with each country designing basic and mid level training courses.

3. The U.S. entomologist will work closely with and under the host government Director of Agricultural Production and with his Director of Plant Protection. In the four countries, the National Plant Protection services are concerned with increasing food crop production through reduction of losses caused on food crops by insects and diseases both before and after harvest. Private or parastatal commercial and export crop production companies have developed some capability to combat plant pests with their own organizations.

4. Within 120 days after arrival, the entomologist in each country should prepare with the assistance of the AID project manager a one year work plan in quarterly segments. This should be done in complete collaboration with the host government and USAID so there is a clear understanding of each parties' responsibility, inputs, and a realistic time schedule adapted to each countries' capability to follow it.

5. Each country has recently established a skeleton plant production division based on two fundamental types of plant protection services:

a. The "fire department" concept which requires mobile units which can work in areas of localized outbreak and which are too large for the numerous small farmers to organize in that area. This capability is necessary for combatting such regional grasshopper outbreaks as those of 1974. To get

this operation started, AID will assist by providing funds for improved truck mounted dusters and sprayers which can cover large areas in a relatively short time. These units including personnel, applicators, and supportive equipment should be divisible into sub-units for covering three or four localized invasions at the same time if they occur simultaneously. A capacity to combat certain grasshopper and locust species in the uncultivated areas away from the crops before the farm lands are invaded will also be established. This type of preventative measure is the most effective type of control work because the young nymphal stages of grasshoppers yet unable to fly are the most susceptible to control methods before entering crop lands. In the Cameroon and Senegal, charter airplane services are available for spraying of Ultra Low Volume (ULV) pesticides and large areas may be protected in a short time.

b. The second and most important activity for each country is to build, train, and expand existing field services to teach and motivate the farmers to protect their crops. In total area, small farms greatly exceed that which the "fire department" type of units can control. In Senegal in 1974, it was estimated that 5,000,000 hectares were attacked which could extend over 1 million farm units that require individual farmers to perform simple pest control functions. The way to reach small farmers is by staffing, training, and retraining the new or existing field service personnel in

method and result demonstrations for plant protection techniques. If a pest control field service has been established, lower level staff can be partially trained on the job to then provide farmers with new plant protection techniques by demonstrations. The Cameroon, Senegal, and Chad have commercial crop protection organizations in the field and the governments will expand their authority for training small farmers. Food crop protection techniques will thus be spread throughout the country much more rapidly.

It is planned to establish a Regional Plant Protection Training Center at the Agricultural School in Bambey, Senegal which will be used for low and medium level training in plant protection for both Senegal and Mauritania.

The type of training depends on the level at which the extension agents will be working and the amount and kind of previous training they have received.

The United Republic of Cameroon, Director of Agriculture has verbably agreed to also establish a Plant Protection Training Center in their country which would accept participants from Chad for a three or four month plant protection course. The curriculum at both schools will be developed with the collaboration of the country entomologist, the Sahel Food Crop Control,Project Manager and the Plant Protection Training Sepcialist on the PASA staff stationed in Yaounde.

Each country project will have provisions for on the job training of the field agents, district, and regional plant protection officers. Provisions are made for conducting short

courses, field demonstrations on practical technical subjects such as pesticide chemistry, toxiocological effects, safety measures, operations of equipment, and how to conduct surveys.

The type and duration of training for specific courses will be developed by the country Entomologist in collaboration with the host governments officials. The services of a USDA consultant for design of curriculum for all levels and kinds of plant protection activities courses is available under the PASA agreement.

C. Implementing Plans

Certain actions can be taken in concert for the four countries the Design Team has recommended be included in the Sahel Food Crop Protection project as soon as this PP is approved.

1. Project Agreements must be written and signed in collaboration with host countries and RDO/CDOs.

2. The AID Regional Project Manager for whom a position has been established should be immediately assigned to the project to make a major input into the project design, PP, PIO/T for a USDA, PASA, and other implementation documentation.

3. In order to obligate as soon as possible, after the Project Paper has been approved a PIO/T should be issued to provide the services of three Country Project Officers (Entomologist) and a Plant Protection Training Specialist through a PASA with the U.S. Department of Agriculture. It will also provide funds for special consultant services as requested by member nations in related areas of Plant Protection. The provision of funds for the part-time services of a USDA plant protection backstop officer in Washington and for his inspection trips may be included.

4. Project Implementation Orders for Commodities should be issued for vehicles, pesticides, application equipment, materials and supplies, scientific instruments for a pest identification pesticide trials laboratories, and some communications equipment.

5. Obligation funds for the "Other Costs" element of the Project Agreement should be quickly approved to provide initial operational field budget support to Participating Countries (PCs).

6. The AID Project Manager should go to each participating nation to develop between them and the AID Mission a bilateral Project Agreement to be executed as soon as possible, hopefully before the end of FY 75. An alternate plan would be to cable instructions and with copies of the approved PP, each mission could develop their own agreement.

7. The USDA should identify and nominate the three Country Project Officers (entomologist) and the Plant Protection Education Specialist when the PASA is signed and commence their training in French language so they could arrive at post in January 1976.

8. Candidates for non-academic training in the U.S. should be identified quickly so training could commence during the spring of 1976.

9. The possibility of using Peace Corp Volunteers as operational and training personnel working with the extension service will be explored at the time of negotiations with each country for preparing the Project Agreements.

The actions necessary to implement the project in the four countries must be taken on an individual basis as the present situation and level of plant protection work varies greatly from country to country.

B. Senegal

1. AGRICULTURE

The Senegalese economy is based on agriculture which employs 70 percent of the labor force, contributes an average of 25-30 percent to GDP, and provides the basis for groundnuts oil refining and extractive or food processing industries. Groundnuts are the predominant cash crop, grown in rotation with millet and sorghum, the major food crops. Real potential exists for increased production of rice, cotton, vegetables and fruits in the south and southeast and in the Senegal River Valley if water resources are brought under control.

In 1972 total agricultural production amounted to nearly 1,950,000 MT, of which over half was groundnuts (988,500 MT), and about 1 percent was cotton, both cash crops. The remainder of production was for food crops, of which 62 percent was millet and sorghum, 15 percent manioc, 12 percent rice, 4 percent corn and 7 percent vegetables.

The government has long sought to increase peanut production, which accounted for about 70 percent of exports during the 1960's and is a major source of government revenue (about 60 percent of government revenue). Production was anticipated to attain the 1.3 million ton mark by the end of the Second Plan in 1969. However, a combination of the low price incentive offered to the peasant, the mediocrity of extension services, and the practices of ONCAD, the peanut marketing board, prevented production from expanding rapidly

and even promoted widespread smuggling to Gambia which offered higher prices.

Thus peanut production was only 830,000 MT in 1968/69 and dropped to 583,000 MT in 1970/71, owing in part to drought conditions, but mostly to a shift toward subsistence production. A major reversal seems to have occurred in 1971/72, when with a view towards regaining peasant confidence, the government introduced far-reaching measures including: 1) the cancellation of farmers' outstanding debts; 2) the payment of premiums for 1970/71 production; and 3) a 15 percent increase in groundnut prices. As a result, small farmer demand for fertilizer doubled, that for small equipment tripled, and short-term credit jumped by almost 60 percent. Although acreage remained at about a million hectares, production increased nearly 70 percent from 583,000 MT to 989,000 MT in 1972, while 95 percent of farmer debts were repaid. This is significant because it indicates farmer incentive is strongly based upon availability of inputs and a market. Unfortunately, 1973 was a major drought year, but the government is continuing its promotional policy by having pardoned farmers' debts and by having undertaken emergency measures for food distribution and cash grants. The groundnut Stabilization Fund, which provides 40 percent of government revenue, realized a larger trading profit than forecast in 1973 owing to a 38 percent increase in the world market price for peanuts and a 100 percent increase in the price of peanut cake.

Until the exigencies of the drought made themselves so alarmingly evident, Senegal tended to turn its back on agriculture even though 60

percent of its total exports were agricultural in origin, almost all of it peanuts. The recent surge in absolute expenditures reflects alarm in a mounting food import bill, a stagnant export sector and food production problems associated with the drought and insects attacks.

The country is spending 20 percent of its scarce foreign exchange earnings just to supply rice and bread wheat to feed its cities. If fundamental changes cannot be initiated and institutionalized into the farm system, i.e., crop protections practices, Senegal will have to resign itself either to permanent dependence on the goodwill of donors or spend much of its exchange income merely to feed itself. A weak balance of payments position deriving from this sort of agricultural weakness, and one which must become yet more aggravated as urbanization moves apace, cannot but dampen donor interest. And this outlook must be taken in context of the worsening world food situation and likely persisting high world cereal prices.

This plight need not come to pass. Senegal is in a good position, with help, to increase its foreign exchange earnings, diversify both export and food crops and satisfy its own food needs. Were only the modest goal of cereal self-sufficiency to be won, pressure on world food supplies would be diminished to that degree. This along would save Senegal from importing in excess of 350,000 tons of cereals annually.

AGRICULTURAL REGIONS OF SENEGAL

Senegal is perhaps the most physically diverse of the Sahelian countries, possessing lands which include well-watered savanna, the full Sahelian range and the Cape Verde. In addition it has the Senegal River Valley. This physical diversity is complemented by unusually diverse agriculture for an African country. Not only does Senegal have an extensive pastoral

and subsistence agriculture but one of the best developed commercial rural sectors as well. Indeed an estimated 40 percent of Senegalese farmers grow some portion of their crops specifically for sale, principally peanuts.

The country can be divided into five quite distinct physical regions each one possessing different problems, physical and economic and, consequently, requiring a different development approach.

THE CROP PRODUCTION SYSTEM

Senegalese agriculture is comprised of a large number of small producers (typically less than five hectares under cultivation). Almost all of the 2.4 million persons living in the villages are farmers; rural population represent perhaps 75 percent of the total - a rather low proportion in Africa. Different land-use patterns prevail among the different groups. Land consolidation would be useful especially as economies of scale or the application of new techniques become important. Land parcels are presently scattered about village sites making them difficult to till, spray, weed, or water.

If farm production is to expand it must come from the introduction and widespread acceptance of farm technologies such as plant protection which greatly increase the per worker productivity of the farm sector. Output per worker can finally be increased by improving the skills of the individual farmer. Better practices must be made known and should be the objective of adaptive research in entomology and extension. So far in Senegal improved technologies have not typically been of the sort which are easily adapted to farms of all scales of operation. Neither has sufficient investment been made in training or expansion of farm training systems. These remain limited to the commercial crop areas for the most part, and until recently mainly devoted to the promotion of cash

crops among model farmers. A beginning, but an inadequate one, has been made in research stations throughout Africa towards improved a higher yielding varieties of cereal crops that are insect resistant. What are badly needed, and yet lacking, are minimum packages which are easily adaptable by farmers.

RESEARCH AND DIFFUSION OF INNOVATION

The confinement of farmers to low-level technology is not the result of lack of interest or even knowledge but rather of their incapacity to afford higher production costs or accept the extra level of risk which new technologies often entail. To be acceptable by farmers a technology must satisfy three criteria. It must be, simultaneously, technically feasible to the particular farm situation - and conform to the quantity and quality of available resources; it must be of a tolerable risk level; and it must be profitable. In addition, if the technology is to be acceptable to a wide range of farms of differing scales of operation it must be divisible; that is to say, its component inputs must be usable in discrete quantities sufficiently small that farms of any size can afford to buy into the system. This is important as early marginal returns to new inputs can be proportionately large. Sadly, this has not been the approach practiced by IRAT, the farm research group charged with the development of new cereal production systems in Senegal. The emphasis remains, after 20 years of fairly systematic work on demonstration sites and pilot villages, to focus upon model farmers. IRAT has directed its program to the best 15 percent, which group is hoped to influence another 60 percent through a process of demonstration and diffusion. The remaining 25 percent are not believed to be potentially viable farms under

modern conditions.

The approach reflects both the colonialist philosophy of rural development and the desire to get early returns from efforts to promote cereal production. In practice this has meant that technical packages have emphasized capital intensive inputs such as fertilizer and improved energy sources, which because of the cost, eliminates the majority of farmers as early adaptors.

In theory, IRAT has attempted to design a stream of technological improvements to lead farmers step-by-step from a traditional system through a process of gradually adding practices ultimately to a maximum package which included heavy use of fertilizers and animal traction with full range of equipment. In practice, emphasis has gone to the full package to the neglect of the early and intermediate steps. Needed work in varieties of millet and sorghum suitable to minimum package users have been very much neglected. Furthermore, and following from the monocrop nature of extension in Senegal, improvements in peanuts have often not fitted well into farmer crop programs. What is badly needed, and is missing, is an integrated crop program which will provide ecologically and technically suitable minimum package programs which will satisfy the three above criteria.

The experience with fertilizer and improved varieties for commercial crops demonstrates that farmers do respond to opportunity within their means to do so. Until minimum packages are designed to meet the needs of smaller units, the rate of spread of improved technologies must remain slow. The choice among crops and technologies at the present time is far too limited and much too costly to allow anything else. However, in its assistance to the Senegal (SODEVA) Cereals project, AID is emphasizing the low technology, minimum package approach.

AGRICULTURE SUPPORT ORGANIZATIONS

Senegal has adopted a regional development policy for agriculture, but this new strategy grows out of the former crop-centered approach and many elements of the earlier period linger into the new. At least six regions have been identified as development areas, but as yet regional organizations exist in a mature state in only one - the peanut basin. No organization exists at all in the Casamance apart from the rice promotion program. In the Senegal Valley a nucleus exists. Yet more rudimentary frameworks are beginning to function in Eastern Senegal and in the central region.

SODEVA	peanut zone
SAED	Senegal River Valley
SODESP	central region
STN	eastern region
SODIFITEX	eastern cotton scheme
Operation riz	Casamance

Eventually all of these regional groups will approximate the organizational structure which now functions in Western Senegal, in the peanut basin, with distinctions suitable to local peculiarities. A review of this organization can therefore be viewed as a model for the whole.

The farmer is the objective of the system which may be divided into two functional parts: the research and technical support and the marketing and input supply side. In addition the farmer receives some attention from several rural-oriented agencies covering political, social, health and other welfare functions. Behind all of the development

structures stands IRAT, which group is responsible for fundamental and applied research into crops and supporting systems for the whole of the country.

The product of the research group is taken by the responsible development agency, such as SODEVA, which prepares a regional outreach strategy and plans the necessary steps to implement and deliver new technologies to the farmer. This is a function which must be sensitive to and responsive to the particular needs and character of each region. The peanut basin, which has three quite different soil and moisture regions requires a particular approach specially suited to each zone.

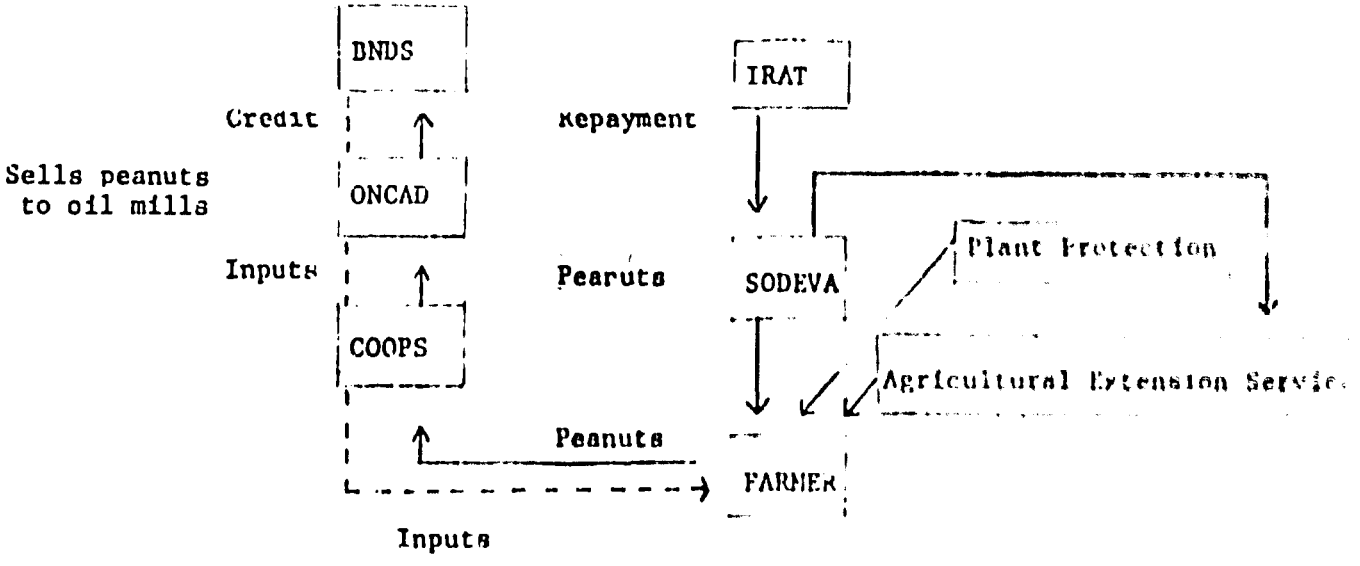
The farmer does not, however, actually receive a supply of inputs from SODEVA. These must come from his local cooperative. An elaborate network of local cooperatives has been imposed on the rural sector by law. The system is intended to create a marketing network, which has not existed, at a stroke. A staff of civil servants work at each outlet. In principal, a local elected body manages the cooperative, but given the lack of local skills the public employees bear most the burden. In fact, cooperatives have very little local autonomy and operate as an arm of the government. SODEVA plays a supportive and advisory role to the cooperatives and is represented on the local board of the cooperative.

Credit and supplies are made available to farmers at the cooperative outlet (including tools, seeds, fertilizers, pesticides). These inputs have been provided to farmers at subsidized rates (up to 50 percent) which have been supported by the revenues from peanuts. Farmers sell their peanuts to the cooperative. In theory, farmers can also sell cereals but funds have not, in fact, been provided the co-ops to purchase these

staples. Credit is advanced to farmers at the beginning of the planting season and deductions made from gross peanut revenues when these are delivered to the outlet. This credit system has been functioning for ten years, a record in Africa, which suggests that repayments have been at a high level. Government hopes that in time the cooperatives will become a true farmer organization, but this must await a great deal more experience by farmers and a wider level of practical education than is the case at present.

AGRICULTURAL DEVELOPMENT STRUCTURE-WESTERN SENEGAL

TYPICAL SYSTEM FOR INPUTS AND MARKETING



This regional infrastructure coexists in just a position with the regular national and local governmental structures including what would appear to be a somewhat superfluous parallel extension service. To coordinate all of this administrative structure an inter-departmental committee has been established (comite departmental de developpement). The indications are that this group has its work cut out, as the system appears to function only with a good deal of friction. But then it is a very new system and a certain shake-down period is inevitable.

