PROJECT REVIEW PAPER

TITLE: SAHEL FOOD CROP PROTECTION PROJECT

FY PROPOSED FOR FINANCING: FY 75/76
See Section III - Project Description for explanation of ten-year project duration

APPROPRIATE CATEGORY: Food Production and Nutrition

DATE OF SUBMISSION TO BUREAU: February 1975

PROJECT DEVELOPMENT TEAM:

1. L. Stanley Peek, Chief, AFR/CWR/AGR
2. Donald D. Shallow, Project Design Officer, AFR/CWR/AGR
3. Joseph W. Gentry, APHIS, PPQ, USDA

I. PRIORITY AND RELEVANCE

In recent months the increased demand for emergency assistance in the Sahel States has suggested certain conclusions which bear on the medium and long-term recovery and development of the Sahelian zone. The present capability of the Sahel States to manage common, annual crop pests is extremely limited. This condition, where it exists, will tend to neutralize attempts at increasing crop production. The Sahel Governments are aware of the crop pest problem and many are ready to seek a long-range solution to it. The members of the donor community are also aware of the problem. They have already contributed to resolving local outbreaks and would probably support a longer term solution. Up to now there have been no overall proposals advanced for the technical solution of the problem, which of necessity must provide for active efforts in each country as well as a coordinated regional approach. The U.S. has taken the initiative to obtain a consensus among the interested donor and African technicians as to a technically feasible approach to the solution of this problem.

The agricultural sectoral program goal of first priority in all Sahel countries is to increase production and especially of food crops. The FY 1976 Field Budget Submission (FBS) for the Central and West Africa Regional Program has selected as the number one major area of concentration, the production and marketing of food crops and the necessity to improve the quality of rural life.

The project purpose is to establish in each participating Sahel country a self-sufficient plant protection organization to demonstrate to farmers the most efficient methods of insect control, which should lead to an increase in agricultural production and farmer income.

II. BORROWER/GRANTEE/ADMINISTRATING AGENCY

The U.S. will have a bilateral Project Agreement or Memorandum of Agreement with each of the participating host Governments. The administering agency may differ in each country and will be determined with specificity by the field survey team and will be included in the Project Paper. In most cases it will probably be a unit of the individual Ministry of Agriculture.

III. DESCRIPTION OF PROJECT

This is a technical assistance grant project. Inputs for services and support of a direct hire Project Manager will be funded by the Africa Bureau. Experts, commodities, participant training, and other costs for plant protection experts' support are suggested to be funded under a PASA with USDA.

A. Duration

This project has an estimated ten-year duration with three phases of four, three and three years.

During Phase I from FY 75 or FY 76 to FY 78-FY 79 activities will emphasize the protection of food crops both before and after harvest. The capability of the plant protection units to achieve this in each participating country will be enlarged and improved by training the field staffs and host country professional memebers for the leadership positions in regional and headquarters offices.

Governments must locate and provide chemicals and determine the feasibility of producing, importing or mixing pesticides. This is necessary for building a distribution and marketing system that will provide farmers with inputs demonstrated to give profitable pest control results.

The participating countries' capabilities to conduct, direct, and logistically support pest control campaigns through farmers' participation will commence from different levels of efficiency. Some plant protection units may require five or six years to achieve this objective and others may be able to reach the target of Phase I in two or three years. Therefore, the beginning of Phase II will vary from country to country.

Phase II of the project will increase the variety of crops for which campaign control measures will be developed. These could include deciduous fruit trees, nuts, and date and coconut palms, cocoa, coffee and fiber crops. Phase II will also add assistance to develop more advanced survey and forecasting skills for predicting pest outbreaks, both at the national and at the local level by the farmers.

Field trials officers trained during the first phase will commence a concentrated campaign to take insect control research results to the field. Linkage of national, regional and international research institutions will be built to coordinate research work that will benefit the farmers.

Plant quarantine legislation, both national and international, should be developed to prevent the introduction and possible export of harmful species into or away from the nations. This requires trained staff to conduct the regulatory functions of the individual countries' phytosanitary sections for inspection, quarantine and/or treatment by fumigation or other methods at airports, sea ports and border entry posts.

Phase III will add assistance in developing more sophisticated methods of integrated pest control where more than one method, such as

spraying or dusting, is used in conjunction with cultivation practices and/or biological control techniques.

Also, in Phase III more emphasis will be placed on solving other plant pest control problems such as destructive nematodes, weeds, birds, termites and plant diseases. Some nations may also require assistance in training personnel for developing government and/or private aerial application capabilities.

It is estimated that support will be provided for the above activities over an estimated ten-year span but will not be definitely limited to that period for each country. The project should have flexibility to increase or decrease the number of countries participating. A previous project of the same type, which operated for fourteen years in the Middle East and other areas of Africa, had from six to thirteen participants at various times.

B. Plans for achieving objective

1. Establish and staff a Regional Pest Management project headed by a coordinator with a selected Plant Protection Specialist stationed in each participating country as a counterpart to appropriate Ministry of Agriculture offices.

2. Provide liaison on intra- and interregional basis on administrative and operational matters interlocking with goals of regional organizations such as FAO, OICMA, OCLALAV, and other agencies interested in development of agricultural resources of the region.

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

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

b. 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.

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

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

a. Direct and conduct surveys to determine major insect problems, assess population and incidence levels for treatment purposes, estimate crop losses.

b. Determine and carry out demonstrations of the most effective and economical methods of pest control, 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 applicators and impact on the nontarget environment.

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

e. Provide technical advice and consultation to regional organizations and other interests 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.

IV. BENEFICIARY

The primary benefits of the project will go to small farmers. As food crop sufficiency is reached and farmers can increase production of cash crops, Governments will also benefit through decreased food imports and possible export of crop surpluses.