2. PREVIOUS PROJECT ACTIVITY

The French administration undertook control of the principal insects and pests during the Senegalese pre-independence period. Specialized organizations dealing with cash crops undertook the task of controlling insects and predators attacking these crops while food crops were controlling insects and predators attacking these crops while food crops were controlled only in certain regions of the country by such organizations as SODEVA and SAED. However, these organizations dealt in the past with insects and pests on a limited localized scale which was not sufficiently effective. Following the recent catastrophic drought, the GOS decided to establish the Plant Protection Service in the Ministry of Rural Development and Hydrology to cope with the serious menace of insects and pests which were a major factor in thwarting plans to increase food crop production. The Plant Protection Service was established in 1974 in the Ministry of Rural Development and Hydrology and is directed by a Senegalese entomology graduate from Belgium.

Plans for organization call for five sections, each to be headed by a chief who has specific academic training for his areas of responsibility. Their training will be part of AID input. At the next level in the field, each of the seven administrative regions will have an extension Plant Protection agent who has a Baccalaureate from a secondary school plus two years at Bambey, the National School for Rural Officials, but not yet any training in plant protection. Each administrative region has plans to staff from three to six positions in the departments, for a total of twenty-eight members specializing in

food crop protection activities. Each DEPARTMENT has several DISTRICTS and most will eventually have an extension field man to work with farmers on food crop protection in his geographic area. Commercial crop farms use the French type of vertical extension system for "intervention," in which the field staff performs certain operations for the farmer such as application of pesticides.

The staffing of the Plant Protection Division has government priority, and the training of new personnel at all levels is one of the most important inputs that A.I.D. can make.

The GOS undertook steps to build the embryonic infrastructure of this service by arranging for the training of seven agriculturists in entomology at the African Institute for Planning and Development (IDEP) in Dakar. The UNDP sponsored training program which was held during January/February 1975 and included 18 other agriculturists from ten other African countries. Each of the seven graduate trainees have been assigned to establish regional offices in the seven regions comprising Senegal.

Use of pesticides on food crops has been negligible before last year. There is a French-owned mixing plant in Dakar but prices are as high as those for ready mixed formulas imported from Europe. The budget for plant protection of food crops for 1975 is $5 million of which the Senegal Cabinet approved about one third. The remainder is to be sought from donors. Another $622,000, mainly for pesticides, has been donated by OSRO for the short-term food crop pest control campaign for 1975. The Government is planning on building pesticide and application equipment storage facilities in each Region.

The 1974 crop year gives some idea of the magnitude of the losses suffered by the small farm producers from insects and plant diseases.

The main crops in order of tonnages produced for food are millet and sorghum, peanuts (producing the biggest crop of which 20 percent is consumed in-country for food and oil), rice, and cowpeas. The Senegal Plant Protection Organization has calculated losses for the 1974 crop year for food crops as $89 million. There are several insect species attacking the crops during various stages of their life cycles which sometimes necessitated replanting or replication of pesticide treatment. A total of 550 metric tons of insecticide were used but the aceage covered is unknown since some insect control systems required more than one application of pesticide.

The Agriculture Department field service based the loss estimates on visual observation, correlation of acres planted to average yields expected, and for some crops by random sampling of one square meter plots. Under normal conditions the GOS estimates 90% of the potential food crops are lost annually to insects, diseases, weeds and birds.

Insects attacking food crops

The most important species for each of the main food crops are known, with the exception of two stem borers on sorghum and millet. The insects have similar life patterns in the Sahel countries so control measures have been developed with work effectively in each farming region.

Several plant diseases are major threats to the food crops and are included by the Government in the total losses caused by plant pests.

To this is added their estimated losses of the same products after harvest caused by at least nine identified species of insects.

Treatment

Total material made available for the 1974 campaign to save food crops was 500 tons of BHC and 49 tons of other pesticides, including Dieldrin, Fenitrothion, Malathion, and Endosulfan, which in total is a very small amount compared to the acreage requiring treatment. The total estimated area attacked by grasshoppers was about 10 million hectares!

These estimates of losses emphasize the need for a strong plant protection organization to deal with insect problems and reduce losses by mobilizing the farmers to individually use simple techniques and safe insecticides available at the farm. Logistical support will be the Government's responsibility so the farmer can protect his crops after being taught practical methods through field service method and result demonstration campaigns.

3. IMPLEMENTATION

General plans for achieving project purposes for all countries were discussed in Section 3 above. This is solely the plan for Senegal.

Plant protection activities have emphasized insect control for commercial crops. The Government is very receptive to a medium- long-term project to increase food crop production, especially since the 1974 insect invasion which they figure cost them $90 million.

The project would consist of the components to build an institution capable of conducting control activities for localized outbreaks of food crop pests and through building and teaching the existing extension services methods adaptable by farmers to reduce insect damage to crops and increased by yields.

Under the Ministry of Rural Development and Hydrualics, the Plant Protection Service was established two years ago. The only professional entonomologist in the Ministry is the present Director, Mr. Diagne. He is planning to complete staffing for his service which will eventually include the following five divisions by 1978.

Crop Protection - The most important division because it provides the basic institution for teaching and motivating small farmers to conduct campaigns against food crop pests. It will develop a professional corps of 20 plant protection specialists to make surveys for predicing infestations size and location. They will be trained to organize, euip, and conduct campaign operations. They will learn and then teach integrated pest management techniques to the 150-200 field agents who in turn will train farmers.

Zoology - Identify, study characteristics, and devise controls for mammals, nematodes, birds, and other non-insect pests both in the field and in storage.

Phytopathology - Will work to identify plant diseases recommend control programs. They will be responsible for training staff to man inspection and quarantine stations at border, sea, and air entry stations.

Legislation - Develop and recommend regulatory laws; develop safe pesticide residue tolerance laws for food crops, licensing for importation and exportation of food crops.

Pest Control Pharmacology - Testing effectiveness of pesticides in the laboratory and in the field for toxicological effect, determining safe levels of pesticide residue, licensing of pesticide dealers, and qualitative and quantitative analysis of commercial pesticides to determine if they meet specifications.

Project Support AID Inputs

a. Technical Services

1. An AID Regional Project Manager experienced in pest control whose services are available to all countries for planning, monitoring, and evaluating the project on a regional basis and for individual countries through the local AID representatives and collaboration with host governments, with headquarters in Dakar he can lend a hand to the U.S. entomologist for the Senegal or Mauritania project activities.

2. In addition to the Project Manager, a U.S. Country Project Officer (entomologist) will also be stationed in Dakar to work for both Senegal and Mauritania. The Mauritania program is starting on a modest scale and it has been requested that the Senegal entomologist work with the Mauritania Plant Protection Unit. The Mauritanian agriculture sector description explains that most of the food crop plant protection activity is in the Senegal River basin along the north side of the river. The project can begin with this arrangement and if Mauritania activities increase rapidly, arrangements can be made to provide a full-time advisor.

3. The services of a full time Plant Protection Training Officer stationed in Yaounde will be shared to assist in establishing the Regional Plant Protection Training Center in Bambey and to develop the curriculul and syllabus.

b. Training

1. Higher level training for headquarters staff will provide through two to five AID academic scholarships for Master's or Bachelor's degrees in U.S. or third country Universities. Hopefully, two Senegalese candidates will be available to start training by February of 1976. In the 2nd and 3rd year of the project, the other qualified candidates will become available according to the Chief of the Plant Protection Service.

2. Middle level training for plant protection personnel will be provided first for seven agriculturists who will work as supervisors in those regions where the plant protection field services has the most activity. Funds will be provided to finance Senegal and Mauritania students at a regional plant protection training center to be established with assistance of AID funds at the National School for Rural Officials at Bambey. It will accommodate twenty live-in students courses of three months duration. A technical and practical plant protection courses will be given for preventing both pre and post harvest losses. A USDA consultant who specializes in designing and establishing plant protection courses will be available as need on a part time basis' the first year and if training activities expand in the Cameroon as planned with another regional plant protection training center funded by AID, it will be possible to add a full-time Agriculture Education Advisor to the project in FY 77 to work in all participating and/or cooperating countries.

Before facilities at Bambey are open, advance training for six participants will be given in the U.S. at a special three month course to be developed by USDA plant protection specialists. The participants should be given an intensive English course before leaving Senegal if possible but funds are provided to have an interpreter for them in the U.S.

3. Lower Level Training: the largest number of people to be trained are the lower level field staff, who have the direct contact with cultivators on their farm to teach the farmers new techniques for control of pest themselves. Courses for this level of worker will also be developed in collaboration between the U.S. training specialist, the Senegal Plan Protection Service and the staff at Bambey. It is planned to use the same facilities described above for a minimum of theoretical and classroom work and a maximum of practical training on the school farms, field trial plots, and with local farmers. Plans for the regional lower level training were discussed with Senegalese agricultural officials and tacit agreement was reached for AID to assist financially in the expansion of dormitory facilities for housing up to 20 extension personnel from Mauritania, and Senegal for two courses per year so 120 will have training by 1979.

c. Commodities

1. AID will supply funds to assist in building a mobile pest control unit capable of combatting plant pests in large but localized areas which are more extensive than farmers are able to cover. With five mobile spray units, the first year target is to protect 50,000 hectares during 1976. With the Senegal government providing all staff

and bulk of equipment. The "fire department" unit should be capable of treating 200,000 hectares per year by 1979 and will also provide excellent on-the-job training opportunities while the campaigns are conducted in the field. Also, during the off season, the entire organization will be capable of splitting into modular units, each with pesticides, vehicles, sprayers mounted on heavy duty vehicles, to demonstrate and teach techniques against pest outbreaks in more than one area at a time.

2. Laboratory equipment, furniture, supplies and materials will be provided to build a small plant protection identification and pesticide testing laboratory to provide farmers information on insects attacking their crops and devise best methods for reducing damage. Important work remains to be done in the design and extension of minimum packages of pest control techniques, specifically planned for the small farmers adaptation in a wide range of ecological conditions and cropping pattern and for stored food crop pests.

The Project Implementation Orders for the commodities should be prepared as soon as possible. No waivers for offshore procurement are required except for vehicles. All machinery, equipment, and vehicles should be procured from manufacturers whose spare parts and maintenance facilities are locally available.

d. Other Costs

This includes funds for support of the technicians, housing, local contractual services, materials and supplies available locally for supporting the technicians' activities, construction of the pest control training school dormitory, laboratory, machinery storage,

garage and office, and laboratory equipment, local currency for operational field budget support, gasoline, oil, vehicle maintenance, and per diem, and a local hire bilingual Secretary.

e. Phase I Budget

Senegal
($000) FY 1975 thru FY 1978

Year	Total	Personnel	Participants	Commodities	Other
FY 1975	394	146	46	119	83
FY 1976	220	120	65	20	15
FY 1977	220	130	30	40	20
FY 1978	185	130	10	20	25
TOTAL	1,019	526	151	199	143

f. Senegal Input

The Government of Senegal will provide for the first year through the Cooperating Agency, Plant Protection Service, the following CFA inputs to the project shown converted to U.S. dollars.

a. Technical and Other Services	$ 30,000
b. Commodities	
Pesticides	150,000
Application Equipment	50,000
c. Other Costs	
Operation, maintenance, repair of vehicles and equipment	10,000
Offices, furniture and Equipment	5,000
Maintenance operation and use of Regional Pest Control Training Center at Bambey	20,000
TOTAL	$265,000

A detailed budget for remaining years of Phase I will be negotiated when Annual Work Plan is developed in collaboration with GOS.

g. Output Targets

Senegal Training Output Targets

1. Build dormitory at Bambey to accommodate 20 live-in students.
2. Train two instructors for the Bambey School.
3. Develop French Plant Protection Courses for pre and post harvest crops available to all countries of the Sahel.
4. Five U.S./Third Country Academic Degrees by 1979 - General Plant Protection.
5. Fifteen Middle Level Managers and Regional Directors training in plant protection implementation procedure.
6. 120 field level extension agents trained by 1979 in a series of 6 courses at Bambey.
7. Ten three man teams trained and on job with mobile units (see below).
8. Mobile units important component for training new and old staff. They will teach preventative control techniques off season also.
9. Training courses for the prevention of damage to stored food crops and how to treat infested stores will be designed and taught at Bambey.

Technical and Management Assistance

1. Assist GOS to organize staff, develope, help manage and train a Plant Protection Service with five divisions.
2. Establish network of 120 field level staff with 7 regional coordinators.

3. 100 "method and result" demonstrations by individual farmers in 1976; 500 in 77; 1,000 by 78.

Logistic Support for Plant Pest Control Campaigns

1. Vehicles and demonstration equipment for five U.S. funded "fire department" mobile units operations capable of covering 50,000 hectares in 76, 75,000 hectares in 77, and 100,000 hectares in 1978.

2. Special mobile squads equipped for the demonstration and teaching sanitization of grain storage buildings and methods of control of infested stores by fumigation and/or other modern techniques.

End of Project Status

Reduction of pest caused crop losses by 50% from 1973/74 base to 1978/79 end of first phase of project.

PART IV - PROJECT DEVELOPMENT

C. Mauritania

1. Agriculture Policy, Financing, and Administration

Agriculture production is confined to subsistence, cultivation of cereals, vegetables, and dates. Seventy-five percent (75%) of cereal production occurs in irrigated areas and in normal years, production totals about 110,000 MT. Since total cereal requirement is 145,000 MT, there is always a shortage met by imports. Owing to the drought, cereal production from 1971 thru 1974 was only 20 to 30 percent of normal levels.

b. Farming Patterns

Mauritania may be divided into three crop zones. The northern four-fifths, the southern fifth, and the narrow band along the Senegal River. The Senegal Valley, an area perhaps 30 km wide to the north of the River on the Mauritanian side, occupied by 20 percent of the country's population, grows 80 percent of the cereals, all of the rice and most of the millet.

Across the balance of the country, a band some 100 km wide, only millet is grown under high risk conditions, and some maize. This coarse grain culture is in close association with the quasi-sedentary husbandry culture of the Moors, who are the predominant social group in the country and give it its particular character. Cultivation fades out as one moves north from the river; it is indeed the frontier of the Sahel and Sahara.

Not surprisingly, Mauritania is finding it difficult to feed itself. Per capita availability of cereals, even with imports, has been in decline since independence.

The country has been a cereal deficit area for years. Imports make up 40 percent of annual consumption, on the average; in some years it has exceeded 50 percent. Whereas total production of all cereals has remained little changed on the average since independence (with considerable variations about the mean), the population has been increasing at close to two percent per annum, from 970,000 at independence to over 1,260,000 in 1973. There being no check in prospect to the latter's growth, one cannot but be pessimistic as to the near future in terms of Mauritania's ability to satisfy demand for cereal staples. The country depends upon concessional imports now. Indeed Mauritania can easily remain an international ward in this regard.

Two quite different farm regimes function in Mauritania.

The Toucouleurs make use of the river as their primary source of moisture, sowing millet as the summer flood recedes. In recent years, some paddy rice has been introduced and vegetables. A few motors lift pumps exist, virtually no irrigation exists. North of the river, millet is grown under rain-fed conditions, but this is the most rain-assured part of the country. Yields of millet along the river are of the magnitude of 400 kg/ha and 300 under rain-fed conditions.

Unfortunately, this land, which has the most potential in the country, is the most isolated. There exists no usable roads linking the river area with the coast or with the major towns. The river is not used for traffic. It is consequently very difficult to distribute supplies and pesticides to these farmers.

A proposed road linking the southern zone will be significant to the area north of the river.

This is a difficult physical environment occupied by a dispersed poor hard-to-reach human population. No radical breakthroughs seem in prospect with which to ameliorate their condition. Perhaps the best hope in the near future for increasing food crop production lies in efforts to improve flood retreat cultivation by simple and quickly attainable methods not involving extra risk and little or no cash. The longer term future may offer opportunities for more intensive irrigated agriculture along the Senegal River, aided by the water control and navigation that will be made possible by the delta and Manantali dams. The greater market for the produce may be in Senegal rather than the distant cities of Mauritania.

c. Support Organizations

There are few African countries more poorly endowed with agricultural support organizations. What does exist is meager in number, weak in organization, poor in training, and lacking in needed support. The Agricultural services do not attract the best available school graduates. The agricultural school at Kaedi, for example, seems to get the rejects from alternative educational opportunities. Its output is limited to a few score annually, barely a third of the number needed just to carry out the schemes presently planned.

At the present time, the Mauritanian farmer is unlikely to have very close contact through formal institutions with his government. Even where such contacts exist government has little to offer, neither technology nor support. An indigenous farm research system scarcely can be said to exist.

d. Price and Market Policy

The Government of Mauritania attempts to place controls on prices of food-stuffs, however, in practice such controls are of no consequence in as much as the Government has no means to administer or enforce these controls. Similarly, no marketing organization exists to store, move or distribute domestically produced cereals.

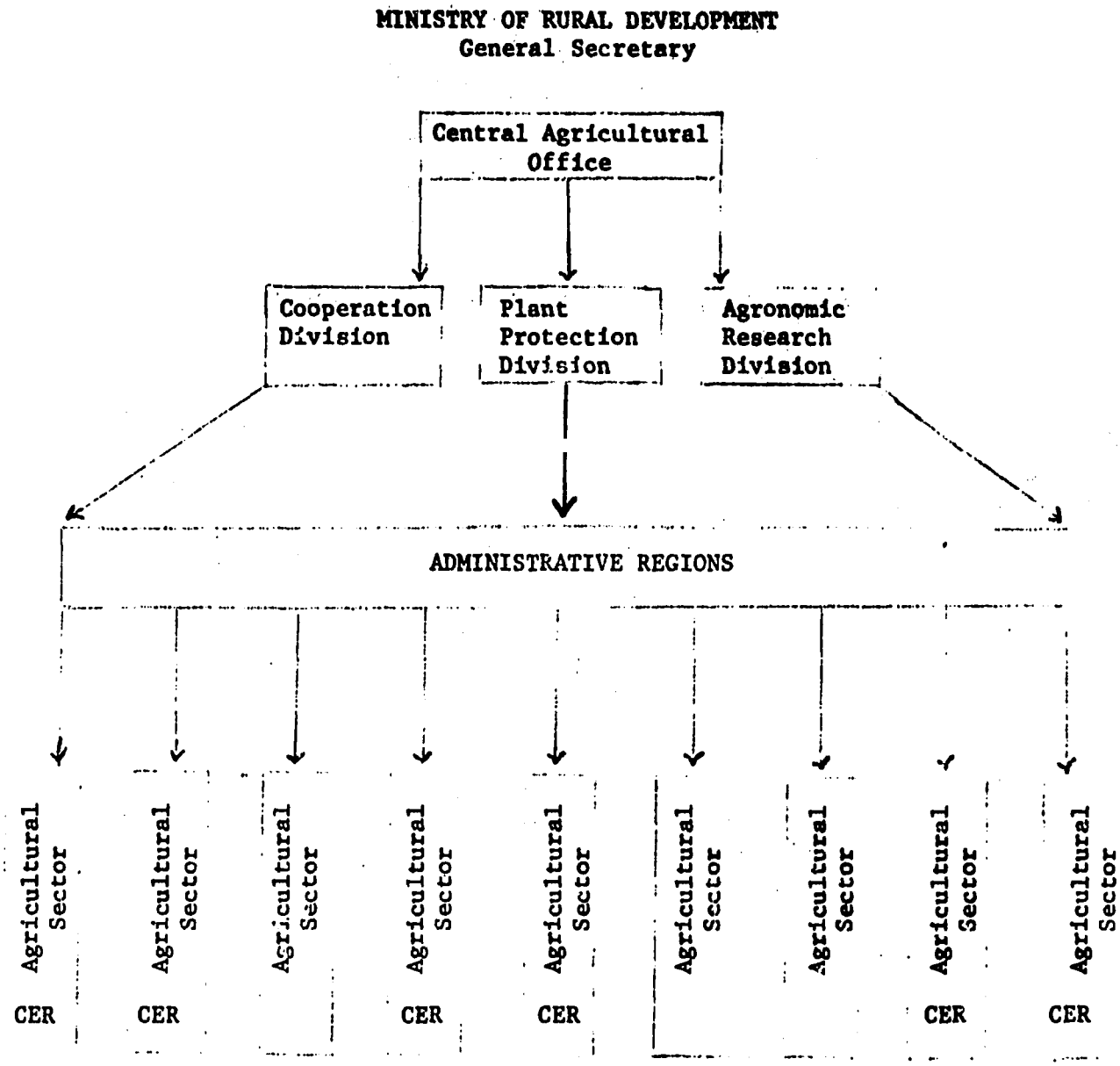
The Government would like to establish price controls and a market system for cereals. But until adequate staff and facilities can come into being, this must remain a remote hope. Some scope exists for a more decentralized price and marketing policy based on the regional administrative level.

2. Previous Activity

Mauritania has had very little activity in the way of insect or plant disease programs during its history. The share of public funds allocated to agriculture by the Mauritanian government has been nearly constant for the past 7-10 years, 2 to 3 percent of the national budget of which none was available for a plant protection organization until 1974. The Ministry of Agriculture is currently in the process of developing a comprehensive crop and livestock development plan.

It gives the first and highest priority to activities which will have a rapid pay off in terms of more food which includes improved varieties of fertilizer and a pest control package to help the farmer.

These packages will reach the farmer in a few areas to begin through the skeleton framework of the Ministry of Rural Development as presently organized and as depicted in the following chart.



Although there are twelve administrative Regions only nine have "Agricultural Sectors" with the task of carrying out agricultural policy in each of the 9 regions. In some of these sectors there are C.E.R.'s (Rural Expansion Centers) which are directed by Rural Economy Monitors who deal with all aspects of extension work among the peasants.

These Agricultural Sectors and C.E.R.'s are the structures which are involved in the implementation of the action programs decided upon at the central level concentation with these local structures.

As far as personnel is concerned, there are about 50 Upper middle and lower level staff involved in the carrying out of policy and operations in the field and the sectors.

Expanding and staffing the plant protection unit will be slow.

There are only seven agricultural agronomists working in all government ministries who have college degrees and two of these are in the Ministry of Rural Development. At the next level are Engineers de Travaux who have a Baccalaureate plus two years in Agricultural School. There are only ten of these. There are 5 works conductors, who have attended primary school and four years at the Agricultural College at Loga, Senegal. The fourth level are the monitors who provide direct contact with the farmers, and have primary school training plus 3 years at the Center for Agriculture and Extension Training at Kaedi, Mauritania. It is the only school in Mauritania supporting crop and livestock production. The center enrolled 60 students in 1973; 76 students had previously graduated, all of whom have been employed by the Ministry of Rural Development (50 as agricultural agents). The Kaedi program has been redesigned and expanded to increase the quality and numbers of graduates who are divided between specialties in Livestock, Water and Forestry, and Agriculture. There are about thirty degree candidates studying overseas in Agriculture subjects and one has nearly completed work for an entomology degree at the University of California.

Authority to establish a Plant Protection Unit has just been received from the Ministry of Rural Development. A major A.I.D. input will provide training to develop plant protection specialists at all levels, when qualified candidates become available.

The Minister of Rural Development, the Director of Agriculture Production, and the Chief of the Plant Protection Unit met with the design team in Dakar to outline Mauritania's policy, present status, and requirements to initiate a plant protection project.

The Minister had read the Project Review Paper and said they are trying to build an organization,very similar to the one proposed by the U.S. and with the same project purposes, but that Mauritania is only beginning. There has been a lack of operational capability and logistic support even when funds for pesticides and equipment have been available, therefore, in 1974, losses occurred amounting to 40 to 50 percent of the food crops. Their infrastructure needs to be developed to: (1) build small warehouse facilities to stock insecticides; (2) build a transport capability for distribution of pesticides and application equipment; (3) obtain middle and upper level training grants; (4) locate source for operational support funds; and (5) to build an effective extension plant protection field service.

These would all contribute to forming the infrastructure they consider necessary to conduct campaigns against local outbreaks in consolidated areas and to teach farmers control techniques through the field services.

Other donors are coordinating efforts through the FAO, Extension Project at Kaedi, and which the UNDP is partially financing, and through the Rural Radio Service Project, funded by the World Bank.

Some entomological research should be started on the new Kaedi agronomic research farm but in the meantime, the results from existing research facilities in other countries can be used to help farmers increase production by demonstration.

A few pesticides are provided by the government which orders them from the commercial mixing plant in Dakar. Larger chemical firms such as Bayer, Hoechst, Union Carbide and others have agents in Senegal, through whom orders can be placed.

There is very little application machinery or manually operated dusters and sprayers available to farmers at this time.

3. Implementation Plan

a. Background

Food crop losses caused by insects and other plant pests in Mauritania have been occurring regularly. The recent severe insect invasions have brought attention to the government that these losses, added to the annual food deficit, must be prevented or reduced.

In 1974-75, food crop production in Mauritania for dry land areas was about 20 percent of normal. Yields for river recession crops planted last November and December were average. Total production averaged about 64 percent of requirements. The percentage of losses caused by insects is estimated at 30 percent or 23,000 tons of food grains.

The government has already initiated a food production program which is slow in getting underway because of a lack of trained agriculture personnel, roads, availability of production inputs for farmers, and a marketing system.

b. Course of Action

A "package" system for small farmers requiring little or no cash input is to be developed under this package. A major component will be development of simple, integrated pest management control systems for use by the famer, the presently understaffed and undertrained, agricultural field service will be trained in these techniques and show the farmers how to utilize them.

The A.I.D. project activities in Phase I will assist the Mauritania Ministry of Rural Development to build almost from the ground

up a Plant Protection Service, capable of reducing pest losses and thereby significantly increasing plant production.

Food crop protection activities in Mauritania have just begun. Four of the 40 agriculture "monitors" serving in the field have had a short course in practical control work at the FAO course held in Dakar in February 1975.

An organization and management plan for the Plant Protection Service will be developed under the A.I.D. project to include central, regional, and field staff and their relation to each other.

Mauritania is not capable at the present time of absorbing very large scale inputs. The Plant Protection Service is still on paper and no budget allocation has yet been made; the food crop production area is small compared to other Sahel nations, and communications and transportation systems are underdeveloped. Therefore, for the first year, the organization, management, and administrative assistance will be provided through the AID project personnel stationed in Dakar who will make frequent trips to Mauritania and lend assistance as required by the annual work plan schedule.

The purpose of the project in Mauritania is to build a strong plant protection service which will train the farmers to use simple techniques to reduce food crop losses. This is a long-term institutional approach which should be started quickly with a training program for which the country can provide qualified candidates for training in-country, or in Senegal, Cameroons, France, Canada, or the United States.

At the same time, the U.S. will assist the Mauritania in establishing and training self-sufficient mobile plant protection units

to combat large scale but localized types of attacks experienced when grasshoppers, locusts, or other pests appear in non-arable areas or invade crop lands.

Most project activities will be centered in the food crop production area of the Senegal River Basin.

c. Inputs

Through a bilateral project agreement with Mauritania, A.I.D will provide several inputs.

Management: Services of the A.I.D. Regional Project Manager, one Sahel Country Project Officer (entomologist) and the Regional Pest Control Training Officer will be shared with Senegal. They will advise and assist the Mauritania Government thru the Plant Protection Service in organizing and managing an integrated pest management system for control of insect outbreaks through two methods: (1) the establishment of mobile control units capable of moving to and logistically supporting themselves while combatting pests in food crop areas or in desert areas before pests can penetrate farm lands; (2) building into the present small field service corps by training and demonstration a crop protection capability to show farmers the most simple and low cost integrated pest management methods.

Training: Funds will provide for training at all levels.

--Professional: two academic degrees courses in entomology will be provided to train staff for the top level positions in the Plant Protection Service. One man is due to return next year from the United States where he is obtaining a B.S. Degree in entomology with funds provided under a former A.I.D. project.

--Middle Level: Mauritania will provide qualified candidates

from the present agricultural field service and graduates from the Agriculture and Extension Training School of Kaedi. A.I.D. will provide during Phase I funds for several qualified plant protection service members to attend a non-academic, practical pest control project designed by the USDA specifically for the Sahel countries. Other participating countries will also attend.

Another source of middle level training will be at the Regional Plant Protection Training Center to be established at Bambey, Senegal and the training center in the Cameroons as a part of the region-wide inputs of this project. Tentative agreement for establishing the school to be attended by participants from Mauritania, has been made with the Senegalese Ministry of Agriculture.

--Basic Training for field staff on techniques to be used by the farmers will usually be on the job, in the field, and at the Regional Plant Protection Center at Bambey.

Commodities

These will consist of vehicles, materials, and pesticides for the Plant Protection Service to build two mobile units to demonstrate logistical support and field spraying techniques. They will serve as training units when not engaged in control operations. A modest amount of safe, non-environmental polluting pesticides are provided for use in 1976-77. OSRO has provided $350,000 for pesticides, equipment, and transportation distribution costs for the short-term activities. This will support the Mauritania campaign against predicted large scale grasshopper outbreaks in the summer and fall of 1975.

Other Costs

1. These funds will provide operational field budget support for (1) equipment and vehicle operations, repair, and maintenance costs; (2) local seasonal labor and training costs including per diem for mobile unit crews; (3) materials, supplies, parts, safety supplies and pesticide handling equipment and tools; and (4) demonstration pesticides, equipment, and supplies for stored grain pest control; (5) tuition and per diem for participants attending courses at Regional Plant Protection Training Center, Bambey, Senegal.

SAHEL FOOD CROP PROTECTION
MAURITANIA PHASE I BUDGET
1975 THRU 1978

	Total	Tech Services	Participants	Commodities	Other Costs
1975	148	0	24	61	63
1976	120	0	41	39	40
1977	149	70	24	30	25
1978	175	70	25	30	30
	592	140	134	160	152

Mauritania Inputs

The host governments has no approved budget for operations. The field work is to be done by the agriculture service described above. Some pesticides will be available. The Plant Protection Service Directors salary and position is presently funded from the Department of Agriculture Production in the Ministry of Rural Development.

Mauritania Output Targets

Training:

1. Two U.S./third country academic degrees by 1979 - General Plant Protection.
2. Eight middle level managers and regional directors training in plant protection and the organization, operation, and provision of logistical support for large scale campaigns, by end of FY 1978.
3. Forty field level extension agents trained by 1979 in a series of courses at Bambey.
4. Four three-man teams trained and on the job with mobile units (see below).

5. Mobile units are an important component for training new and old staff, and to teach preventative control techniques off season for demonstrating stored grain control techniques where the units equipment is suitable.
6. Training courses for prevention of damage to stored food crops on the farm and how to treat infested stores will be designed and taught at Bambey.

Technical and Management Assistance:

1. Assist GOM to organize, develop, Help manage and train a Plant Protection Service by 1978.
2. Establish a network of forty field level staff with three Regional Coordinators to work with farmers.
3. Fifty "method and result" demonstrations by individual farmers in 1976; 100 in 1977; and 200 in 1978.

Logistic Support for Plant Pest Control Campaigns:

1. Vehicles and demonstration equipment for two U.S. funded "fire department" mobile units operations, capable of covering 20,000 hectares in 1976; 40,000 hectares in 1977; and 60,000 hectares in 1978.
2. Special mobile squads equipped for the demonstration and teaching sanitization of grain storage buildings and methods of control of infested stores by fumigation and/or other modern techniques.

END OF PROJECT STATUS

Reduction of pest caused crop losses by 50 percent from 1973/74 base to 1978/79 end of Phase I.

D. CAMEROON

1. Agriculture Background

a. Agriculture Macro Assessment

Agriculture is by far the most important economic activity in Cameroon, accounting for 40% of GDP, and leading the export sector with 76% of export earnings in 1973. Together with forestry, animal husbandry and fishing, it provides the source of livelihood for about 75% of the population. Agricultural commodities form the basis of the country's principal processing and manufacturing industries. The real growth rate of agricultural production was 9.7% in 1972, compared to 7.5% in 1971.

Cocoa and cocoa products, coffee and lumber are the predominant export crops, accounting for 29%, 26%, and 13%, respectively, of exports in 1973. Cotton (3% of exports), rubber, bananas, palm kernels, palm oil and ground nuts comprised the remaining 8% of total exports derived from agriculture. Cocoa production has been declining since 1971/72 owing to adverse health and aging trees. Cotton production has declined since 1969/70, mostly because of reduced acreage in order to increase food crop production. Coffee, bananas, groundnut and rubber production shows slight upward trends.

Millet and sorghum are the most important cereals and are grown mainly in the northern part of the country for purposes of subsistence consumption. Production has consistently decreased from 480,000 MT in 1968 to 356,600 MT in 1972. Maize is the second most important cereal, showing a consistent increase in production to 298,300 MT in 1972, surpassing the Plan target. The major tuberous starches are macabo, taro, manioc, yam, and sweet potatoes.

Rice production attained 15,300 MT in 1972, far from the estimated 28,000 MT consumption predicted for 1975. In light of sharp increases in consumption, the government is devoting considerable effort to the expansion of rice production, principally at the SEMRY project in Yagoua. The project is expected to bring 4,300 hectares under cultivation, as well as the addition of a rice processing mill, and is financed by IDA, FAC, and CCE. Feasibility studies in other areas are under way.

CROP PRODUCTION

Principal staple foods are maize in the West, plantains, yams, manioc, and cocoyams in the Center South and millet, sorghum, and peanuts in the North.

While there is no severe food problem generally in Cameroon; relative food scarcities, partly as a result of distribution problems, do exist in the major urban centers of Yaounde, Douala, Garoua and elsewhere. The 1972-73 drought resulted in local food shortages in many parts of North Cameroon. Uncertainty about the adequacy of food supplies in the North stimulated the region's subsistence farmers to make a massive readjustment in the area devoted to cash crops versus food crops during the growing season following the drought. While the area planted to cotton, prior to the drought in 1971-72, exceeded 110 thousand hectares, in 1973-74 the area planted to cotton was little more than 60,000 hectares.

There is growing but inadequately documented evidence that food crop yields throughout Cameroon are declining or at best stagnating because of soil fertility exhaustion, insect pests and plant diseases, and competition from cash crops. Sorghum and millet production in the North was seriously affected by drought and losses to plant pests while maize production in the West is affected by insects and leaf and stem diseases.

Cash crop production in Cameroon is stagnating and declining. The output of cotton in the Northern plains was at a ten-year low in 1973-75 due not only to drought, but also to the drastic reduction in the area planted. Although yields are also low for peanuts, they are rapidly becoming a cash crop in the North and Center South; in recent years approximately 50 percent of the peanut crop has been sold for local consumption or processing into cooking oil to meet local and domestic demand.

In general, the institutional framework in support of food crop production is inadequate to the task of increasing and improving staple production. Input delivery systems for food crop production are virtually non-existant although there is some spin-off of imports into food cropping by virture of the fact that large numbers of subsistence farmers are reached by the input - extension-marketing services of cash or export companies.

Large scale migration to the cities and rapid rate of urbanization have revealed inadequacies and inefficiencies in food storage and marketing networks. Local urban shortages of staple foods have developed and food prices have risen sharply. In addition, the inability to store properly and to move food crops into commercial circuits leads to a considerable loss of income to poor farmers. Similarly, because of the poorly organized markets for food crops, bumper crops as expected for cereals this year in the North also mean low incomes for farmers who are unable to receive a reasonable price for their output.

Although research institutions have produced good results on cash/export crops, research on food crops has lagged behind. An agricultural research infrastructure exists and it is being restructured to place additional emphasis on food crops. A major shortcoming in agricultural research which must be corrected is the failure to include integrated pest management systems in the research program.

Not surprisingly, extension services personnel are inadequately trained and few in number in relation to the number of farmers to be reached. Middle and low-level agents that are closest to the farm level are also handicapped by bad roads, inadequate transportation and logistic support and small operatin budgets. The most effective extension work is carried out within the framework of export-oriented companies.

In general, the wider use of animal traction, improvements in hand tools, improved crop varieties, increased fertilizer use, plant protection techniques, improved weed control, and small scale irrigation could improve and increase food production in Cameroon. Activities to improve and increase food production should be carried out in the context of the total farm enterprise including both cash crops and livestock production activities.

Responsibility for agricultural policy, programs, and projects is divided among the Ministry of Agriculture, the Ministry of Livestock and a multiplicity of antonomous, usually commodity specific, agencies or companies. This organization structure renders it difficult to coordinate rural development activities, particularly those aimed at increasing staple food production or integrating agricultural and livestock productions, while pursuing equally legitimate goals of increasing production of export and/or domestic cash crop production to improve foreign exchange earnings and income of farmers.

The Government of Cameroon, in setting priorities for agricultural development, will weigh program approaches against economic objectives contained in the current five-year development plan: (1) reducing regional income disparities; (2) contributing to export expansion or import substitution; and (3) alleviating domestic staple food scarcities. These objectives are consistent with AID's Congressional mandate to increase food production and improve nutrition, to assist the development of the rural poor and to rehabilitate ecologically fragile areas (such

as the Northern Plains of Cameroon) seriously affected by drought.

A major food crop campaign for increasing production was initiated in January 1975 and is planned to provide farmers with information on cultural practices and subsidized inputs such as pesticides.