The crop losses caused by insects have not been quantified, but it is apparent that present losses are beyond tolerable levels on most crops in virtually all Sahel areas. Losses may be total in cases of mass invasion of migratory locusts, mainly the African migratory locust and desert locust. Only constant monitoring and application of prompt control measures before infestation of crops prevent widespread devastation from occurring.

During the 1974 crop year, the amount of damage caused by indigenous grasshopper species in various regions of Sahel countries was estimated at between 10% and 70%. This was a dramatic example that good climatic conditions for crops are also conducive to insect attacks, especially when adequate rainfall is present for the first time after several years of drought conditions. However, it is also known that farmers suffer repeated annual losses, but these have been absorbed by the agricultural communities which lack the pest control campaign inputs to reduce losses.

Yields of cowpeas, an important high protein food crop, can be increased severalfold with timely insecticide applications. An earworm has caused 20-30% losses in millet production in Niger for the last several years.

Stored products insects are also extremely serious in all areas. Weevils in stored beans and peanuts have caused a 50% weight loss in eight months in some countries. In Mali the stored millet, sorghum, and corn losses from the Khapta beetle, and other stored grain pests, is estimated for October 1974 - September 1975 as 39,000 tons or $7.500,000 at today's

world market prices for these commodities. These are cereals grown in Mali and not those imported as food grain donations, which usually suffer higher losses.

Most major pest species have been identified but economical control measures have not been developed for all. A team consisting of a plant protection expert, an agricultural economist and a program specialist will visit the Sahel countries in February 1975 and, among other duties, will collect information required to make an estimate of the amount of damage to each crop and what method of treatment is feasible. In their report an attempt will be made to estimate cost/benefit ratios which will convince farmers and Governments that crop pest management is necessary and profitable, and also to provide the economic justification for the Project Paper.

V. PROJECT DESIGN

A draft logical framework for this proposal is attached as Annex I.

VI. AID EXPERIENCE

A. Regional insect control: Middle East

A pest control project was successfully conducted by an AID predecessor agency, the U.S. Foreign Operation Administration (F.O.A.) for the Near East/South Asia area commencing in 1951. The original purpose of that project was to make participating nations capable of combating the centuries-old desert locust invasions. Their common goal of combating and eventually stopping locust incursions that had devastated their farm lands since time immemorial was realized in 1965. These countries also had other similar crop pest problems, so the project was expanded in 1954 to include efforts on research, teaching and extension to build plant protection units capable of combating more than locusts. The project became the Regional Insect Control project 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 established aerial units for applying pesticides by aircraft. Pilot and mechanic training schools were conducted with assistance of the U.S., and the nations purchased aircraft for the plant protection units.

As a result of this coordinated international effort, the locusts were beaten back to their primary breeding grounds in Ethiopia. After swarms crossed the Red Sea to the Saudi Arabia peninsula, they bred another generation and scattered as far as East Pakistan (Bangladesh). As more powerful aircraft were developed and improved techniques of application were taught, it enabled the fight to be carried into the previously inaccessible desert locust primary breeding grounds in Ethiopia where swarms have originated for thousands of years. The successful conclusion of this project 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.

The United Kingdom and the Foreign Agricultural Organization of the United Nations made large contributions to the battle against the desert locust. Their activities were especially important for surveillance, research on new combat technologies, and reporting networks for predicting invasions.

This new project for the Sahel countries, most of which are at a similar stage of development as were the Middle East countries when the Regional Locust Control project was initiated, is based on the same principles but does not include establishing individual aerial units. Aerial application capabilities will be provided by OICMA and OCLALAV.

It is believed by many countries that Governments should have the entire responsibility for the protection of growers' crops from pests. We do not share this view and believe that plant protection should be the grower's responsibility except for such activities as pest forecasting,

quarantine enforcement, extension, etc. Government spraying of growers' fields has not been successful in other countries. It is the larger grower who benefits most from this activity and plant protection must 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 an important charge to the extension service.

Critics of this view would argue 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, individual plantings can be properly protected regardless of the existence of adjacent unprotected fields. 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.

B. Agricultural extension*

A major bottleneck or "gap" in agricultural production and 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 get to the small or peasant farmers who are on a subsistence base. Extension is an important link in the improvement of peasant agriculture.

*Crop Protection in Senegal, Niger, Mali, Ghana, Nigeria, Kenya, Tanzania and Ethiopia, Sasser, J.N., Reynolds, H.T., Meggitt, W.F., and Hebert, T.T., University of California Contract No. AID/csd-3926, October-December 1972

It has been observed that extension effort and acceptance is faster if a commercial crop is involved. Again, lack of trained personnel and funds are the major factors. Farmers, for example, might accept animal traction but neither money nor credit is available. There are certain sociological and traditional concerns that also slow change.

It is necessary to bring scientific information to bear on a scale that is meaningful and in keeping with the farmer's ability to use it. Change must be gradual and an extended, low profile program is necessary. The extension of sociological aspects is as important as the economic aspects.

In some areas the extension looks good on paper but the need for facilities, transportation, and to some extent, personnel is apparent. There is less need for more people than there is for more contact with farmers. In no case were there plant protection people in extension in any area visited by the team mentioned above.

In summary, upgrading of extension programs is necessary by organising training programs to improve technical knowledge, interest rural persons into coming into extension service, and develop action programs that revolve around socioeconomic progress. It is important that the level of skilled manpower be raised, and with a motivation toward insuring that farmers are kept abreast of modern scientific developments that are relevant to allowing for steady, continuous improvement in agricultural production.