II. Agricultural Regions and Crop Production Systems

Five principal regions can be distinguished in Cameroon: The Northern Plains, the Western Highlands, the Western and Coastal Lowlands, the Southern Rain Forest, and the Central Savannah. These five regions are characterized by considerable ecological and climatic diversity and therefore considerable diversity in agricultural production systems. Diversity in soils and climate suggests there is considerable potential for agricultural and food crop development based on regional comparative advantage.

A. The Northern Plain is the area north of the Adamaous plateau which is characterized by relatively low rainfalls:

Sorghum and millet are staple food crops widely grown on small holdings of 2 to 3 hectares.

Average yields are 600 to 700 kg/ha for millet, sorghum, maize and peanuts, about 1 ton/ha for upland rice. Since 1970, yields have suffered from insect attacks and drought and there is growing documented evidence that yields are declining.

Although the Northern plains region is undoubtedly the poorest region in Cameroon, considerable potential exists for improving the production of food.

B. The Central Savannah covers two zones: the grasslands of the Adamaoua plateau and the tree savannah extending to the edge of the southern rainforest.

Millet, sorghum and maize are the principal food crops.

C. The Western Highlands correspond to the western and north-western provinces. Rainfall ranges from 1500-2000 mm over a lengthy rainy season. Food crops are corn, peanuts, beans and taro. Crop yields are low: 1 ton/ha for corn, 500 kg/ha peanuts. Major problems include low-yielding varieties insects and leaf diseases such as rust and helminthosporium on corn.

Throughout the region, a well organized cooperative system, the heritage of the British colonial period, is responsible for coffee production and marketing activities. This system maintains a good working relationship with agricultural extension services which are to be utilized for distribution and sale of inputs for developing small farmer pest management practices.

The most promising food crop development potential for the Western Highlands is in improving and increasing the production of corn. There is considerable interest in corn as a subsistence crop, as a source of farm income and as an export crop. Corn already represents the second major source of farm income to farmers in the Highlands and in recent years some corn has been exported to Zaire, Gabon, and CAR. Essentials for a corn improvement program include: (1) production, multiplication, and distribution of insect and leaf disease resistant varieties; (2) soil fertility improvement especially meeting nitrogen requirements; and (3) extension assistance in farm management including pest control.

D. The Western and Coastal Lowlands cover parts of three provinces: the Southwest, the Littoral and the Center-South. Average rainfall is 2500 mm. Approximately 50 percent of the population is urban and this heavy concentration creates a growing market for food crops produced in the region and in nearby areas.

The principal food crops are plantain, corn, and root crops, grown by smallholders on farms that average two hectares in size. Oilpalm, rubber and bananas are grown largely in commercial plantations. Robusta coffee is grown in association with food crops. Fruit gathered from wild palm trees represents a sizeable source of income to small farmers. As elsewhere Cameroon food and cash crop yields are low and output has not kept pace with growing urban demand, particularly in the port city of Douala. The relative absence of farm-to-market roads complicates the food supply problem for the urban centers and leads to loss of substantial income from food crops to farmers.

The most promising food crop development activity is in the area of improving the market organization for both traditional and non-traditional foodstuffs. This implies improving the network of farm to market roads, as well as improved storage techniques for vegetable produce.

E. The Southern Rain Forest includes most of the provinces of Center-South and the Eastern, and parts of Littoral and Western. Average rainfall is between 1400 and 1900 mm.

Major food crops are plantain, manioc, and cocoyams. Concern over short food supplies and high prices has led the Government to formulate a program for a "green revolution" in the area surrounding Yaounde. The program, is just getting underway and has as its goal increasing the production and marketing of plantain and other staples in the area to meet the demand for foodstuffs in Yaounde. Initially the program has met with difficulty largely because of inadequate farm-to-market roads and the unavailability of means of transport to Yaounde from the producing areas.

Agricultural Institutions

Government Agencies

Responsibility for agricultural policy, programs and projects is divided among the Ministries of Agriculture and Livestock and a multiplicity of autonomous agencies which have exclusive control over cash/export crop production and marketing activities. This commodity-specific orientation of cash crop production has resulted in the neglect of food crops in the areas managed by the companies.

In the past year, the Government has taken a positive step that could lead to better coordination and control of rural development activities. In August 1973, FONADER (National Rural Development Fund) was created by presidential decree. It has a 12 member board of directors chaired by the Minister of Agriculture. It will have broad responsibility for all economic and social aspects of rural development. Its major responsibilities will be to finance and execute rural development projects and to function as an agricultural credit agency. Credit in the form of loans or grants will be provided directly to farmers. Individuals with collateral may also receive credit. Loans for production will have terms of up to ten years, but most will have three to four year repayment periods, depending on the type of productive activity for which credit is extended. Most importantly, credit, with minor exceptions, will be "in-kind" and food crop pest control items materials supplies and hand applicators will be available at subsidized prices.

Agricultural Research

As in other former French territories, agronomic research priority has been placed on export crops while research on staple food crops has lagged behind. Research on cash crops has had good results in disease and insect control. Research station extension for food crops either from the research institutes themselves or through the extension services is virtually non-existent. Farming systems and farm management research does not exist.

In an effort to gain control of the orientation of all research activity in Cameroon, a new organization, ONAREST (National Office for Scientific and Technical Research), has been recently created to take responsibility for supervising the research now being carried out by eleven independent French research organizations. This reorganization could help to reorient agricultural research towards more applied farmer-related programs.

Extension Services

Not surprisingly extension personnel are inadequately trained and few in number. They also lack the mobility which would enable them to reach farmers in relatively remote and inaccessible locations. Since extension personnel are so critical in carrying FONADER's credit programs and ONAREST's research activity to the farm level, training and retraining of existing agents at all levels is badly needed. IRAM (Institut de Recherches et d'Application des Methodes de Developpement) is currently conducting a survey of agricultural education and training for all of Cameroon; and partially as a result of this study, the Director of Agriculture is considering ways in which to restructure the extension service, which is practically non-existent for food crops, and to concentrate on enabling middle and low level technicians to attend to food crops, as an export crop extension activity. A major training activity

will be concerned with food crop pest control systems and an integrated pest management package using less pesticides.

IV. Program Opportunities in Food Crops Production

The potential for improving and increasing food crop production in Cameroon is good. The variety of soils and climate should facilitate a balanced approach to diversifying agricultural production. Program planning and project preparation should take into account not only this eco-climatic diversity but also Cameroon's objectives for the rural sector: (1) reducing regional income disparities; (2) contributing to export expansion or import substitution; and (3) alleviating domestic staple food scarcities. These objectives are consistent with AID's congressional mandate to increase food production and improve nutrition; assist in improving the quality of life of the rural and urban poor; and to assist in the rehabilitation of ecologically fragile areas (such as the Northern plains of Cameroon) seriously affected in recent years by drought.

A. On grounds of reducing regional income disparities, the Government of Cameroon has accorded high priority to rural development activity in the ecologically fragile Northern plains. The target population in this poorest region of Cameroon includes sedentary farmers who produce staple cereals.

A program to maximize production of food crops among sedentary farmers in the North is probably inadvisable at this time. AID's

approach should be to promote balanced farming systems that assure a dependable supply of staple cereals to the farm family and the region and that ensure a reasonable return to the farm family on its investment and risks. Development based on existing farm systems could be pursued by developing a minimum input package for cereal production including provision of treated elite millet/sorghum seed, improved techniques of land preparation, insect control, seeding density and weeding, draft animals and credit. Since staple food producers in the North are invariably producers of cotton and peanuts, the latter for home consumption as well as sale, the place of those crops in rotation in the farm enterprise needs to be clearly understood.

A food crop production activity in the Northern Plains should incorporate the following elements: (1) input supply, credit and marketing; (2) extension services and training; (3) seed multiplication and demonstration; and (4) plant pest control.

B. Another feasible intervention would be in the promotion of corn production in the Western Highlands region of Cameroon. High priority should be given to the development of this region on the basis of reducing regional income disparities. Corn is important in the West as a subsistence crop. Essentials for a corn improvement program would include (1) production, multiplication and distribution of insect and leaf disease restraint varieties; (2) integrated pest management; (3) soil fertility improvement; (4) extension assistance in farm management; (5) simple equipment for on-farm village storage; and (5) credit to purchase improved inputs.

D Cameroon

2. Previous Activity in Pest Control

According to the Government of Cameroon the annual losses of potential food crops from predators are as follows:

Maize	20% to 50%
Sorghum and Millet	25% to 40%
Paddy Rice	10% to 20%
Peanuts	5% to 10%

In some years when migratory locusts and Quelea birds ataack the losses are much higher and may reach 100% in localized areas.

If these high estimates were reduced by two-thirds, the most conservative financial loss is $16 million including post harvest losses.

Also vegetables and other cash crops suffer heavy losses from insects and diseases which reproduce very rapidly year around in the warm tropical climate.

The competition for food crops between humans and predators is critical in the Northern Plateau area where the bulk of the food grains are grown on small farms. Farmers here, even in good crop years lead a precarious existence with a per capital income of $90 which is less than half of that for the majority of small farmers in other agricultural regions where different ecological conditions exist, and other crops are produced.

Cameroon is nearly self sufficient in food production, but grain production supply and demand is precariously balanced. Only by reducing drastically the acreages of some cash crops during the last few years and expanding new acreages for food grains has the supply kept up with increasing demand. As more new development farming schemes are established, the plant pest

attacks will grow more frequent and increase in severity. It is therefore most important to develop a Pest Control Service now in order to reduce losses on the present level of food grains production and prevent future incursions.

The British and French administered areas of the Cameroons built a plant protection activity into their export crop farming systems. The colonial companies and later parastatal organizations developed plant protection research and extension services for coffee, cocoa, palm oil, cotton, sugar, tobacco, bananas, tea, etc. These specialized organizations undertook the task of controlling insects and predators on cash crops where food crop protection was practically nil except for a few small areas growing wheat and rice. The recent catastrophic drought across Africa also seriously affected the grain growing areas of Cameroon. The GOC decided in late 1974 to establish a Plant Protection Service in the Ministry of Rural Development and Hydrology which will direct activities to food crops, mainly sorghum, millet, maize, rice, peanuts, and cowpeas (niebe); nearly all grown by small farmers except rice.

There is a shortage of personnel to operate the Plant Protection Service and a specific need for three specialists for the above divisions. The Chief of Plant Production is a University trained graduate in Agronomy. One U.S. trained entomologist has recently returned and been assigned to the Ministry but is working on cotton research. There are eight people working in plant protection but not on food crops and only three have degrees in entomology, plant pathology or nematology. The Ministry of RD and H said they could provide five qualified candidates for academic degree training in the U.S. or third country, and the first

would be available in January of 1976 and second and third in the summer of 1976.

There is an agriculture education program for middle level field staff, most of who are hired by commercial crop organizations upon graduation, but no plant protection courses are given.

The O.A.U. Regional Phytosanitary center has a well endowed and equipped station in Yaounde but it has not accomplished a great deal. A few middle level staff have been trained for inspection and quarantine duty.

Although virtually all food crops are grown by peasants and a special organization has been formed to increase production there are no donors helping to build an extension service. The design team was told that the idea for developing a food crop protection project is most opportune and that the Government of Cameroon would give high priority and collaboration to U.S. activities to assist them.

The GOC is supporting the Green Revolution for the following reasons:

1. Decrease inflation of food prices
2. Stabilize food supplies with storage facilities so drought years drasticality effect the economy.
3. Increase farmers income by increasing availability of inputs to remoter farm areas.
4. Decrease rural youth exodus by improving farm life.

These are about the same as agriculture sector program goals for the AID Africa Development Assistant Programs.

At the present time there is no financial structure for food crop production loans for farmers to buy inputs such as pesticides and manual

application equipment. However, the Commercial Crop Bank is providing over $700,000 for production loans to accelerate cereal production in the North Plateau Region for 1975.

Also in the Northern Region a cereals research station has been started which hopes to test high yielding drought and insect resistant varieties of sorghum, millet and maize.

The FAO is assisting the GOC to establish a grain marketing board in the north which is necessary for a systematic pricing policy. This in turn can be a vehicle for delivering through the board's purchasing stations, the necessary seed treatment and pest control chemicals.

A few airplanes equipped with spray equipment are available for hire. All work so far has been on commercial crops, but in 1974 only 3,650 hectares of coffee were treated in a target of 10,000 hectares.

These spray planes are available to supplement ground operations increase large outbreaks of plant pests.

The GOC has requested both OICMA and OCLALAV to assist in setting up a small store of insecticides in the northern area to support locust control efforts with the natural teams, but they don't expect them to operate a control program.

The Cameroon has had pesticides available for many years but the marketing and distribution system for food crop areas must be developed. The government is interested in having a commercial chemical company establish a mixing plant in Douala to help decrease high prices of imported pesticides caused by long distance freight charges. The pesticides market is rapidly expanding in neighboring countries and especially in Chad. The inland distribution and marketing system for supplying inputs

to the farmers is barely adequate but measures are underway to improve it through existing and new organizations. Emergency logistic support and supplies in time of mass predator attack are not possible for large areas, but to build this ability is a primary target of the new Plant Protection Service.

3. Implementation

Purpose

Assist the Plant Protection Service to reduce food crop losses estimated by the Government of Cameroon, at from 5% to 50% of yields of various cereals and groundnuts including both field and storage losses. Among the principal pests attacking millet, sorghum, rice and corn are grasshoppers, locusts, stem borers, shoot flies, and head borers of several species. An elimination of crop losses is equal to a corresponding increase in staple food production by 30% of yields to meet the rising food needs of a population increasing at a rate of 2.5% annually.

To begin, the following divisions will comprise the Plant Protection Service.

Crop Protection responsible for

a) Anti locust and grasshopper campaigns
b) Building an extension organization to teach farmers pest control techniques
c) Integrated pest management techniques
d) Surveys, economics of treatment, predictions
e) Stored food pest control campaigns and in villages on the farm.
f) Development of Regional Plant Protection Training Center.

Phytopharmacy responsible for

a) Determination of pesticide efficiency and residual effect on parasites.

b) Quantitative analysis of pesticides and rate and method of application.

c) Study of pesticide residues on plants and animals.

d) Evaluation and establishment of tolerable residual levels of pesticides for all food crops.

e) Testing chemicals and gases for new stored pest control techniques.

f) Study and research on chemical substitutes for control of insects, rodents, mematods and birds.

Phyto Sanitary responsible for

a) Preparation of phytosanitary legislation

b) Approval of pesticides and areas of use.

c) Establishment of phytosanitary controls over imported and exported crops at all border, sea, and air entry points in collaboration with Regional O.A.U. phytosanitary office in Yaounde.

d) Disinfection and fumigation techniques for infected plant materials.

AID Inputs

a. Technical Services

1. A country Project Officer (entomologist) will be stationed in Yaounde to work directly with the Ministry of Rural Development and Hydraulics, Agriculture Production Department, National Plant Protec-

tion Service.

2. The AID Regional Project Manager stationed in Dakar is also available to assist the GOC in planning, programming, and preparing project documents as required. He is an entomologist and can also assist in technical matters.

3. Regional Plant Protection Training Officer will be stationed in Yaounde to design curriculum for low, middle, and senior level personnel. He will also assist in the establishment of a Regional Plant Protection Training Center at the University of Yaounde.

4. Consultant services in special fields of plant protection such as stored food pest control will be available from the other Country Project Officers in Dakar and Chad or from the USDA.

b. Training

1. High level training for headquarters staff will be provided through four AID academic scholarships in Plant Protection Masters or Bachelors degree in the U.S. or third country universities.

2. Middle level training in integrated pest management will be provided for up to thirty supervisory and regional field staff at the Regional Plant Protection Center at Bombey.

Two instructors will be trained in the U.S. as soon as the government can provide them and will teach at the Center.

Technical and practical plant protection courses for preventing field and storage losses will be emphasized.

Before training facilites are open in Yaounde, advance training for six participants will be given at a specially designed plant protection course to be designed for the group by the USDA, Pest Control organization. The participants should have intensive spoken English classes before leaving the Cameroon if possible, but funds are provided for an interpreter to be with them in the U.S.

3. Basic Training

This category is the most important as the field staff are the major link to having farmers gain incentive for raising food production. Their training will be in country at Yaounde and on the job for method and result demonstration pest control techniques. There will also be special courses designed for them at the Yaounde Center and with the mobile "fire department" units described later.

c. Commodities

A.I.D. will supply funds to assist in building a mobile pest control unit capable of combatting pests in large but localized areas which are more extensive than farmers are able to cover. This "fire department" type of unit will also cover non-arable areas to prevent grasshoppers and non-flying locusts from reaching the cultivated crop lands. Off season responsibilities will include stored pest control demonstrations where the equipment is adaptable as well as giving basic training to field staff on the operation and maintenance of equipment. There will be three modular units capable of splitting to combat pest outbreaks in more than one area at a time.

Vehicles for mounting sprayers and some pesticides to start operations are included.

d. Other Costs

Included are funds for the construction of a dormitory wing to accommodate twenty live-in students at the Regional Plant Protection Training Center.

At the same location, if possible, it is planned to build a small laboratory, office and storage house and yard area for project machinery, equipment and supplies.

Operational field budget support is provided for support of technicians' activities, purchase of demonstration materials and supplies available locally, housing and per diem.

CAMEROON PHASE I BUDGET

FY 75 thru FY 78
($000's)

FISCAL YEAR	TOTAL	TECH.SERV.	PARTS,	COMMODITIES	OTHER COSTS
1975	333	130	35	107	61
1976	164	60	56	25	23
1977	123	65	21	25	12
1978	134	65	34	20	15
TOTAL	754	320	146	177	111

f. Host Country

The Government of Cameroon will provide for the first year, through Cooperating Agency, Plant Protection Service, the following CFA inputs to the project shown coverted to U.S. dollars.

1.	Technical and Other Services	$30,000
2.	Commodities; pesticides and equipment	200,000
3.	Other Costs: Operation, maintenance, repair of equipment	10,000
4.	Operation, maintenance, land for Regional Pest Control Training Center at Yaounde	20,000
	Total	$260,000

A detailed budget for remaining years of Phase I will be negotiated when Annual Work Plan is developed by the Regional Project Manager, USAID, in collaboration with COC.

g. Cameroon Output Targets

1. Training

a. Build dormitory for twenty students and office, laboratory and storage at Yaounde Regional Plant Protection Training Center by December 1976.

b. Train two instructors for the Yaounde Training Center before school opens.

c. Develop French Language Plant Protection Courses for pre and post harvest crops available to all countries of the Sahel.

d. Five U.S./Third Country Academic Degrees in general plant protection studies by 1979.

e. Fifteen middle level managers and Regional Directors training in plant protection implementation procedures.

f. 120 field level extension agents trained by 1979 in a series of six basic plant protection courses at Yaounde.

g. Ten three-man teams trained on job with mobile units (see below).

h. Mobile units important component for training new and old staff. They will teach preventive control techniques off-season also.

i. Training courses for the prevention of damage to stored food crops and how to treat infested stores will be designed and taught at Yaounde.

2. Technical and Management

a. Assist GOC to organize, staff, develop and help manage and train a Plant Protection Service with three divisions by 1977, four by 1978, and five by 1979.

b. Establish a network of 120 field level staff with five regional coordinators.

c. 100 "method and result" demonstrations by individual farmers supervised by extension field service in 1976; 500 in 1977; and 1,000 by 1978.

d. Possible use of 2 to 5 Peace Corps Volunteers to perform plant protection field demonstration and teaching jobs.

3. Logistic Support for Pest Control Campaigns

a. Vehicles and demonstration equipment for three U.S.-funded "fire department" mobile unit operations capable of covering 15,000 hectares in 1976, 25,000 hectares in 1977, and 40,000 hectares in 1978.

b. Special mobile squads equipped for demonstration and teaching sanitization of grain storage buildings and methods of control of infested stores by fumigation and/or other modern techniques.

4. End of Project Status

Reduction of pest caused crop losses by 50% from 1973/74 base to 1978/79 end of Phase I of the project.

PART IV. PROJECT IMPLEMENTATION

E. Chad

1. Agriculture Background, Policy, Administration

a. Introduction

Chad is one of the poorest and least developed countries in Africa. Approximately 95 percent of its 3.6 million people are engaged in subsistence agriculture and semi-nomadic livestock herding. Although the potential exists for self-sufficiency in food crop production, Chad rarely produces a surplus of food. Recurrent droughts, at least since 1968, resulted in local food shortages and in 1972-73 widespread famine necessitated large relief shipments of grains from the United States and other donors. Problems of food supply are complicated by low yields, soil fertility depletion, inadequate storage facilities, insect and pest infestation of crops in the field and in storage, and competition from cash crops, notably cotton which has been the Chad government's number one agricultural sector priority. Cotton is a major source of GDP, foreign exchange earnings, and government revenues. In 1971, it accounted for 14 percent of money GDP, 70 percent of export earnings, and about 7 percent of government revenues.

While cotton is the government's highest crop priority, food crop production is the farmer's top priority. Millet and sorghum are the staple foods usually grown in rotation with cotton throughout southern Chad. These cereals are also widely grown throughout the central Sahelian region as well. Yields are low, production is highly variable, and the market is fragmented and poorly organized. Local food shortages regularly occur particularly during the period preceding the harvest. Prices are low at harvest time, but just before harvest, small merchants benefit from the scarcity of supplies by selling grain back to farmers or to urban consumers at exorbitant prices. Improvement in millet and

sorghum production and marketing will require improved inputs and techniques, as well as improving on-farm and village storage capacity, raising producer prices, and surveillance and control of the marketing activities of the small-scale grain merchants. Of particular interest to the Chadian government is that with an assured food supply through improved production and marketing, farmers would be more willing to produce cotton as a cash crop.

In addition to cotton and millet/sorghum production, rice and wheat are produced on more limited areas in selected zones in Chad. Irrigated rice is produced along the Chari and Logone Rivers and rainfed rice is grown elsewhere in the south.

b. Agricultural Regions and Crop Production Systems

Three distinct eco-climatic zones can be distinguished in Chad:

Most of the northern region is true desert, an extension of the Sahara. The area provides a tenuous livelihood for less than two percent of Chad's population. Its potential for food crop production is virtually non-existent.

The southern region is a humid subtropical zone where nearly half of Chad's population is concentrated.

Farming is practiced almost entirely by smallholders on farms that average 2.7 hectares. Approximately 600,000 hectares (1973) is planted to millet and sorghum and associated crops. Rice is grown on approximately 43,000 hectares. Corn, beans, manioc, taro, and fonio are secondary crops. More than 2.5 million hectares are estimated to be under cotton cultivation in all of Chad and only 40,000 hectares are

cultivated under relatively modern systems. Average yields of cereals are low but comparable to those of other regions in Sahel-Sudanian Africa. Average yields are 400-500 kg/ha for millet, sorghum and maize and one ton/ha for paddy rice.

Development assistance to reach the largest number of farmers in the southern region should seek to promote integrated approaches to food and cash crops, specifically millet and sorghum. The interrelationships which exist between subsistence food production and cotton production cannot be ignored in deciding strategies and designing programs to assure adequate food to farm families and to increase their incomes.

Attempts to improve cereal production in the south should initially concentrate on multiplication, production, and distribution of improved seeds; improvement of cultural practices such as land preparation, sowing date, timely weeding, correct density, and crop protection. A food crop production improvement program should be carried out within the framework of the intensive cotton productivity project which is financed by the Chadian government, FED, and FAC.

FDAR (The National Rural Action Fund) has established a Cereals Department with assistance from WFP and FAO that has the responsibility for a national program of cereal marketing and price stabilization including the establishment of a national reserve stock.

There are two cotton production systems in Chad. First, there is the traditional system practiced by the large majority of subsistence farmers whose main crops are millet and sorghum, but who produce cotton to earn enough income to purchase necessities and pay taxes. Second, there is the cotton production system involving fewer farmers who participate in a cotton "productivity program" and who receive training, farm management extension assistance, and improved inputs from the project authorities, COTONTCHAD, and ONDR (National Rural Development Office). COTONTCHAD has the responsibility for production, processing and marketing of cotton, while ONDR organizes and operates the extension and input delivery system in the southern region.

FED and FAC are the major contributors to the cotton productivity program which will emphasize an integrated approach to cotton production including food crop improvement, animal traction, farmer cattle feeding, processing of cotton seed oil for export, and cotton cake for livestock feed. Project plans call for reinforcing the extension capacity of ONDR, constructing storage facilities for fertilizer and insecticides, production and multiplication of improved seeds of sorghum and seed treatment. The food production aspects of the cotton productivity program should be carefully studied by AID. At the very least, sorghum research results carried out by the Major Cereals project in Northern Nigeria should be made available to ONDR through the Field Trials Officer in neighboring northern Cameroon, who manages field trials on the research station located in Deli.

Rice is another food crop that is grown extensively in areas that are flooded during the rainy season and elsewhere on rainfed lands. Paddy production is highly dependent on the flooding of the Logone which failed to flood many rice growing areas in 1972/73; and upland rice is dependent on highly variable rainfall in dryland cropping systems. Output reached a

peak in 1971/72 at 60,000 tons, but 39,000 tons produced in 1970/71 is closer to the ten-year average. IBRD is financing an 11,000 hectare rice production project in the Satequi-Dressia plain of the Logone River Valley in southern Chad. The project will include all aspects of rice production, including seed research and multiplication, pest control, introduction of improved cultural practices and modern production inputs, and processing and marketing of output.

The Central or Sahelian Region lies to the north of the Chari River, and extends across a belt approximately 300 miles wide from Lake Chad and eastward to the Sudanese border. Many farmers combine subsistence food production, mainly millet, with the raising of cattle, sheep, goats, or horses. The area planted to Millet and sorghum in the Sahelian zone is approximately 500,000 hectares, with average yields of from 500-550 kg/ha. In recent drought years, yields have been lower, ranging from 350-400 kg/ha. Estimated production for the Sahelian zone in 1973 was 200,000 tons.

c. Policy Issues in Food Crop Production

The major agricultural policy issue in Chad involves the conflict between the previous government's desire to maximize cotton production, in order to meet foreign exchange, and fiscal policy objectives, and the farmers' real need to meet subsistence requirements by emphasizing the production of staple cereals. Historically, the colonial administrators and the Government of Chad obliged traditional farmers to produce cotton to meet export demand and to have cash to pay taxes. Farmers on the other hand,

have persisted in according first priority to food crop production to minimize the risk of an inadequate food supply throughout the year, thereby guaranteeing their own subsistence. At the same time, production incentives and improved techniques have not been sufficient to generate increases in output. Moreover, a marketing system which could ensure a reasonable price to farmers and consumers alike does not exist.

The key to resolving this conflict and associated policy issues of price incentives and marketing lies in viewing the agricultural sector as an integrated economy to which emphasis is given to the production and marketing of traditional crops, such as millet and sorghum, and sedom crops, such as rice and wheat, as well as the main cash crop, cotton. There appears to be some recognition of the need for an integrated approach to agricultural development on the part of the Chadian government. Both the slowing of the rate of growth in cotton production in recent years and the extreme food shortages created by drought have helped create this realization. Such an integrated approach is implicit in the new "productivity program" for cotton now being undertaken in the southern region.

The cotton "productivity project" is a large regional activity in the south designed to improve production and marketing of food crops as well as cotton. This approach makes agronomic sense as cereals and cotton are rotation crops, and cereals will benefit from the residual effect of fertilizers applied to cotton.

Price policy for cereals is a separate but related issue. Officially, the Chadian government maintains a floor price on millet and sorghum of 28 CFA per kilogram. In practice, this policy is not operational because of inadequate storage capacity and inability to undertake buying and selling of grain on a scale which would stabilize producer prices at a remunerative level or consumer prices at a reasonable level. In surplus years, prices to farmers may drop as low as 5 CFA/kg. Similarly, consumer prices range from 20 to 80 CFA/kg according to annual and seasonal availabilities. The aproach to stabilizing at a reasonable level both producers' and consumers' prices will involve increasing on-farm and local (village) storage to raise producers' prices to a guaranteed and effective minimum, thereby reducing the trading margins and giving consumers the benefit of a lower price. An intensive stored pest control campaign at the farm and village level must be started so potential losses of 20% to 40% can be averted.

It should be relatively easy for FDAR to extend its operational capability into the area covered by the cotton productivity project. Outside the project area, the large majority of subsistence farmers who produce 85 percent of the cotton output will be more difficult to reach. An extensive program involving relatively modest improvements in inputs and practices for this larger group of farmers should be given high priority by the Chadian government.

d. Program Recommendations

A.I.D. should not directly assist cotton production efforts as that would be contrary to the Congressional regulations and its mandate to transfer resources and provide technical assistance to improve food production and nutrition. However, A.I.D. should provide assistance to efforts to improve and increase production and marketing of staple cereals within the framework of other donor-financed agricultural production activities which include food crops. But nevertheless, these donor activities are principally designed to increase the output of cotton, the major source of foreign exchange, public revenues, and farm income.

The institutional constraints imposed by minimal capabilities in project management, agricultural research and extension, and training programs, together with the government's inability to devote substantial financial resources to develop activities, make donor cooperation and coordination of agricultural projects essential. A basis for donor cooperation in project assistance has already been established between A.I.D. and major donors through the R and R program through activities such as the provision of veterinary supplies, the construction of storage facilities to handle grain supplies for drought relief, and the production of food in the polders of Lake Chad.

Specific program and project recommendations include the support of cereals production aspects of the cotton productivity project in the southern region, including multiplication and distribution of improved sorghum varieties, integrated pest management techniques, seed treatment, correct planting density and weeding practices, and minimum fertilizer application. ONDR will be responsible for providing extension assistance to farmers in the productivity project area. ONDR also has the responsibility for assuring input delivery (seed, insecticides, fertilizers) for both food crops and cotton and with the administration and collection of loans financed by the Chadian Development Bank. As is typical of agricultural services which operate in the framework of cash crop specific projects, ONDR has had very little experience in meeting input and extension needs of food crop producers. Consequently, creating or reinforcing a food crop extension capability among middle and lower level extension agents through training or retraining programs is urgently needed. A.I.D. has approached the Chadian government, FED, and FAC to review project details and jointly determine what assistance can be provided by A.I.D. within the pest control activities of this intensive crop production activity. A.I.D. should also make available improved varieties of sorghum, and maize developed by the Major Cereals Project in northern Nigeria either through its own participation in the productivity project or through liaisop provided by the Field Trials Officer stationed in Maroua, Cameroon.

The great majority of farmers (85%) in the southern region producing millet and sorghum for their own subsistence, as well as cotton, have no organized program of input delivery or extension services carried out on their behalf. In pursuing its strategy of developing an integrated agricultural economy, the Chadian government should accord high priority to an extensive program to improve cereal production and on-farm and local storage. Selected improvements in inputs and practices (improved and treated seed, pest control, timely land preparation, sowing and weeding, etc.) derived from experience in the more intensive productivity project area could be disseminated to farmers. In addition to crop production and improvement measures, simple measures for protection of field crops and stored grains should also be extended to farmers. Assistance to ONDR in providing extension services would be required to carry out the project. The relatively high returns to farmers, as well as foreign exchange earnings and tax receipts derived from the cotton produced by these traditional farmers, should be considered as partial justification for this extensive activity. The major justification is of course assuring adequate food supplies to large numbers of farmers most subject to the vagaries of weather, attacks by insects in the field and storage and the disorganization of the cereals market.

IV. Project Implementation

E. Chad

2. Previous Activity in Pest Control

There are no accurate statistics on food crops acres planted, yields or losses due to pests. The best loss estimates available from the Ministry of Agriculture and F.A.O. reports are as follows for millet, sorghum and rice which normally comprise about 90% of cereal production.

	Estimated Loss Lo		Hi	Annual Average Production	Lowest Estimated Loss
Millet/Sorghum	29%	to	60%	500,000 tons	145,000 tons
Rice	20%	to	42%	50,000 tons	10,000 tons

It is evident that if the low damage estimates are cut by another 50%, the losses are still intolerable.

Chad has developed, through French efforts, a commercial crop pest control program mainly conducted in cotton growing areas. No program has been initiated for food crop protection against pre and post harvest insects or diseases.

The neophyte plant protection service consists of the Acting Director who has an agronomy degree. There are no entomologists. One student training in Abidjan for a MS degree could be a candidate for an AID scholarship to study plant protection subjects.

Work in farming areas is conducted by the field staff of the Ministry of Agriculture in the intensive cotton growing areas which produce only about 15% of the crop. The organization usually consists of one man with a general agriculture degree trained at the University

in Yaounde who is in charge of agriculture activities for the area. He has two to four middle level staff members in change of sub-sectors. At the grass roots level are the agricultural agents who work directly with the farmers for cotton production. The inputs are usually provided and applied under the "French Intervention" system. The spraying for pest control is done for the farmer by a government team and deducted from proceeds of his cotton deliveries, along with fertilizer costs and taxes. The cost of fertilizer, pesticide, and application is $31.00 per hectare.

The field service needs to expand activities into the food crop protection program.

This requires building a plant protection service and staffing it in three levels. The manpower available from the agriculture education system is limited. There are two agricultural curriculum schools teaching secondary school graduates. One is a three year course with an enrollment of 100 which will produce 30 graduates per year for the basic field level agent or "Agriculture Conductor". The best twelve, however, are selected for advancement into the higher on-going two year course, which has an enrollment of thirty-five and graduates about fifteen per year. There are no women presently in these training courses. These are the middle level workers, a few of whom were previously trained in the Cameroon. The Agriculture Department eventually hopes to have from twenty to forty agents in each of the cotton growing prefectures, but who will also work on food crop production.

The Ministry of Agriculture under the Department of Agriculture

Production recently established the Plant Protection Service. There will eventually be a headquarters office with three divisions: Entomology, Plant Pathology, and Phyto-Pharmacy.

Nearly all field operation budget support and administrative costs for the Ministry of Agriculture Projects are provided by donors.

The government imports the pesticides for the commercial crops such as cotton, and subsidizes their cost to the farmer. The price for Peprothion a combination of DDT, Endosulfan and Methyl Parathion has increased from $2.50 per liter in 1974 to $5.50 this year. The government has had discussions with the Cameroon for a joint venture to install a mixing plant near Douala.

For short term campaigns in 1975, OSRO has granted Chad $353,000 for 300 tons of Benzene Hexachloride, 16,000 small burlap bags for dusting crops by the farmers, 1,600 hand dusters, funds to hire 80 hours of spray plane operations, and transportation/distribution operational field support budget funds. This will be an excellent opportunity for the new Plant Protection Service to initiate field control operations by the growers at the farm level. The longer term AID project activities scheduled to start in January 1976 will support the Chad 1975 summer and fall anti locust and grasshopper control work.

Other donors have no entomologists working in Chad, but the U.N. through F.A.O. has a team of three people they are supporting, who are doing research, experiments and field trials on the best methods of controlling the Quelia Bird species. This is part of a Regional project from which all African countries will benefit.

OCLALAV, which usually works on Desert Locust and Weaver Bird Control

has an input in this project through budget support. They plan to provide funds for training middle level staff to a point where they can be accepted for academic studies in plant protection.

OCLALAV activities on grasshopper or locust control do not exist in Chad because of the great distance from headquarters in Dakar, the difficulty of moving equipment and supplies and because the region is serviced by OICMA.

A scouting and surveillance system is being initiated by OICMA in the Lake Chad Basin for Nigeria, Chad, Cameroon and Niger. A base camp has been established in Maiduguri in Nigeria.

3. Implementation

Purpose

Assist the plant protection service to reduce food crop losses estimated by the Government of Chad at from 20% to 60% of yields of various cereals and ground nuts including both field and storage losses. Chad is beginning "from scratch" in developing a plant protection program to reach the farmers.

To begin, the following three divisions will comprise the Plant Protection Service.

Entomology responsible for

a) Anti locust and grasshopper campaigns

b) Building an extension organization within existing field service to teach farmers pest control techniques

c) Surveys, predictions, economics of treatment

d) Stored food pest control on farm and villages

Plant Pathology responsible for

a) Identifying diseases

b) Developing integrated controls using a minimum chemicals where possible

c) Establishing a phytosanitary control system for preventing entry or exit of contaminated plant materials

Phytopharmacy responsible for

a) Determination of pesticides efficiency and residual effect with lowest toxicity materials

b) Quantitative and qualitative analysis of pesticides. (First phase by sending USDA samples for anlaysis)

c) Study and Field trials on integrated pest management techniques with organic materials; e.g. pyrethrum.

AID Inputs

a. Technical Services

1. A country project officer (entomologist) will be stationed in Ndjamena to work directly with the Ministry of Agriculture, Agriculture Production Department, National Plant Protection Service.

2. The AID Regional Project Managers stationed in Dakar is also available as part of his duties to assist Chad in planning, programming and preparing documentation as required. He is an entomologist and can also assist in technical matters.

3. Consultant services in special fields of plant protection such as stored foods pest control will

4. Two to five Peace Corps Volunteers may be assigned to work with Plant Protection Field Service.

be available with the other country project officers or from the USDA.

A training specialist on a consulting basis will be available to Chad for assisting in developing any level of training courses required.

b. Training

1. High level training for headquarters staff will be provided through three AID academic scholarships in Plant Protection.

2. Middle level training will be provided at the Regional Plant Protection Training Center to be established with AID assistance in Yaounde, Cameroon for ten to twenty candidates. Technical and practical plant protection courses for preventing field and storage losses will be emphasized.