VII. OTHER DONOR COORDINATION

Following is a partial list of some donors' activities, presented at the Sahel Crop Pest Management Conference held in Washington in December. A complete description of donors' activities in pest control in the Sahel

will be developed for the Project Paper after a feasibility study is completed in February and March of 1975. Also, the French, who have been the major donor to plant protection activities in the Sahel, are sponsoring a joint donor meeting with AID, the Canadians and British, in Paris in February 1975 to consider all of their activities and ours to coordinate efforts.

A. Programs

1. Organisation Commune de Lutte Antiacridienne et de Lutte Antiaviare (OCLALAV). This regional organization has the primary responsibility for control of the desert locust and the weaver birds. It has many operational bases throughout the Sahel with headquarters at Dakar, Senegal. Although it is not officially responsible for grasshoppers, it has demonstrated its ability and willingness to conduct campaigns against grasshoppers, although it suffers from a chronic shortage of funds. OCLALAV has been involved in offering courses in plant protection for the Sahel States (e.g., a training course given in French at Dakar will be offered in February 1975), and this resource could be reinforced. It has a radio network to facilitate communication in the region. With external emergency assistance, OCLALAV treated 20,000 ha. for grasshopper control in 1974.

2. Organisation Internacional 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 OCLALAV is also short-supplied, obviously their combined resources fall short of the 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 Maiduguiri, Nigeria, with a secondary base at Garoua, Cameroon.

3. The Food and Agriculture Organization (FAO).

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 & Kara Mopima, 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

In addition, a training course in Crop Pests and Desert Locusts is scheduled to be held in Dakar from 17 February 1975 for a period of 5 weeks, which will be attended by most of the French-speaking West African countries. We had a similar course 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 as well as in 1977.

4. 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.

5. Canada. CIDA

is assisting in establishing plant quarantine and plant protection programs in Niger and Upper Volta, and anticipates including a plant protection element in a cereal grain project in Mali.

6. France. ORSTOM

has conducted research on plant protection in several francophone Sahel States. ORSTOM and IRAT have maintained laboratories in Senegal, Niger, Mali and elsewhere in the Sudano-Sahelian region. A four-man team is commencing entomological and ecological research on grasshoppers attacking crops and methods of control.

7. United Kingdom. COPR of ODM

has been working closely with the regional locust organizations and has other projects on birds, grasshoppers and termites in northern Nigeria.

8. United States.

In recent years assistance has been limited to the grasshopper outbreaks, largely through OSRO.

During the past years plant protection activities in the Sahel have mainly emphasized research and the building of teaching facilities, except for OCLALAV, OICMA and a few large private or government farms specializing in commercial crops. The U.S.

efforts will be concentrated for the protection of small farmers' food crops first and other cash crops second. This coordinated program will employ available techniques resulting from previous and future research work carried out by other donors. Their activities and the U.S. project will thus complement each other and prevent duplication of efforts.

It is not envisaged that the Regional Plant Protection project will contribute funds, equipment or materials to the OCLALAV or OICMA organizations. The U.S. input will be through technical advisory services of the U.S. country plant protection experts or through provision of consultative services of experts provided through the United States Department of Agriculture Participating Agency Services Agreement. A study of the two organizations was made by a USDA team of experts in July, August and September of 1974 and recommendations were for strengthening their operations through contributions from FAO and other donors.*

B. Pattern of crop pest control

After discussion by the Sahel Crop Pest Management Conference in December 1974 of the existing survey and control strategies practiced by national and regional plant protection organizations, the following pattern emerged:

1. Initial action against pests in the Sudano-Sahelian zone is taken by the national plant protection services. They are also responsible for making surveys of the crop areas, identifying pests and reporting on their occurrence.

*Locust Control in the Sahel, Project No. 625-11-130-913, July 1 - September 10, 1974, Bartholf, D.E., Dyer, R.W., Thrailkill, R.B.

The conference recommended that the countries of the zone be requested to coordinate their information gathering and reporting, particularly on the migrant posts, and to send copies of reports to the regional organizations.

2. The regional plant protection organizations implement surveillance in their normal 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 undertake control of any infestations discovered directly by them and of any others where their help is requested by two national services. Regional organizations insure centralization and processing of information and provision of forecasts. The regional organizations insure popularization of information on acridial infestations, recognition of different species and assessment of infestations both in their own area of operation and by cooperation with national teams. Some in-service training is provided.

VIII. FINANCIAL PLAN

U.S. contribution:

Personnel (MM/$000)	FY 75/76	FY 77	FY 78	FY 79	Total
DH	12 / 60	12 / 60	12 / 60	12 / 60	240
PASA	432*	440	450	460	1782
Participants (No./$000)	5 / 70	10 /140	10 /140	5 / 70	420
Commodities	223	60	30	60	373
Other costs	42	45	48	50	185
Total	827	745	728	700	3000

*Standard costing factor $60,000 includes allowances, international

transportation, transportation of things, retirement contribution, health insurance, medical shots and exams, French training, visas, passports, utilities, housing, R&R, educational allowances/ travel, hardship post differential, cost of living allowance, furniture storage; miscellaneous commodities and supplies; USDA, PASA, 20% overhead administrative charge.

Host countries contributions:

It is difficult to determine the host countries contributions until a technical team meets in the field with Governments - but it is expected to be mostly "in kind" consisting of personnel, vehicles, demonstration supplies, buildings, and research facilities.

IX. PROJECT DEVELOPMENT SCHEDULE

The Project Identification Paper (PID) originated in AID/AFR/CWR after the Sahel Crop Pest Management Conference, December 11 and 12, 1974. It was the second of two messages which were sent to all Sahel countries and organizations which participated. The first gave a summary of the conference and explained the short-term recommendations of the conference and proposals for 1975 crop year plans. It also identified the long-term requirements which were unanimously considered necessary to increase agricultural production in the Sahel. The PID explained in more detail the proposed project purpose and requirements, and asked possible participating countries for suggestions and level of interest.