3. Before training facilities are open in Yaounde, four staff members will be trained at a specially designed USDA four month pest control course in the U.S. The participants will have intensive spoken English training prior to departure and an interpreter will accompany them which in the U.S.

c. Commodities

1. AID will supply funds to assist in building a mobile pest control unit capable of combatting pests in large but localized areas which are more

extensive than farmers are able to treat. This "fire department" type of unit will also cover non-arable areas to present grasshoppers and non-flying forms of locusts from reaching the cultivate crop lands. Off season responsibilities will include stored pest control demonstrations where the equipment is adaptable as well as giving basic training to field staff on the operation and maintenance of equipment. There will be two modular units capable of dividing into smaller groups to combat pest outbreaks in more than one area at a time.

Vehicles for mounting sprayers and some pesticides to start operations are included. Two vehicles for the country project officer (entomologist) and his counterpart.

d. Other Costs

Operational field budget support is provided for support of technicians activities, purchase of demonstration materials and supplies available locally; housing and per diem; chauffers and wages for seasonal labor.

e. Phase I Budget

Chad
($000) FY 1975 thru FY 1978

Year	Total	Personnel	Participants	Commodities	Other Costs
FY 1975	225	65	27	93	40
FY 1976	196	60	41	40	55
FY 1977	208	65	53	60	30
FY 1978	156	65	16	40	35
TOTAL	785	255	137	233	160

f. Host Country

The Government of Chad will provide for the first year, through the Cooperating Agency, Plant Protection Service, the following CFA Inputs to the project shown converted to U.S. dollars.

1. Technical and Other Services	10,000
2. Commodities; pesticides and equipment	50,000
3. Other costs; offices	3,000
TOTAL	63,000

A detailed budget for remaining years of Phase I will be negotiated when annual Work Plan is developed by the Regional Project Manager, USAID in collaboration with GOC.

g. Chad--Output Targets

1. Training

a) Three U.S./Third Country Academic Degrees in general plant protection studies by 1979;

b) Four trained in USDA special course for 4 months in USA by 1977;

c) Thirteen middle level managers and Regional Directors training in plant protection implementation procedures;

d) 30 field level extension agents trained by 1979 in a series of six basic plant protection courses at Yaounde;

e) Two three man teams trained on job with mobile units (see below);

f) Mobile units important component for training new and old staff. They will teach preventive control

techniques off season also;

g) Training courses for the prevention of damage to stored food crops and how to treat infested stores will be designed and taught at Yaounde.

2. Technical and Management.

a) Assist GOC to organize, staff develop and help manage and train a Plant Protection Service with three divisions by 1979.

b) Establish a network of 40 field level staff with five regional coordinators.

c) 30 "method and result" demonstrations by individual farmers supervised by extension field service in 1976; 80 in 1977; and 200 by 1978.

3. Logistic Support for Pest Control Campaigns

a) Vehicles and demonstration equipment for three U.S. funded "fire department" mobile units operations capable of covering 10,000 hectares in 1976; 20,000 hectares in 1977; and 30,000 hectares in 1978.

b) Special mobile squads equipped for demonstration and teaching sanitization of grain storage buildings and methods of control of infested stores by fumigation and/or other modern techniques.

4. End of Project Status

Reduction of pest-caused crop losses by 50% from 1973/74 base to 1978/79 end of Phase I of the Project.

V. Evaluation Plan

The evaluation and monitoring of each country's activities will be a major responsibility of the Country Project Officer, with over-all coordination assumed by the Project Manager. Routine evaluation will be conducted annually through submission of a PAR (Project Appraisal Report), beginning one year after preparation and approval of each country's work plans, and continuing yearly through the end of project. As there is some degree of experimentality in this project, and therefore uncertainty about project outcome, evaluative indicators should, where possible, be derived from experimental areas (actual control by project representatives) and control areas (areas adjacent to on immediately peripheral to experimental plots). Experimental areas can be demonstration or model farm sites which can be regularly monitored; on farm units that adopt suggested practices early and are carefully monitored for adherence over a given time period. Control areas become those farm units in close physical proximity to experimental sites and/or those farm units in reception of and cultivating in accordance with information covering crop protection practices. Project Officers in each country will be required to submit quarterly progress reports to the Project Manager which will reflect actual versus scheduled completion of project work plans. Work plans should extend through the life of project, but be divided into yearly segments so that quarterly reports can be assessed over a manageable timeframe. Country work plans should be prepared and approved within 120 days after each country project officer reaches country of assignment. Country work plans will provide for the identification, selection and development of demonstration sites on various locations in the cereal crop areas. These demonstration (experimental)

sites will be used to collect country base line data necessary to support progress indicators, i.e., yields via traditional cultivation methods versus yields obtained with the introduction of protective measures. It is understood that because of sample size, the data results can only be representative and not indicative of country-wide conditions. By collecting data from both experimental and control areas, a comparative measure of project induced change will be available, and the benefits to be derived from protective measures will be demonstrable to farm units in the control areas. Frequency of data collection will be determined by country project officers. It is assumed that base line data will be collected at the end of the first harvest after establishment of experimental (demonstration) sites.

A. Project Purpose Evaluation - The project purpose will be evaluated according to verifiers indicated above, each country logical framework matrix (Part V, Annex A) and the "means of verification" attached.

To measure progress in reducing field crop losses, it will only be necessary to compare yield data from base line statistics with yields obtained in successive years with suggested protective practices. To measure the capability and development level of the country crop protection units, a comparison of degrees acquired; the number of agents trained; the number of vehicles and equipment on hand and operational; the number of demonstrations conducted; the number of farm units reached; and the number of training sessions conducted, will be verified. Further measurements can be obtained from country work plans, country logical framework matrix, and country project agreements.

B. Input and Output Evaluation - Achievement of project inputs and outputs described in the implementation plan and country logical framework matrices will be monitored by individual Country Project Officers and the Project Manager. Construction, development and conduct of training programs, and phasing in of staff can be compared to the scheduling of work plan activities for each Country Project Officer. Funds will be made available during the life of project from AID provided evaluative services on a consultant or direct hire basis.

Attachment to Evaluation Plan

End of Project (EOP) Objectively Verifiable Indicators and Means of Verification

I. Goal - (All participating countries) To increase the capacity for domestic agriculture production and to correspondingly reduce existing food deficits. To accomplish this goal, AID will initiate a project for the introduction of crop protective measures.

II. Project Purpose - Strengthen or establish the ability of plant protection units to combat plant pests, and to demonstrate, train, and assist local farm units in pest management; and to extend to farm units information on pest management practices which will reduce pre and post-harvest food crop losses.

It is assumed hat a reduction in losses now occurring due to pest infestations will contribute to attainment of stated goal.

VERIFIABLE INDICATORS FOR:

I. Goal - Level of productivity rises, and quantity of pest induced food crop losses fall in experimental and control areas. (An indication of "spread effect" can be obtained from data collected in control areas), and;

II. Project Purpose - Crop protection units staffed; equipped; conducting demonstrations; training extension and agriculture service agents, farmers, and other personnel.

MEANS OF VERIFICATION FOR:

I. Goal - Compare yields from experimental and control sites. Comparison of number of farm units adopting new practices in control areas, and;

II. Project Purpose - Number of positions filled by qualified personnel; equipment, vehicles, supplies, materials, and commodities on hand and operational; number of demonstration (experimental) sites in place; number of training programs completed, and number of staff, extension agents, farmers, and other personnel trained.

The Source of Verification for I and II above will be the country project agreements; country work plans; protection unit records; training program records; data collected at both experimental and control sites; and other records created and maintained in support of country projects.

Target amounts for each country are indicated in Country Logical Framework Matrixs, Part IV, Annex A.

Part VI--Annexes

B. Environmental Statement

In the past man has learned to live with pests and he must continue to do so in the foreseeable future. Most pests are highly versatile adversaries and capable of adapting to their hosts, their environment, and man's best efforts to gain control. Even with opportunities for research and new technology perfect control cannot be expected, much less eradication.

The new concepts of pest management include the integrated approach to pest control which this project will address itself to. Normally without interference from man, crops and pests survive in a natural balance due to ecological factors in the environment; however man's propensity to disturb this balance by his material needs and the establishment of new varieties, monoculture cropping, careless introduction of new pests, the balance becomes upset. Pests under these conducive situations run wild resulting in disastrous losses which are intolerable.

The use of varieties having maximum tolerance, resistance, or capability to recover from attacks is essential. Even the best germplasm may be inadequate to meet all pest situations, but some measure of resistance provides greater latitude for other strategies and gives some measure of relief for a few years until new biotypes develop.

Cultural measures are an important factor of pest management and suppresion of pests can be obtained by rotation of crops, sanitation, choice of sites, sterilization, etc. These measures can be useful under certain normal ecological conditions, but can become inoperative when conditions deviate excessively.

Certain direct actions can be taken by suppressing population buildup with the sterilized male technique; thereby interfering with the reproduction of the pest. Likewise use of hormones to upset maturation and sex attractants are other means. Biological controls through parasites and predators can be most effective in integrated programs.

Even with the foregoing practices adopted, conditions still develop whereby pests multiply explosively because of inevitable shifts in the environmental conditions regulating pest development, changes in physiological resistance, etc. All the evidence suggests that pesticides will need to be extensively utilized in the future. They provide the crop insurance that permits the farmer to invest in other inputs, i.e., irrigation, fertilizers, good seeds and mechanization. Chemicals are part of the production team that must be further perfected to meet the growing demands for food and fiber.

Usage of pesticides in the countries concerned in this project has been minimal which is reflected directly in considerable crop losses especially in the basic food crops such as maize, millet, sorghum, ground nuts, etc. Likewise environmental side effects have also been minimal as a result of under-utilization of pesticides.

The greater percentage of pesticides involved in increasing food crop production in the Sahel will be the insecticides; although it is anticipated increasing use of fungicides and herbicides will develop in the ensuing years.

As stated in the goals of this project, the decisions on pesticide use are to be based on assessments of the need for use. This assessment based on surveys will evaluate the degree of economic damage by a given pest or types of pests tolerable to a specific area of agriculture, and determine the need for one or more pesticides to control pests based upon a cost

benefit analysis.

Under tropical conditions, it is not possible to effectively protect farm workers from the effects of the more hazardous organo-phosphate pesticides, therefore wherever possible recommendations and training of personnel will bear this in mind to avoid unnecessary poisonings of humans, livestock, and wildlife. The U.S. Government will not procure highly toxic pesticides. Historically, BHC has been used in the Sahel countries in preference to other insecticides because of its relative safety, low mammalian toxicity, short residual activity, fairly wide spectrum and low cost. Other products such as carbaryl and malathion meet the same criteria.

It is generally agreed by research workers and practitioners in the field of crop protection and pest control that non-chemical methods of pest control are not likely to be effective substitutes for chemical pesticides by themselves; but will work best in conjunction with one or more other (chemical or non-chemical) pest control tools in an integrated pest management system. In this approach, the best of all available control techniques are brought to bear against pest problems, instead of sole reliance on chemical pesticides, or on any other single technique above.

The expertise under the PASA with the USDA will develop the theme of integrated pest management and will be an integral part of the project endeavor to minimize pesticide usage and consequently avoid adverse environmental effects

D. TABLES

TABLE I

RELATIVE MEASURE OF COUNTRY ECONOMIC AND SOCIAL DEVELOPMENT

	Chad	Cameroon	Mauritania	Senegal
1. GNP per capita in 1972	85	187	175	185
2. Life expectancy in 1971	40	48	42	44
3. Infant survival per 1,000 live births	825	858	831	841
4. Agriculture labor force as % of economically active populace	91%	82%	85%	76%
5. Literacy	10%	15%	5%	10%
6. Population in mid-1973	4.0	6.2	1.2	4.0
7. Population density per square mile	8	34	3	53
8. Acres per capita of agriculture land	32	6	78	

Sources:
1/ A.I.D. Economic Data Book, 1974

TABLE II

CEREAL PRODUCTION TRENDS (1970-1975)
(000 MT)

	1970	1971	1972	1973	1974	1975
MILLET & SORGHUM						
Cameroon	312	331	350	300	330	-
Chad	651	610	631	590	400	-
Mauritania	110	81	80	50	25 1/	-
Senegal	635	501	583	323	467	650
MAIZE						
Cameroon	273	282	350	310	350	-
Chad	-	-	11 2/	15 2/	-	-
Mauritania	-	-	-	-	-	-
Senegal	49	39	39	20	20	30
RICE						
Cameroon	18	14	15	-	-	-
Chad	37	39	51	25	30	35
Mauritania	-	-	-	-	-	-
Senegal	156	91	108	37	50	90

Sources:
1) FAO Production Yearbook, 1974.
2) Draft Report "The Recent Economic Evolution of the Sahel," Elliott Berg, The University of Michigan. Center for Research on Economic Development, April 1975.
3) A.I.D. Economic Data Book.
4) Department of Agriculture Service, Yaounde, Cameroon.
5) IBRD, Recent Economic Development.

1/ Includes 3-4,000 tons of Maize.
2/ Includes 6,000 tons of wheat in 1972 and 9,000 tons in 1973.

TABLE III

LOSS ESTIMATES FOR SELECTED FOOD CROPS
(1974)

	High Loss Estimates			Low Loss Estimates		
	Pests (%)	Disease (%)	Weeds (%)	Pests (%)	Disease (%)	Weeds (%)
CAMEROON						
Rice	20	7	15	10	3	7
Millet and Sorghum	20	10	25	10	5	12
Maize	20	14	35	10	7	16
Average	20	10	25	10	5	12
CHAD						
Rice	20	7	25	10	3	7
Millet and Sorghum	25	10	25	12	5	12
Maize	20	14	35	10	7	16
Average	22	10	25	11	5	12
MAURITANIA						
Rice	20	7	15	10	3	7
Millet and Sorghum	20	10	25	10	5	12
Maize	20	14	35	10	7	16
Average	20	10	25	10	5	12
SENEGAL						
Rice	20	7	15	10	3	7
Millet and Sorghum	20	10	25	10	5	12
Maize	20	14	35	10	7	16
Average	20	10	25	10	5	12

SUMMARY OF LOSS ESTIMATES FOR SELECTED FOOD CROPS
(1974)

	Cameroon		Chad		Mauritania		Senegal	
	High	Low	High	Low	High	Low	High	Low
	(%)		(%)		(%)		(%)	
Rice	42	20	42	20	42	20	42	20
Millet and Sorghum	55	27	60	29	55	27	55	27
Maize	69	33	69	33	69	33	69	33

SOURCES: High loss estimates due to pest infestations for millet and sorghum provided by officials of the Ministry of Agriculture and Crop Protection Units in each country.

Other loss data compiled from FAO Multi-Donor Mission Report, 1974; ~~Crop Protection and World Crop Production, Bayer Leverkusen, Germany, H. H. Gummer, 1967;~~ Ministries of Agriculture; USAID Country Missions; Unofficial on-site estimates.

CEREALS IMPORTS
(in thousands of MT and billions of CFA)

	1970	1971	1972	1973	1974
CAMEROON					
-Rice					
Quantity	7.7	8.8	9.0		
Value					
-Millet & Sorghum					
Quantity					
Value					
-Maize					
Quantity	188.0	45.0	100.0		
Value					
-Wheat & Wheat Flour					
Quantity	53.4	41.1	49.7		
CHAD					
-Rice					
Quantity	25.0	1.0			
Value					
-Millet & Sorghum					
Quantity					
Value					
-Wheat & Wheat Flour					
Quantity	6.5	6.7	6.9	10.6	
Value	0.4	0.4	0.4	0.7	
MAURITANIA 1/					
-Rice					
Quantity	11.0	16.2	10.0	24.0	28.0
Value	61.8	102.2		200.4	482.0
-Wheat & Wheat Flour					
Quantity		5.5	6.0	29.7	
Value		21.0	23.5	156.0	
-Maize					
Quantity				10.0	
Value				26.4	
-Millet & Sorghum					
Quantity				17.6	
Value				91.8	
-Other					
Quantity				10.0	
Value				28.4	

TABLE IV (cont'd)

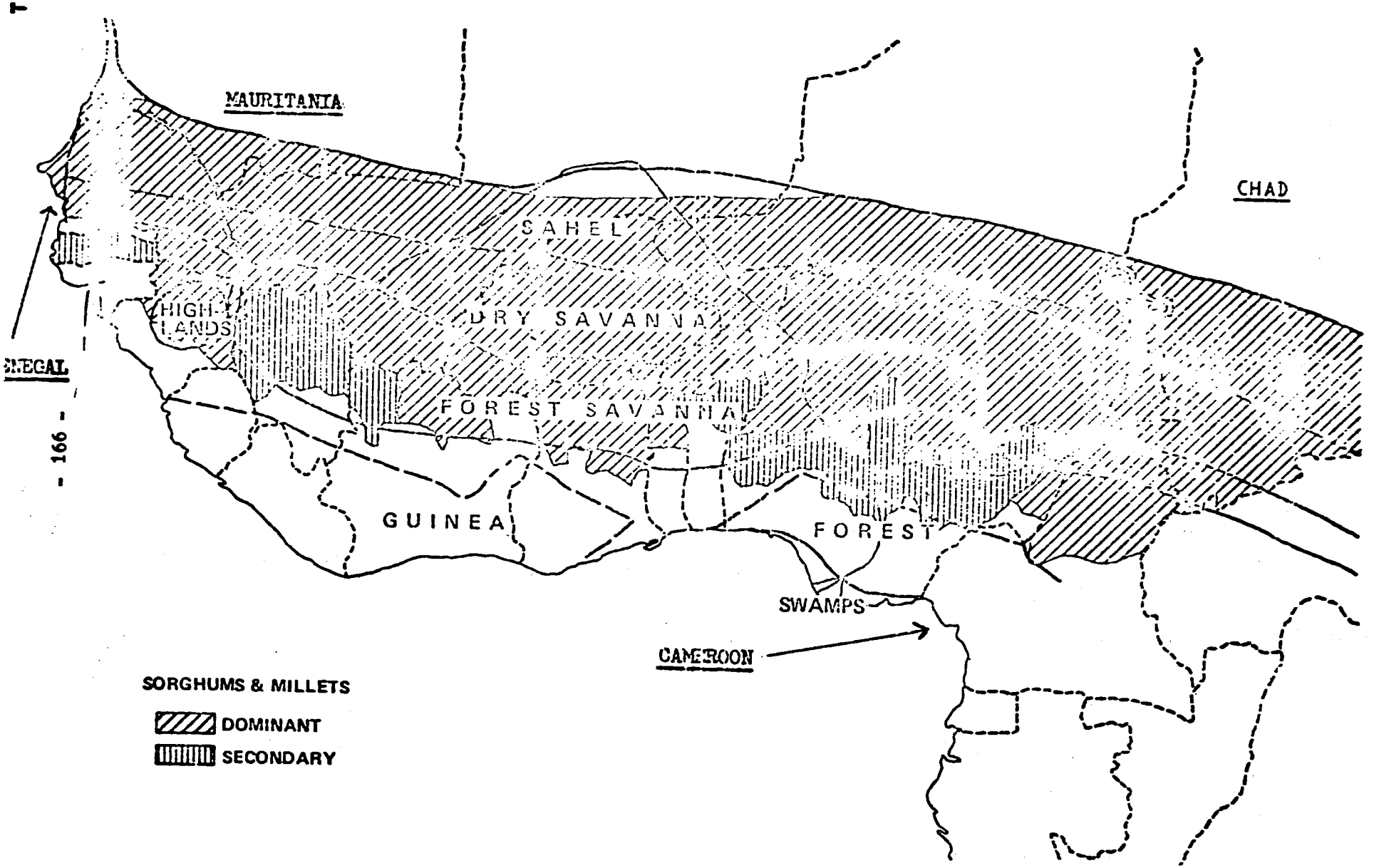
	1970	1971	1972	1973	1974
SENEGAL					
-Rice					
Quantity	119.0	188.0	170.0	192.0	176.0
Value	3.3	4.6	4.3	9.5	14.7
-Millet & Sorghum					
Quantity		30.0	10.0	41.0	4.0
Value		0.7	0.2	0.7	0.1
-Wheat					
Quantity	112.0	112.0	95.0	105.0	77.0
Value	2.4	2.6	2.1	2.6	2.9
-Maize					
Quantity	5.0	32.8	10.0		
Value					

Sources: FAO World Production and Trade Statistics, 1974; Draft Report "Economic Evolution of the Sahel," Elliott Berg, 1975

1/ In millions of ouguiyas for Mauritania.

TABLE V

WEST AFRICA - VEGETATION ZONES



ACTUAL AND POTENTIAL PRODUCTION OF SELECTED FOOD CROPS (1974) 1/

	Actual Production	Potential Production (Estimate)		Production Losses (Estimate)		Value 2/	
		High Loss	Low Loss	High Loss	Low Loss	High	Low
CAMEROON							
Rice	-	-	-	-	-	-	-
Millet & Sorghum	330	511	419	181	89	[illegible]	[illegible]
Maize	350	591	465	241	115	-	-
Total	680	1102	884	422	204		
CHAD							
Rice	30	43	6	13	6	-	-
Millet & Sorghum	400	640	516	240	116	[illegible]	[illegible]
Maize	-	-	-	-	-	-	-
Total	430	683	522	253	122		
MAURITANIA							
Rice	-	-	-	-	-	-	-
Millet & Sorghum	75	116	95	41	20	-	-
Maize	-	-	-	-	-	-	-
Total	75	116	95	41	20	-	-
SENEGAL							
Rice	50	71	60	21	10	-	-
Millet & Sorghum	467	724	593	[illegible]	[illegible]	[illegible]	[illegible]
Maize	20	34	27	14	7	-	-
Total	537	829	680	[illegible]	[illegible]	-	-

SOURCES: Tables II and III, Statistical Annex.

1/ 1,000 MT

2/ Billion CFA Units, at 1975 Price levels - See Table VII, Statistical Annex.

BASELINE ASSUMPTION FOR ECONOMIC ANALYSIS [1/]

	Cameroon	Chad	Senegal
PRODUCTS			
Millet and Sorghum	21 CFA/kg	25 CFA/kg	30 CFA/kg
Rice	31 CFA/kg	40 CFA/kg	42 CFA/kg
Maize	30 CFA/kg	-	30 CFA/kg
INSECTICIDE			
BCH	152 CFA/kg	152 CFA/kg	150 CFA/kg
EQUIPMENT			
Sprayer	255 CFA/ea	255 CFA/ea	250 CFA/ea
Duster	55 CFA/ea	55 CFA/ea	50 CFA/ea
PRODUCTION YIELD			
Millet and Sorghum	650 kg/ha	475 kg/ha	500 kg/ha
Rice	-	-	-
Maize	-	-	-

[1/] April 1975 farm gate prices - 210 CFA = $1.00 U.S.

TABLE VIII

ESTIMATE OF
FARM UNIT FINANCIAL RETURNS
(one hectare (CFA unit))

Year	COSTS 1/			BENEFITS 2/		
	Cameroon	Chad	Senegal	Cameroon	Chad	Senegal
1	3350	3350	3300	3066	3906	2970
2	152	152	150	3066	3906	2970
3	152	152	150	3066	3906	2970
4	152	152	150	3066	3906	2970

1/ On-farm costs of chemicals and equipment required to treat 1 hectare of millet/sorghum - 1 sprayer, 1 duster, and 20 kilograms of 25 percent BHC.

2/ Farm-gate value of incremental yield.

TABLE IX

PHASE I PROJECT FUNDING

FY 75 thru FY 78
($000's)

	Total	Personnel	Participants	Commodities	Other Costs
Senegal					
1975	394	146	46	119	83
1976	220	120	65	20	15
1977	220	130	30	40	20
1978	185	130	10	20	25
Total	1,019	526	151	199	143
Mauritania					
1975	148	0	24	61	63
1976	120	0	41	39	40
1977	149	70	24	30	25
1978	175	70	45	30	30
Total	592	140	134	160	158
Chad					
1975	225	65	27	93	40
1976	196	60	41	40	55
1977	208	65	53	60	30
1978	156	65	16	40	35
Total	785	255	137	233	160
Cameroon					
1975	333	130	35	107	61
1976	164	60	56	25	23
1977	123	65	21	25	12
1978	134	65	34	20	15
Total	754	320	146	177	111
By Year					
1975	1,100				
1976	700				
1977	700				
1978	650				
TOTAL	3,150				

AID 1020-20 (10-71)
SUPPLEMENT 1

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

NOTE: IF ONLY THIS IS AN ORIGINAL FORM, IT MAY BE USED AS AN AID TO ORGANIZING DATA FOR THE PAR REPORT. IT WILL NOT BE REVIEWED OR SUBMITTED.

Life of Project: From FY 1975 to FY 1978
Total A.I.D. Funding
Date Prepared:

Project Title & Number: (Sahel Food Crop Protection (Senegal) 625-11-130-916

PAGE 1

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Program or Sector Goal: The broader objective to which this project contributes: (A-1)	Measures of Goal Achievement: (A-2)	(A-3)	Assumptions for achieving goal target: (A-4)
To increase the capacity for domestic Agriculture production and to correspondingly reduce existing food deficits through the introduction of crop protective measures.	Field and stored food crop losses are reduced 50% by the EDP in control areas.	- Project Records - Implementation and work plans - Project Agreement - AID evaluation - PAR	- That host government gives priority to agriculture production. - That price policies are conducive to food crop production. - That transportation, marketing channels, and production inputs are available at prices affordable to local farm units. - That method and demonstration exercises will be conducted as intended on rural farm sites. - That crop protection practices are adaptable and acceptable to farmers.

p 1020-26 (11-73)
APPENDIX 1

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Life of Project:
From FY _____ to FY _____
Total U.S. Funding _____
Date Prepared: _____

Project Title & Number: (Sahel Food Crop Protection (Senegal) 625-11-130-916

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Project Purpose: (B-1)	Conditions that will indicate purpose has been achieved: End-of-Project status. (B-2)	(B-3)	Assumptions for achieving purpose: (B-4)
- To strengthen the ability of plant protection units to combat plant pests, and to demonstrate, train, and assist local farm units in pest management. - To extend to farm units information on pest management practices which will reduce pre and post-harvest food crop losses.	- Crop protection unit fully staffed, equipped, supplied, and operational. - Training facilities in place with training programs conducted on a scheduled basis. - Demonstration and control areas selected, and exercises conducted regularly.	- Crop Protection Unit staffing pattern and inventory. - Project Records - Implementation and work plans. - Project Agreement - AID evaluation - PAR	- That personnel will be assigned to the crop protection unit and available for academic and practical training. - That extension, agriculture service, farm unit, and other personnel will be available for training. - That personnel receiving training will be available to conduct method demonstration exercises. - That farm units accept suggested protection measures.

AID 1020-28 (11-72)
SUPPLEMENT 1

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Life of Project:
From FY _____ to FY _____
Total U.S. Funding _____
Date Prepared: _____

Project Title & Number: (Sahel Food Crop Protection (Senegal) 625-11-130-916

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Project Outputs: (C-1)	Magnitude of Outputs: (C-2)	(C-3)	Assumptions for achieving outputs: (C-4)
- An established and functioning plant protection unit, with a mobile field service capable of conducting demonstrations and combating local pest infestations. - A trained crop protection cadre, capable of training other personnel and farm units in the practical application of pest management technology. - A domestic capability is created to share regional and international research results; techniques; and policies relating to crop protection activities.	- One African counterpart (on understudy if qualified individual is not available) assigned to work with the Country Project Officer. - A selected number (See Part IV, section B, Country Implementation Plan) of personnel trained under regional training programs. - Building/office, training and boarding facilities. - Comprehensive National crop protection plan.	- Project Records - Implementation and work plans - Project Agreement - AID evaluation - PAR	- That host government provides personnel, land and building or office space required to establish and operate training program. - That trained personnel will be assigned to crop protection unit, on exec execution and agriculture services units. - That linkages can be created between regional/ international and domestic crop protection organizations.

AID 1020-28 (1-72)
SUPPLEMENT 1

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Life of Project:
From FY _____ to FY _____
Total U.S. Funding _____
Date Prepared: _____

Project Title & Number: (Sahel Food Crop Protection (Senegal) 625-11-130-916

PAGE 4

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Project Inputs: (D-1) **AID** - One Project Manager - One Project Officer Reg. Trng. Off. - Yaounde - Vehicles (1) for project manager and project officer, and equipment, supplies, materials, etc., as necessary for support. - Local-hire administrative or clerical staff. - Long-term academic and under-study training for selected African personnel. - Application equipment; sprayers, mining units, vehicles; demonstration pesticides; and other equipment, supplies, commodities, and materials as necessary for administrative and	Implementation Target (Type and Quantity) (D-2) - See Part IV, Section B, Country Implementation Plans for type, quantity, and cost of inputs. - A more detailed input-output implementation plan scheduling targets and activities will be developed following PP approval.	(D-3) - Implementation and work plans - Project Agreement - Design and Construction contracts - Procurement orders - PASA Agreement - Project Records	Assumptions for providing inputs: (D-4) - Technicians will be available on schedule at the planned funding levels. - Local design and cons. construction firms qualified to undertake construction on a timely basis. - Supplies, materials, and equipment can be procured on-time. - Funding will be available for life of project.

AID 1020-20 (11-71)
SUPPLEMENT 1

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Life of Project:
From FY _____ to FY _____
Total U.S. Funding _____
Date Prepared: _____

Project Title & Number: (Sahel) Food Crop Protection (Senegal) 625-11-130-916

PAGE 4

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Project Inputs: (D-1)	Implementation Target (Type and Quantity) (D-2)	(D-3)	Assumptions for providing inputs: (D-4)
operational support. Host Country Personnel; buildings or office space; land; Budget support for the crop protection unit; and other supportive services. Other OICMA and OCLALAV: will furnish assistance in combating international insect outbreaks and in teaching locust and grasshopper control methods through in-country, on-the-job training courses at the regional training centers. Other donors are expected to assist in the areas of research and teaching.			

AID DSC-1010 (3 79)
SUPPLEMENT 1

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

(INSTRUCTIONS: THIS IS AN OPTIONAL FORM WHICH CAN BE USED AS AN AID TO ORGANIZING DATA FOR THE PAR REPORT. IT NEED NOT BE RETAINED OR SUBMITTED.)

Project Title & Number: (Sahel Food Crop Protection (Cameroon) 625-11-130-916

Life of Project: From FY 1975 to FY 1978
Total U.S. Funding:
Date Prepared:

PAGE 1

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Program or Sector Goal: The broader objective to which this project contributes: (A-1)	Measures of Goal Achievement: (A-2)	(A-3)	Assumptions for achieving goal targets: (A-4)
To increase the capacity for domestic Agriculture production and to correspondingly reduce existing food deficits through the introduction of crop protective measures.	Field and stored food crop losses are reduced 50% by the EDP in control areas.	- Project records. - Implementation and work plans - Project Agreement - AID evaluation - PAR	- That Host government gives priority to agriculture production. - That price policies are conducive to food crop production. - That transportation, marketing channels, and production inputs are available at prices affordable to local farm units. - That method and demonstrating exercises will be conducted as intended on rural farm sites. - That crop protection practices are adaptable and acceptable to farmers.

AID 1020-20 (7-72)
SUPPLEMENT 1

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Life of Project:
From FY _____ to FY _____
Total U.S. Funding _____
Date Prepared: _____

Project Title & Number: (Sahel Food Crop Protection (Cameroon) 625-11-130-916

PAGE 2

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Project Purpose: (B-1)	Conditions that will indicate purpose has been achieved: End-of-Project status. (B-2)	(B-3)	Assumptions for achieving purpose: (B-4)
- To strengthen the ability of plant protection units to combat plant pests, and to demonstrate, train, and assist local farm units in pest management. - To extend to farm units information on pest management practices which will reduce pre and post-harvested food crop losses.	- Crop protection unit fully staffed, equipped, supplied, and operational. - Training facilities in place with training programs conducted on a scheduled basis. - Demonstration and control areas selected, and exercises conducted regularly.	- Crop Protection Unit staffing pattern and inventory list. - Project Records - Implementation and work plans - Project Agreement - AID evaluation - PAR	- That personnel will be assigned to the crop protection unit and available for academic and practical training. - That extension, agriculture service, farm unit, and other personnel will be available for training. - That personnel receiving training will be available to conduct method demonstration exercises. - That farm units accept suggested protection measures.

AID 1330-24 (11-78)
SUPPLEMENT 1

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Life of Project:
From FY _____ to FY _____
Total U.S. Funding _____
Date Prepared: _____

Project Title & Number: (Sahel Food Crop Protection (Cameroon) 625-11-130-916

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Project Outputs: (C-1)	Magnitude of Outputs: (C-2)	(C-3)	Assumptions for achieving outputs: (C-4)
- An established and functioning plant protection unit, with a mobile field service capable of conducting demonstrations and combating local pest infestations. - A trained crop protection cadre, capable of training other personnel and farm units in the practical application of pest management technology. - A domestic capability is created to share regional and international research results; techniques; and policies relating to crop protection activities.	- One African counterpart (on understudy if qualified individual is not available) assigned to work with t the Country Project Officer. - A selected number (See Part IV, section D, Country implementation plan) of personnel trained under regional training program. - Building/office, training and boarding facilities. - Comprehensive National crop protection plan.	- Project Records - Implementation and work plans - Project Agreement - AID evaluation - PAR	- That host government provides personnel, land and buildings or office space required to establish and operate training program. - That trained personnel will be assigned to crop protection unit, or execution and agriculture services units. - That linkages can be created between regional/international and domestic crop protection organizations.

AID 1020-20 (5-72) SUPPLEMENTAL

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Life of Project: From FY _____ to FY _____
Total U.S. Funding _____
Date Prepared: _____

Project Title & Number: (Sahel Food Crop Protection (Cameroon) 625-11-130-916

PAGE 2

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Project Inputs: (D-1)	Implementation Target (Type and Quantity) (D-2)	(D-3)	Assumptions for providing inputs: (D-4)
AID - One project manager- Dakar - One project officer-Yaounde - Reg. Trng Officer - Yaounde - Vehicles (1) for project manager and project officer, and equipment, supplies, materials, etc., as necessary for support. - Local hire administrative or clerical staff. - Long term academic and understudy training for selected African personnel. - Application equipment; sprayers, mining units; vehicles; demonstration pesticides; and other equipment, supplies, commodities, and materials as necessary for administrative and	- See Part IV, Section D, Country Implementation Plans for type, quantity and cost of inputs. - A more detailed input-output implementation plan scheduling targets and activities will be developed following PP approval.	- Implementation and work plans - Project Agreement - Design and construction contracts - Procurement orders - PASA Agreement - Project Records	- Technicians will be available on schedule at the planned funding levels. - Local design and construction firms qualified to undertake construction on a timely basis. - Supplies, materials, and equipment can be procured on-time. - Funding will be available for life of project.

AID 1320-20 (11-72)
SUPPLEMENT 1

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Life of Project:
From FY _____ to FY _____
Total U.S. Funding _____
Date Prepared: _____

Project Title & Number: (Sahel Food Crop Protection (Cameroon) 625-11-130-916

PAGE 4

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Project Inputs: (D-1)	Implementation Target (Type and Quantity) (D-2)	(D-3)	Assumptions for providing inputs: (D-4)
operational support. Host Country Personnel; buildings or office space; land; Budget support for the crop protection unit; and other supportive services. Other OICMA and OCLALAV: will furnish assistance in combating international insect outbreaks and in teaching locust and grasshopper control methods through in-country, on-the-job training courses at the regional training centers. Other donors are expected to assist in the areas of research and teaching.			

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Project Title & Number: [illegible]

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Program or Sector Goal: The broader objectives which this project contributes: (A-1)	Measures of Goal Achievement: (A-2)	(A-3)	Assumptions for achieving goal targets:
To increase the capacity for domestic agriculture production and to correspondingly reduce existing food deficits through the introduction of crop protective measures.	Field and stored food crop losses are reduced 50% by the EOP in control areas.	-Project Records -Implementation and work plans -Project agreement -AID evaluation -PAR	-That host government gives priority to agriculture production. -That price policies are conducive to food crop production. -That transportation marketing channels, and production inputs are available at prices affordable to local farm units. -That method and demonstration exercises will be conducted as intended on rural farm sites. -That crop protection practices are adaptable and acceptable to farmers.

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Life of Project:
From FY _____ to FY _____
Total U.S. Funding _____
Date Prepared: _____

Project Title & Number: _____

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Project Purpose: (B-1)	Conditions that will indicate purpose has been achieved: End-of-Project status. (B-2)	(B-3)	Assumptions for achieving purpose: (B-4)
-To stren-then the ability of plant protection units to combat plant pests, and to demonstrate, train, and assist local farm units in pest management. -To extend to farm units information on pest management practices which will reduce pre and post-harvest food crop losses.	-Crop protection unit fully staffed, equipped, supplied, and operational -Demonstration and control areas selected, and exercises conducted regularly.	-Crop Protection Unit staffing pattern and inventory list -Project Records -Implementation and work -Project agreement -AID evaluation -PAR	-That personnel will be assigned to the crop protection unit and available for academic and practical training. -That extension, agriculture service, farm unit, and other personnel will be available for training. -That personnel receiving training will be available to conduct method demonstration exercises. -That farm units accept suggested protection measures.