1. The Project Identification Document (PID) was cabled to all Sahel Missions on January 13, 1975. Approval by CWR Missions will

indicate a consensus that the proposal is in accord with program and policy directives of the Agency.

2. At the same time this Project Review Paper (PRP) will be finalized in AID/W for submission during February 1975 for possible FY 75 funding and inclusion in the FY 76 Congressional Presentation by the end of February 1975.

3. A team of experts will travel in February to meet Sahel RDO/CDO's and host government officials interested in participating in a long-term Plant Protection project. The purpose will be to study and collect data concerning harmful species, crop losses, availability and priority given host country inputs: e.g., staffing, insecticides, training, vehicles, extension, to develop a cost/benefit ratio, and to work out the details of the project. The team will return to AID/W to complete a Project Paper (PP) by May 1975.

4. It is hoped that the D.H. Project Manager will be in the field - probably Dakar - by July 1, 1975.

5. The USDA Regional Coordinator and the other plant protection experts should be in their respective posts on a staggered basis, the last by January 1976.

Lead time will be needed for language training of personnel prior to departure.

X. ANALYSES

In order to develop a sound Project Paper, a technical team will go on a fact-finding trip to the Sahel to collect the data needed for the feasibility study and economic analysis of the benefits that could accrue by reaching project purposes. The information required for this is not available in AID/W. The Development Assistance

Papers recently prepared will be of great help in providing information from related sectors such as education for manpower and staffing plant protection units, industry and power for possible production or mixing of insecticides, and transportation for the distribution and marketing of pesticides.

Previous studies and reports relevant to this project are as follows:

1. Report of the Sahel Crop Pest Management Conference, December 11-12, 1974, U.S. Agency for International Development, Washington, D.C.
2. Crop Protection in Senegal, Niger, Mali, Ghana, Nigeria, Kenya, Tanzania and Ethiopia - J.N. Sasser, H.T. Reynolds, W.F. Meggit, T.T. Herbert. AID Contract No. AID/csd-3296 with University of California and North Carolina State Subcontract No. 85926.
3. Plant Protection in Turkey, Iran, Afghanistan and Pakistan, C.S. Koehler, R.D. Wilcoxson, W.F. Mai, R.L. Zimdahl. AID Contract with University of California No. AID/csd-3296.
4. Locust and Other Insect Control Project in Near East/South Asia/Africa, 1951-1957. AID PASA with USDA, August 1958. Misc. Publication No. 770.
5. Report of Africa Insect Control Services Seminar, January 25 - February 3, 1961, Tunis, Tunisia.

ANNEX I

AID 1020-26 (1-73)
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.)

Life of Project:
From FY _____ to FY _____
Total U.S. Funding _____
Date Prepared: 1/31/75

Project Title & Number: SAHEL FOOD CROP PROTECTION PROJECT

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 supply and nutrient value of food crops by diminishing losses and damages from pests and insects during the pre- and post-harvest seasons.	Participating countries reduce the absolute amount and value of food crop losses due to pest and insect damage.	Comparison of base line statistics on the agriculture crop sector of each country.	Governments give priority to agriculture production as evidenced by development plans and FY budgets. Lack of extremely adverse environmental effects. Participating countries will maintain or initiate price policies conducive to food crop production. Crop protection practices will be developed which are adaptable and acceptable to farmers in participating countries. Host Governments establish and continue to support plant protection units.

AID 1020-28 (1-73)
SUPPLEMENT 1

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Life of Project:
From FY _____ to FY _____
Total U.S. Funding _____
Date Prepared: 1/31/75

Project Title & Number: SAHEL FOOD CROP PROTECTION PROJECT

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)
Establish and strengthen the capacity of plant protection organizations to effectively combat plant pests and insects. Build a strong plant protection field service to guide and assist farmers in pest control. To institute on-farm pest and insect control practices which will decrease food crop losses and lead to an increase in farmers' income.	An established, staffed and operating plant protection organization/ unit in each participating country. A trained, equipped, and functioning extension system, capable of performing small-scale demonstrations, in each participating country. Farm units adopt suggested pest and insect control practices. A reduction in crop losses due to pest damage of pre- and post-harvest.	In-country comparison of achievements toward project purpose as indicated in national and regional plans. Comparison of previous and present crop yield from selected farms, areas, etc. Amount of pesticides used, and number of extension agents trained. Number of farmers (and model farmers) reached by extension agents, both individually and in the aggregate.	Coordinated plant protection efforts, including sharing of research results, methodology and policies, will decrease losses from pest damage. Participating countries support plant protection programs which will assist and support traditional small producers of food crops. Other inputs as necessary for adoption of plant protection practices, i.e., insecticides, credit, organization, expertise, all available. Trained crop protection personnel are assigned to devise and implement crop protection extension programs and extension training courses. Effective linkages are established between regional and national crop protection organizations.