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Life of Project:
From FY _____ to FY _____
Total U.S. Funding _____
Date Prepared: _____

Project Title & Number: _____

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Project Outputs: (C-1)	Magnitude of Outputs: (C-2)	(C-3)	Assumptions for achieving outputs: (C-4)
-An established and functioning plant protection unit, with a mobile field service capable of conducting demonstrations and combatting local pest infestations. -A trained crop protection cadre, capable of training other personnel and farm units in the practical application of pest management technology. -A domestic capability is created to share regional and international research results techniques; and policies relating to crop protection activities.	-One African counterpart (on understudy if qualified individual is not available) assigned to work with the Country Project Officer. -A selected number (see Part IV, section C, Country implementation plan) of personnel trained under regional training program. -Building/office -Comprehensive national crop protection plan	-Project Records -Implementation and work plans -Project agreement -AID evaluation -PAR	-That host government provides personnel, building or office space required to establish and operate program. -That trained personnel will be assigned to crop protection unit, or extention and agriculture services units. -That linkages can be created between regional/internatinal and domestic crop protection organizations.

AID 1020-10 (11-70)
SUPPLEMENT 1

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Life of Project:
From FY _____ to FY _____
Total U.S. Funding _____
Date Prepared: _____

Project Title & Number: _____

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Project Inputs: (D-1)	Implementation Target (Type and Quantity) (D-2)	(D-3)	Assumptions for providing inputs: (D-4)
<u>AID</u> - -One project manager - Dakar -One project officer - Dakar Reg. Trng. Officer - Yaounde -Vehicles, and equipment, supplies, materials, etc., as necessary for support. -Local-hire administrative or clerical staff. -Long-term academic and under-study training for selected African personnel -Application equipment; sprayers, mixing units, vehicles; demonstration pesticides, supplies, commodities, and materials as necessary for administrative and operational support. <u>Host Country</u> -Personnel; buildings on office	-See Part IV, Section C, Country Implementation plans for type, quantity, and cost of inputs. -A more detailed input-output implementation plan scheduling target and activities will be developed following PP approval.	-Implementation and work plans -Project agreement -Design and construction contracts -Procurement orders -Pasa agreement -Project Records	-Technicians will be available on schedule at the planned funding levels. -Supplies, materials, and equipment can be procured on-time. -Funding will be available for life of project.

AID 1020-25 (11-70)
SUPPLEMENT 1

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Life of Project:
From FY _____ to FY _____
Total U.S. Funding _____
Date Prepared: _____

Project Title & Number: _____

PAGE 4

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Project Inputs: (D-1)	Implementation Target (Type and Quantity) (D-2)	(D-3)	Assumptions for providing inputs: (D-4)
space; budget support for the crop protection unit; and other supportive services. Other OICHA and OCLALAV: will furnish assistance in combating international insect outbreaks and in teaching locust and grasshopper control methods. Other donors are expected to assist in the areas of research and teaching.			

AID 1020-20 (10-70)
SUPPLEMENT 1

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

(INSTRUCTION: THIS IS AN OPTIONAL FORM WHICH CAN BE USED AS AN AID TO ORGANIZING DATA FOR THE PAR REPORT. IT NEED NOT BE RETAINED OR SUBMITTED.)

Project Title & Number: Stored Food Crop Protection (Cloud) 605-11-130-946

Life of Project:
From FY 1975 to FY 1980
Total U.S. Funding
Date Prepared:

PAGE 1

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Program or Sector Goal: The broader objective to which this project contributes: (A-1) To increase the capacity for domestic agriculture production and to correspondingly reduce existing food deficits through the introduction of crop protective measures.	Measures of Goal Achievement: (A-2) Field and stored food crop losses are reduced 50% by the EOP in control areas.	(A-3) - Project Records - Implementation and work plans - Project agreement - AID evaluation - PAR	Assumptions for achieving goal targets: (A-4) - That host government gives priority to agriculture production. - That price policies are conducive to food crop production. - That transportation marketing channels, and production inputs are available at prices affordable to local farm units. - That method and demonstration exercises will be conducted as intended on rural farm sites. - That crop protection practices are adaptable and acceptable to farmers.

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Life of Project:
From FY _____ to FY _____
Total U.S. Funding _____
Date Prepared: _____

Project Title & Number: _____

PAGE 2

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Project Purpose (B-1)	Conditions that will indicate purpose has been achieved: End-of-Project status. (B-2)	(B-3)	Assumptions for achieving purpose: (B-4)
- To strengthen the ability of plant protection units to combat plant pests, and to demonstrate, train, and assist local farm units in pest management. - To extend to farm units information on pest management practices which will reduce pre and post-harvest food crop losses.	- Crop protection unit fully staffed, equipped, supplied, and operational - Demonstration-and control areas selected, and exercises conducted regularly.	- Crop Protection Unit staffing pattern and inventory list. - Project Records - Implementation and work plans - Project agreement - AID evaluation - PAR	- That personnel will be assigned to the crop protection unit and available for academic and practical training. - That extension, agriculture service, farm unit, and other personnel will be available for training. - That personnel receiving training will be available to conduct method demonstration exercises. - That farm units accept suggested protection measures.

AID 1020-28 (11-72)
SUPPLEMENT 1

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Life of Project:
From FY _____ to FY _____
Total U.S. Funding _____
Date Prepared: _____

Project Title & Number: _____

PAGE 3

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Project Outputs: (C-1)	Magnitude of Outputs: (C-2)	(C-3)	Assumptions for achieving outputs: (C-4)
AID -One project manager - Dakar Reg. Trng. Officer - Yaounde -One project officer - Ndjamena -Vehicles (2) for project manager and project officer, and equipment, supplies, materials, etc., as necessary for support. -Local-hire administrative or clerical staff. -Long-term academic and under-study training for selected African personnel -Application equipment; sprayers, mixing units, vehicles; demonstration pesticides, supplies, commodities, and materials as necessary for administrative and operational support. **Host Country** -Personnel; buildings or office	-See Part IV, Section E, Country Implementation plans for type, quantity, and cost of inputs. -A more detailed input-output implementation plan scheduling target and activities will be developed following PP approval.	-Implementation and work plans - -Project agreement -Design and construction contracts -Procurement orders -Pasa agreement -Project Records	-Technicians will be available on schedule at the planned funding levels. -Supplies, materials, and equip-ment can be procured on-time. -Funding will be available for life of project.

AID 1020-25 (11-78)
SUPPLEMENT 1

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Life of Project:
From FY _____ to FY _____
Total U.S. Funding _____
Date Prepared: _____

Project Title & Number: _____

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Project Inputs: (D-1)	Implementation Target (Type and Quantity) (D-2)	(D-3)	Assumptions for providing inputs: (D-4)
space; budget support for the crop protection unit; and other supportive services. Other OICMA and OCLALAV: will furnish assistance in combating internatonal insect outbreaks and in teaching locust and grasshopper control methods. Other donors are expected to assist in the areas of research and teaching.			

AID 1020-20 (11-79)
SUPPLEMENT 1

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Life of Project:
From FY _____ to FY _____
Total U.S. Funding _____
Date Prepared: _____

Project Title & Number: _____

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Project Outputs: (C-1)	Magnitude of Outputs: (C-2)	(C-3)	Assumptions for achieving outputs: (C-4)
-An established and functioning plant protection unit, with a mobile field service capable of conducting demonstrations and combatting local pest infestations. -A trained crop protection cadre, capable of training other personnel and farm units in the practical application of pest management technology. -A domestic capability is created to share regional and international research results techniques; and policies relating to crop protection activities.	-One African counterpart (on understudy if qualified individual is not available) assigned to work with the Country Project Officer. -A selected number (See Part IV, section E, Country implementation plan) of personnel trained under regional training program. -Building/office -Comprehensive national crop protection plan	-Project Records -Implementation and work plans -Project Agreement -AID evaluation -PAR	-That host government provides personnel, building or office space required to establish and operate program. -That trained personnel will be assigned to crop protection unit, on extention and agriculture services units. -That linkages can be created between regional/international and domestic crop protection organizations.

E. CREDIT

There is at present in each participating country, except Mauritania, institutions in mechanism for channeling credit to the farm populace. SODEVA (Senegal),ONDR (Chad), and FONADER (Cameroon) are government agriculture support organizations especially designed to provide credit and other inputs on marketing services to farm units. It is anticipated that farm units in the project control areas will request forward financing for crop protection inputs after the first or second year of the project. To ensure that funds will be available when necessary, a request will probably be made for 2-5 million dollars at the end of phase I for this purpose. These funds will be funneled through existing organizations or other institutions as agreed upon by A.I.D. and host governments for the procurement of chemicals, applicators, pest resistant seeds, or other plant protection supplies. The need for these funds will be determined by country project officers through periodic surveys and interviews with farm families in the project control areas. A.I.D. is currently supporting or assisting various credit delivery systems on a regional or bilateral basis in each of the Sahel countries. As farmer credit demands are unknown at this time, it is felt that actual allocation of funds would be premature. When credit needs are more firmly identified, delivery can be implemented through the above-mentioned framework in the form of loans or grants directly to farmers on farm cooperatives. It is further anticipated that credit will be mainly in-kind, with repayment periods ranging from two to four years dependent upon amount and type of activity for which credit is extended.

PRJP 6-28-75

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JUN 27 11 56 AM '75

Hold for Kelly Jim Graham

JUN 27 1975

ACTION MEMORANDUM FOR THE ADMINISTRATOR

THRU: ES

FROM: AA/PPC, Philip Birnbaum

SUBJECT: Sahel Food Crop Protection Project 625-916

Problem: Because this proposed project exceeds $2.0 million your authorization of the attached Project Paper is required.

Discussion: After several years of low food crop production, primarily as a result of the drought, the year 1974 with better rainfall in the Sahel area held forth the potential for a return to predrought output. However, reports of heavy insect attacks began in April of 1974 and continued to be reported through the end of crop harvests in November. Consequently, several donor organizations and the Office of Sahel Relief Operations (OSRO) organized an emergency short-term food crop protection program. Donors contributed cash, equipment and pesticides totaling $4,115,000 which saved thousands of tons of grain; but due to the enormous area involved could save but a small portion of the region's food crops.

In October of 1974, the AID Administrator and the Deputy Assistant Administrator for Africa on an inspection trip of the Sahel area observed at first hand the damage insects were inflicting on food crops. The situation was described in a series of cables to AID/W, which requested possible assistance in addition to that being provided on a short-term basis by OSRO. Following a field visit by plant protection experts from AID and the United States Department of Agriculture, it was concluded that it was too late in the harvest season for a massive airlift of pesticides, application equipment, vehicles, or even agricultural aircraft to apply pesticides over large areas. AID provided about $100,000 for pesticides for emergency help.

In order to help the Sahel nations develop a continuous pest control capability on food crops, a long-term crop protection project was proposed. An international meeting attended by donor nations and multidonor organizations was organized to arrive at a consensus on what courses of action for Sahel pest control should be undertaken. This meeting was held in Washington on December 11 and 12, 1974, and it was attended by members of international organizations such as FAO, OCLALAV and OICMA, bilateral donor nations' experts, experts from AID, USDA, and the University of California. It was unanimously agreed at this conference that "It is absolutely essential for each country (in the Sahel region) to develop its own institutional capability to maintain surveillance and control its crop pests." AFR/CWR prepared a Project

Identification Document (PID) for a regional project proposal. The PID was transmitted to six Sahel countries, the Cameroon, and the other major donors on January 13, 1975. All CWR field posts responded with affirmative and enthusiastic replies for such a project in their respective countries, and with their host Governments' concurrences, and requested to be included in the final project design. On the basis of these field responses, Africa Bureau prepared a Project Review Paper (PRP). The PRP was approved by Assistant Administrator for Africa on March 4, 1975, with the proviso that a Design Team be sent to all seven possible participating countries to collect data necessary to proceed to the final stage of preparing a Project Paper. The Design Team completed its field trip and finalized the attached Project Paper (PP) in late May 1975.

The proposed grant for this project will provide financing for the following interrelated components:

1. The strengthening or establishment of National Plant Protection Units in Mauritania, Senegal, Chad and Cameroon with a mobile field service capable of conducting demonstrations and combating local pest infestations;

2. Training a crop protection cadre to be capable of training other personnel and farmers in the practical application of pest management technology; and

3. Creating a domestic capacity to share and utilize regional and international research results, techniques, and policies relating to crop protection activities.

The project is now programed to cover an initial four years at a cost to AID of $3,150,000. One million one hundred thousand dollars required for the first year of operation will be obligated against the special drought appropriation in order to initiate the project immediately so as to have a substantial impact on the next crop year. Thereafter the project would become part of our regular development assistance program to the Sahel, and approximately $2,050,000 in FAA Section 103 funds will be provided for the remaining three years of the first phase of this project. Prior to the obligation of these additional funds, an in-depth evaluation, and, if necessary, a review and revision of the Project Paper, will be made. Prior to execution of country project agreements, AID engineers will review construction cost estimates so as to reflect in the project agreements any inflationary pressures or other price factors which might raise cost estimates. The Project Manager will be stationed in Dakar, Senegal, but will service the entire project. All funds will be allotted to the Regional Development Officer in Dakar and will be accounted for by the Regional Controller in Dakar on behalf of the total project.

The participating countries will provide assistance to this project through budgetary support of either their respective crop protection units or their Ministries of Agriculture. AID will finance the services of three technical advisers (crop protection specialists), who will be selected on the criteria of "crop protection specialists" rather than on the more limited criteria of "entomology" as had been stated in the Project Paper; and one plant protection training officer, through a PASA arrangement with USDA. AID will also provide a direct-hire Project Manager, and supporting staff. Peace Corps will be asked to provide volunteers to this project where possible.

Under this project the Project Manager will assist in the organizing of an interlinking network focusing on both field and storage problems of pest control. He will be responsible for collecting and disseminating previous and current research results to participating countries. Following the recommendation of the Project Committee, the Project Manager and the Country Project Officers will be especially cognizant of the necessity to include women participants in all phases of project activities. This was included in the Project Paper, but the Committee wishes this stressed for approval of the project. Training programs at all levels will be continually monitored for affirmative action in creating opportunities and subsequent placement of women.

The Crop Protection project clearly meets the new criteria of the Foreign Assistance Act by directing assistance to the poorest and least fortunate of the developing societies, while concurrently augmenting the production of food in this critically deficit area. Furthermore, the distribution of project benefits is especially designed for accrual to the rural poor subsistence-farm family units.

In addition to the above, the following criteria were used in appraising this project proposal:

(a) An adequate institutional framework

The major thrust of activities to be undertaken in this project will be through the Crop Protection Units or the agricultural services of the respective participating countries. The present organizational structure in each country will be substantially improved and strengthened by the technical assistance provided by AID, and sufficient cooperative, marketing, and other public linkages exist within each country to facilitate the necessary alignment of objectives and implementation coordination.

(b) Technical soundness

A 60-day study was completed by the Design Team during March-April 1975. The technical components of the project are of minimal sophistication, and appear to be realistic for the target social/environmental setting.

(c) Financial viability

The financial framework of the project has been designed to enhance existing host country budgetary and development efforts in the agriculture sector. Primary operational costs will be assumed by the participating countries. Regional operational costs will be shared by AID and host countries through the life of this project.

(d) Economic feasibility

The economic impact of this project depends upon the ability of project components to reduce the amount of crop production losses now occurring from pest infestation. The economic soundness of this project has been studied and found to be acceptable for projects of this type.

(e) Commodity procurement

It is our view that compliance with normal AID procurement policies, i.e., restriction of procurement to U.S. sources, would, in the circumstances of this project, constitute a serious restriction against providing timely and beneficial assistance to the people of the Sahel region. Section 639A(b) of the Foreign Assistance Act of 1961, as amended, which is the source of funds for the initial year of operation for this project, expressly provides that assistance to the drought-stricken nations of Africa may be provided "notwithstanding any...restriction contained in this or any other Act."

The situation in the participating countries parallels that in the other Sahel States: with commodity imports entirely from France and the other EEC countries, U.S. equipment and commodities cannot be serviced or repaired in the event of breakdown. Spare parts are not available, and Africans are not trained in the maintenance of U.S. equipment. Audits and inspections of AID projects in this area which have included the provision of large amounts of U.S. equipment have been sharply critical of the difficulties of host Governments in maintaining this equipment after project phase-out. An additional factor to be considered if procurement were to be restricted to the U.S. is the lead time of up to one year for the delivery of commodity orders required during the first year, and valued at approximately $380,000.

In addition, on the basis of the above circumstances, commodity procurement from Geographic Code 935 (Special Free World) is requested for the life of this project, regardless of funding source (See Annex G, Commodity Procurement Source Waiver). Nevertheless, an attempt will be made prior to project implementation to maximize to the extent feasible U.S. source and origin procurement. A recapitulation of U.S. inputs is found in Parts IV and VI, and Annex G, Commodity Procurement Waiver Statement. Your approval of this project will constitute approval of the waiver as set forth in Annex G.

This project has been reviewed and cleared by all of the concerned AID offices and has the approval of the AFR Executive Committee for Project Review (ECPR). Section 113 of the Foreign Assistance and Related Programs Appropriations Act of 1975 does not require Congressional Notification prior to Agency authorization of the use of FAA Section 639A(b) funds. With respect to meeting the Section 113 notification requirements for the FAA Section 103-funded portion of the project, such notice is included in the FY 76 Congressional Presentation. Section 110(a) does not apply to funds made available under Section 639(A) (b) of the FAA, and since this is a regional project, Section 110(A) of the FAA is not applicable to the Section 103-funded portion of the project.

Recommendation: It is recommended that you approve the attached Project Paper for Sahel Food Crop Protection.

Approved: (PP was signed by J.E.Murphy 6/28/75)

Disapproved: _____

Date: _____

Attachment:
Project Paper

AFR/RA:EGibson:abs 6/19/75

Clearances:

AA/AFR:SCAdams, Jr.	by Abb	Date JUN 26 1975
GC:CGladson		Date 6/26
AFR/CWR:DShear		Date 7/25
AFR/DP:MWarnecke	Draft	Date
AFR/DP:RHuesmann		Date 6/25/75
AFR/CWR:ICoker		Date 6/25
AFR/CWR:JPatterson	Draft	Date
GC/AFR:EDragon		Date
AFR/CWR:JMcLaughlin	Draft	Date
AFR/CWR:LSPeck	Draft	Date
PPC/DPRE:HSharlach		Date
AFR/DS:PLyman		Date
SER/FM:MVahey	Draft	Date
AA/TA:SButterfield		Date 6/25/75
SER/COM:JShollenberger	Draft	Date
PPC/DPRE:AHandly		Date