AID 1020-2B (1-73)
SUPPLEMENT I

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Life of Project:
From FY _____ to FY _____
Total U.S. Funding _____
Date Prepared: 1/31/75

Project Title & Number: SAHEL FOOD CROP PROTECTION PROJECT

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)
Established and functioning plant protection units with mobile field service capability, and equipment, supplies and other materials as necessary, on hand for field demonstrations. A trained staff in each country. A coordinated local and regional pest control program which links host countries with international organizations and other donors. On-the-farm method and result demonstrations located strategically in the major crop production areas of each country. Establishment of an intra- and interregional liaison with other donors for operational and administrative matters.	A coordinated and comprehensive national and regional plan is developed for each participating country, identifying principal constraints to be addressed, and describing and scheduling (to the extent possible) each unit's activities. At least one African is assigned as counterpart or understudy (if qualified, trained individual is not available) to each plant protection specialist in participating countries. Thirty African selectees begin complete necessary academic/professional training on a participant basis. Building/office space provided or established in each participating country, with necessary equipment, supplies, materials and budget.	Assessment against each country's plant protection unit work plans. AID evaluation of regional program. Plant protection units under full operation. Records of plant protection units in each country.	National crop protection plans are designed to integrate regional efforts under a coordinated scheme jointly developed by national and regional plant protection units. National staffs as supplemented by AID's training inputs are adequate to design and conduct plant protection programs. Personnel trained under this program serve as intended upon completion of training program. Other donors and host Governments provide inputs as planned.

AID 1020-28 (1-73)
SUPPLEMENT 1

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Life of Project:
From FY _____ to FY _____
Total U.S. Funding _____
Date Prepared: 1/31/75

Project Title & Number: SAHEL FOOD CROP PROTECTION PROJECT

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 and six plant protection experts. Long-term academic and understudy training for selected African personnel. Demonstration pesticides; hand application equipment; ground and/or truck-mounted blowers; sprayers; small insecticide mixing units; vehicles; and other equipment, supplies and material as necessary for administrative and operational support. Host countries: Personnel; buildings or office space; equipment; development fund budget; required supportive services. 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.	See Annex A for scheduling and costs for plant protection programs in each country. A more detailed input-output implementation plan to schedule targets and activities will be developed following PP approval.	National implementation and work plans. Signed project agreements with host Governments, including grant and budget items. EOP evaluation by AID.	Crop protection specialists are available and can be recruited on schedule at the funding levels indicated to serve in each country. Necessary equipment, supplies, and materials are procured on schedule. Participating countries can allocate personnel for participant training.

*NARRATIVE SUMMARY (D-1) Continued

Other donors - inputs based on activities other than those using AID inputs. Expected to be concentrated in areas of research and teaching whereas AID activities emphasize extension and building a field staff.

ANNEX II

Acronyms Used in This Report

AFR/CWR Bureau for Africa, Office of Central and West African Regional Affairs, USAID

AID see USAID

APHIS Animal and Plant Health Inspection Service. United States Department of Agriculture, Washington, D.C.

CIDA Canadian International Development Agency, Ottawa, Canada

COPR Centre for Overseas Pest Research of the Overseas Development Ministry, Wrights Lane, London W8 5SJ, United Kingdom

FAO Food and Agricultural Organization of the United Nations, Rome, Italy

IBRD International Bank for Reconstruction and Development, 1818 H Street N.W., Washington, D.C.

IRAT Institut de Recherches Agronomiques Tropicales et des Cultures Vivrières, Paris, France

OCLALAV Organisation Commune de Lutte Antiacridienne et de Lutte Antiaviare, Dakar, Senegal

OICMA Organisation Internacional sur Le Criquet Migrateur Africain, Bamako, Mali

ORSTOM Office de la Recherche Scientifique et Technique Outre-Mer, Paris, France

OSRO Office Sahelian Relief Operations of FAO

TA/AGR Bureau for Technical Assistance, Office of Agriculture, USAID

UNDP United Nations Development Programme, New York, New York

USAID Agency for International Development, United States Department of State, Washington, D.C., USA

WARDA West Africa Rice Development Association, Monrovia, Liberia

EXAMEN DE PROJET

TITRE : PROJET DE PROTECTION DES CULTURES VIVRIERES AU SAHEL

A FINANCER PENDANT L'EXERCICE 75/76

39 f.

Voir Section III - Description du Projet pour l'explication de la durée de dix ans fixée pour le projet

CATEGORIE: Production alimentaire et Nutrition

DATE DE PRESENTATION AU BUREAU ; Février 1975

EQUIPE D'ELABORATION DU PROJET :

1. L. Stanley Peek, Directeur AFR/CWR/AGR
2. Donald D. Shallow, Responsable du Projet, AFR/CWR/AGR
3. Joseph W. Gentry, APHIS, PPG, USDA

I. PRIORITE ET APPLICABILITE

Au cours des mois récents, la demande accrue de secours émanant des Etats du Sahel a fait ressortir certaines conclusions qui portent sur le relèvement et le développement à moyen terme et à long terme de la zone sahélienne. Les moyens actuels dont disposent les Etats du Sahel pour lutter contre les insectes parasites annuels et communs des cultures sont extrêmement limités Dans les régions où cela est le cas, cette situation aura tendance à neutraliser les efforts entrepris pour accroître les récoltes. Les gouvernements du Sahel sont conscients du problème des parasit des cultures et un grand nombre d'entre eux sont prêts à recherche une solution à long terme à cet égard. Les membres de la communauté donatrice sont également conscients du problème. Ils ont déjà contribué à la lutte contre les invasions locales et apporteraient probablement leurs concours à une solution à plus long terme. Jusqu'à présent, aucune proposition globale n'a été avancée en vue de la solution technique du problème, qui doit forcément prévoir des efforts actifs dans chaque pays aussi bien qu'une approche régionale coordonnée. Les E.U. ont pris l'initiative d'obtenir un consensus parmi les organismes donateurs intéressés et les techniciens africains quant à une approche techniquement réalisable en vue de la résolution du problème.

L'objectif de première priorité du programme sectoriel agricole dans tous les pays du Sahel est l'accroissement de la production et en particulier des cultures vivrières. Le projet de budget (Field Budget Submission) pour l'exercice 1976 pour le Programme régional d'Afrique centrale et de l'ouest a choisi comme principal domaine de concentration la production et

la distribution des cultures vivrières et la nécessité d'améliorer la qualité de la vie rurale.

Le projet se propose d'établir dans chaque pays sahélien participant une organisation autonome de protection des végétaux pour démontrer aux cultivateurs les méthodes les plus efficaces de lutte contre les insectes, ce qui aboutirait à l'accroissement de la production agricole et des revenus des cultivateurs.

II. EMPRUNTEUR/ BENEFICIAIRE/ORGANE D'ADMINISTRATION

Il y aura un Accord bilatéral de Projet ou Aide-mémoire d'Accord entre les États-unis et chacun des pays d'accueil participants. L'organe d'administration peut ne pas être le même dans chaque pays et sera déterminé très précisément par l'équipe d'enquête sur le terrain et inclus dans le Rapport de Projet. Dans la plupart des cas ce sera probablement un service du Ministère de l'Agriculture.

III. DESCRIPTION DU PROJET

Il s'agit d'assistance technique sous forme de dons. Les services et l'engagement direct d'un Directeur de Projet seront financés par le Bureau pour l'Afrique. Il est suggéré que le financement des experts, des produits et de la formation des participants et de tout autres frais de prise en charge des experts en protection des végétaux soit assuré par un FASA du Ministère de l'Agriculture des États-unis (USDA)

A. Durée

La durée du projet est estimée à dix ans comportant trois phases de quatre, trois et trois ans.

Au cours de la Phase I qui va de l'exercice de 1975 ou 1976 à celui de 1978 - 1979, les activités souligneront la protection des cultures vivrières avant et après la récolte. L'efficacité des

unités de protection des végétaux dans ce domaine dans chaque pays participant sera accrue et améliorée en formant le personnel local et les membres de la profession dans le pays d'accueil pour occuper les postes de direction dans les bureaux régionaux et les sièges.

Les gouvernements doivent trouver et fournir les produits chimiques et déterminer s'il est possible de produire, d'importer ou de mélanger ceux-ci. Ces mesures sont nécessaires pour établir un système de distribution et de commercialisation assurant aux agriculteurs des moyens d'action dont l'efficacité en matière de lutte aménagée a été constatée.

La mesure dans laquelle les pays participants peuvent mener, diriger et fournir un appui logistique aux campagnes de lutte aménagée grâce à la participation des cultivateurs se situe au départ à différents niveaux d'efficacité. Il se peut que certaines unités de protection des végétaux aient besoin de cinq ou six ans pour atteindre cet objectif alors que d'autres pourraient parvenir à l'objectif de la Phase I en deux ou trois ans. Le début de la Phase II variera donc d'un pays à l'autre.

La Phase II du Projet augmentera la gamme des cultures pour lesquelles des mesures de campagne de protection seront mises au point. Ces cultures pourraient comprendre les arbres fruitiers à feuilles caduques, les noix, les palmiers dattiers et cocotiers, le cacao, le café et les fibres végétales. La Phase II ajoutera une assistance pour relever le niveau des enquêtes et des prévisions en vue de prédire les invasions à la fois sur le plan national que sur le plan local par les cultivateurs.

Les responsables des essais sur le terrain, formés pendant la première phase, commenceront une campagne intensive pour diffuser sur le terrain les résultats des recherches en matières de lutte contre les insectes. La liaison entre les institutions de recherches nationales, régionales et internationales sera réalisée afin de coordonner les travaux de recherches dont les agriculteurs bénéficieront.

Il faudrait élaborer des lois de quarantaine végétale, sur le plan national et international, afin d'empêcher l'introduction et l'exportation éventuelle d'espèces nuisibles d'un pays à l'autre. A cette fin il faut un personnel formé pour assurer les fonctions de réglementation des services phytosanitaires des différents pays pour l'inspection, la quarantaine ou le traitement - ou les deux - par fumigation ou autres méthodes aux aéroports, ports de mer et postes frontières.

La phase III ajoutera une assistance pour l'élaboration de méthodes plus perfectionnées de lutte aménagée combinée dans les cas où plus d'une méthode, telle que pulvérisation liquide ou à sec, est utilisée avec des pratiques de culture ou des techniques de lutte biologique ou les deux.

En outre, la phase III insistera davantage sur la solution des autres problèmes de lutte contre les ennemis des plantes tels que les nématodes nuisibles, les mauvaises herbes, les oiseaux, les termites et les maladies des plantes. Certains pays auront peut-être besoin d'assistance dans la formation du personnel pour mettre sur pied des moyens d'action gouvernementaux ou privés ou les deux pour l'application aérienne.

Il est estimé que les activités décrites ci-dessus devront être soutenues pendant environ dix ans mais ne se limiteront pas nécessairement à cette période pour chaque pays. Le projet devrait être suffisamment souple pour pouvoir augmenter ou diminuer le nombre des pays participants. Un projet précédent du même type, exécuté pendant quatorze ans au Moyen Orient et dans d'autres régions d'Afrique, comportait à un moment ou un autre de six à treize participants.

B. Plans pour la réalisation de l'objectif

1. Etablissement et dotation en personnel d'un projet de Lutte antiacridienne régionale, dirigé par un coordinateur avec un expert en protection végétale choisi avec soin, en poste dans chaque pays participant comme homologue des responsables appropriés du Ministère de l'Agriculture.

2. Liaison sur une base intra-régionale et inter-régionale pour toutes les questions d'ordre administratif et opérationnel qui s'articulent avec les buts des organisations régionales telles que la FAO, l'CIRA, l'OCLALAV et des autres institutions s'intéressant au développement des ressources agricoles de la région.

3. Direction du développement d'organisations viables de protection végétale dans chacun des pays par voie de:

a. Conseils portant sur des pratiques traditionnelles de gestion et administration, y compris la dotation en personnel, la planification, la préparation de budgets et l'évaluation.

b. Identification des besoins en formation professionnelle et pratique à court et à long terme. Fournir ou diriger de petits stages, des démonstrations en campagne et autres formes de formation nécessaires dans le pays.

c. Encouragement et assistance en vue de la mise sur pied de systèmes efficaces d'enquêtes, vulgarisation et contrôle.

4. Assurer l'assistance technique des opérations de protection des végétaux comme suit:

a. Diriger et mener des enquêtes pour définir les principaux insectes causant les maux, évaluer les niveaux de population et d'incidence en vue des traitements, estimer les pertes subies par les récoltes.

b. Définir et exécuter des démonstrations des méthodes les plus efficaces et économiques de lutte aménagée, en combinant les méthodes chimiques, culturales et biologiques selon les cas. Accorder une attention particulière aux problèmes posés par les ennemis des cultures après la récolte.

c. Fournir une instruction dans le domaine de la sécurité des produits de lutte, y compris la protection des agents d'application et l'incidence sur la partie de l'environnement qui n'est pas visée.

d. Identifier les principaux besoins en matière de recherche et aider à la création de programmes visant ceux-ci.

e. Accorder des conseils et des consultations techniques aux organisations régionales et aux autres organismes intéressés fonctionnant dans la région.

f. Introduire une philosophie de la réglementation pour aider les pays à se protéger contre l'introduction d'ennemis exotiques des plantes.

g. Fournir des rapports sur l'état d'avancement des activités du projet, par pays et par région, à des intervalles désignés.

IV. BENEFICIAIRE

Les principaux avantages du projet iront aux petits cultivateurs. A mesure que les récoltes suffisent aux besoins et que les cultivateurs peuvent accroitre la production des cultures de rapport, les gouvernements bénéficieront également de la diminution des importations de denrées alimentaires et de l'exportation éventuelle des excédents.

Il n'a été donné aucune estimation quantitative des pertes de récoltes causées par les insectes, mais il est manifeste que les pertes actuelles dépassent les niveaux tolérables pour la plupart des cultures dans pratiquement toutes les zones sahéliennes. Les pertes peuvent être totales dans le cas d'invasion massive de criquets migrateurs, surtout du criquet migrateur africain et du criquet pélerin. Ce n'est que grâce à la surveillance constante et à l'application de mesures rapides avant l'infestation des cultures que l'on peut empêcher une dévastation générale.

Au cours de la campagne de 1974, les dégats causés par les sautériaux indigènes dans les différentes régions des pays du Sahel se situeraient entre 10% et 70%. Ceci illustre d'une manière frappante le fait que les bonnes conditions climatiques elles aussi mènent à des attaques d'insectes, surtout lorsque pour la première fois après plusieurs années de sécheresse il y a suffisamment de pluie. Mais l'on sait également que les agriculteurs subissent des pertes année après année mais que celles-ci ont été atténuées par les collectivités agricoles qui manquent de moyens de lutte aménagée pour réduire les pertes.

Le rendement des dolliques, qui constitue une culture vivrière à haute teneur en protéine, peut être multiplié grâce à des applications opportunes d'insecticides. Un vers gris a causé des pertes de 20 à 30 %

dans la production du mil au Niger pendant ces dernières années.

Les insectes qui attaquent les produits stockés posent eux aussi de graves problèmes dans toutes les régions. Dans quelques pays, des charançons ont causé en huit mois des pertes de 50% du poids des haricots et arachides entreposés. Au Mali, les pertes causées par le ténébrion de Khapta et les autres insectes ravageurs de céréales stockées aux stocks de mil, de sorgo et de maïs est estimé à 39.000 tonnes pour la période qui va d'octobre 1974 à septembre 1975, soit $7.500.000 aux prix courants du marché mondial pour ces denrées. Il s'agit de céréales cultivées au Mali et non pas de celles qui sont importées sous forme de dons alimentaires, ces derniers subissent en général des pertes plus élevées.

La plupart des grands ravageurs ont été identifiés mais des mesures économiques de lutte n'ont pas été mises sur pied pour toutes ces espèces. Une équipe composée d'un expert en protection des végétaux d'un économiste agricole et d'un spécialiste de programme se rendra dans les pays du Sahel en février 1975; l'une de ses fonctions consistera à rassembler les données nécessaires pour permettre d'estimer les dégâts causés à chaque culture et la méthode de traitement applicable. Leur rapport s'efforcera d'estimer le coefficient prix de revient/ avantages qui persuadera les agriculteurs et les gouvernements que la lutte aménagée est nécessaire et rentable, il cherchera également à fournir la justification économique pour le Deuxième Projet.

V. CONCEPTION DU PROJET

Un projet de cadre logique pour cette proposition est donné à l'Appendice I.

VI. EXPERIENCE DANS LE DOMAINE DE L'AIDE

A. Lutte régionale contre les insectes : Moyen Orient

Un projet de lutte aménagée a été mené avec succès par un organisme qui a précédé l'AID, U.S. Foreign Operation Administration (F.O.A.) pour la région Proche Orient/Sud asiatique à partir de 1951. Ce projet avait pour but initial de permettre aux pays participants de combattre les invasions séculaires de criquets pélerins. Leur but commun de combattre et mettre fin aux incursions de criquets qui ravageaient leurs terres de culture depuis toujours fut atteint en 1963. Ces pays se heurtaient également à des problèmes semblables causés par d'autres ennemis des cultures, le projet fut donc élargi en 1964 pour couvrir les efforts de recherches, enseignement et vulgarisation afin de mettre sur pied des unités de protection des végétaux capables de combattre plus que les criquets. Ce projet fut alors intitulé Projet de lutte régionale contre les Insectes et comporta de cinq à douze participants à un moment ou un autre. Comme leur aptitude à mener des campagnes de lutte aménagée variait, il a fallu aux pays respectifs des délais différents pour maîtriser les techniques de lutte aménagée, ce qui sera le cas au Sahel.

Certains pays ont créé des unités aériennes pour l'épandage des produits par avion. Des stages pour pilotes et mécaniciens ont été donnés avec l'aide des E.U., et les pays ont acheté des avions pour les services de protection des végétaux.

Grâce à cet effort international coordonné les criquets ont été rejetés sur les principales aires grégarigènes en Ethiopie. Après que les essaims eurent franchi la Mer Rouge pour arriver sur la péninsule d'Arabie Saoudite, une nouvelle génération se dispersa jusque dans le Pakistan oriental (Bangladesh). A mesure que des avions plus puissants étaient mis au point et que l'on enseignait de meilleures techniques d'application, la lutte put être menée jusque sur les principales aires grégarigènes du criquet pélerin situées en

Ethiopie et inaccessibles jusqu'alors, où les essaims se formaient depuis des millers d'années. Le succès de ce projet qui permit de réduire les pertes causées par les invasions d'insectes et d'augmenter la production agricole grâce à des activités mutuellement bénéfiques menées sur une base régionale est un exemple important de ce qui peut être réalisé par la coordination et la collaboration entre des pays atteints des mêmes fléaux, les Etats-unis, et d'autres donateurs et organisations régionales.

Le Royaume uni et l'Organisation des Nations unies pour l'Alimentation et l'Agriculture ont contribué d'une manière appréciable à la lutte contre le criquet pélerin . Leurs activités ont revêtues une importance particulière en matière de surveillance, de recherches sur les nouvelles techniques de lutte, et de réseaux de dépistage pour la prédiction des invasions.

Ce nouveau projet pour les pays sahéliens dont la plupart se trouvent à un stade de développement semblable à celui des pays du Moyen Orient lorsque le projet de Lutte régionale contre les criquets fut établi, se fonde sur les mêmes principes mais ne comporte pas la création d'unités aériennes individuelles. Les moyens d'application aérienne seront fournis par l'OICMA et l'OCLALAV.

Bien des pays croient que les gouvernements devraient avoir l'entière responsabilité de la protection des cultures, nous ne partageons pas cette opinion et nous estimons que le cultivateur doit assumer la responsabilité de la protection des végétaux , sauf pour ce qui est d'activités telles que la prévision des attaques, l'application de la quarantaine, la vulgarisation, etc..

Dans d'autres pays la pulvérisation des champs des cultivateurs par le gouvernement n'a pas réussi. C'est le gros agriculteur qui bénficie le plus de cette activité et la protection des végétaux doit être mise également à la disposition du petit cultivateur. Il faut apprendre aux cultivateurs à reconnaître les signes et les symptômes de dégats causés par les parasites, à prendre conscience des pertes infligées, et à utiliser les moyens de lutte contre ces parasites. Cette tâche d'éducation devrait être une responsabilité importante des services de vulgarisation.

Les critiques prétendraient qu'il ne sert à rien de protéger un champ si les champs avoisinants sont laissés sans protection, et que pour cette raison le gouvernement doit intervenir et assurer lui-même la protection des végétaux. Pour certains parasites, il faut une action communautaire. Pour d'autres tels que les térébrants du riz, les plantations individuelles peuvent être convenablement protégées, qu'il existe ou non des champs adjacents sans protection. La vulgarisation doit s'organiser pour mener des actions communautaires le cas échéant, mais les agriculteurs doivent être prêts à assurer eux-mêmes la protection des végétaux. Les gouvernements ne sont pas en mesure de mobiliser suffisamment d'hommes, de matériel et de produits pour protéger tous les champs au moment optimum.

B. Vulgarisation agricole*

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*Crop Protection in Senegal, Niger, Mali, Ghana, Nigeria, Kenya, Tanzania and Ethiopia, Sasser, J.N., Reynolds, H.T., Meggitt, W.F., and Hebert, T.I., Contrat AID/csd-3926 avec l'Université de Californie, octobre-décembre 1972

La vulgarisation constitue une grave lacune dans la production agricole et la protection des cultures. Les plantations ou les régions dans lesquelles les gouvernements ou les puissances coloniales avaient des intérêts à défendre puisqu'il s'agissait de denrées d'exportation connaissent bien les solutions. Ce qui est important c'est d'atteindre les petits cultivateurs qui pratiquent une agriculture de subsistance. La vulgarisation est un élément dans l'amélioration de l'agriculture paysanne.

L'on a constaté que l'effort de vulgarisation et son acceptation sont plus rapides s'il s'agit d'une culture de rapport. Une fois de plus, les principaux facteurs sont le manque de personnel formé et l'absence de fonds. Par exemple, les cultivateurs accepteraient peut-être la traction animale mais il n'y a ni argent ni crédit. Certaines préoccupations sociologiques et traditionnelles ralentissent également le changement.

Il faut introduire l'information scientifique sur une échelle valable qui soit conforme à la faculté d'utilisation du cultivateur. Le changement doit être progressif et un programme prolongé et discret est nécessaire. La vulgarisation des aspects sociaux [illegible] est aussi importante que celle des aspects techniques.

Dans certaines régions, la vulgarisation existe sur le papier mais les besoins en installations, transports et dans une certaine mesure en personnel, sont insuffisants. Ce qu'il faut, ce n'est pas tant davantage de personnel que de plus de contacts avec les cultivateurs. Dans la part dans les régions visitées par l'équipe mentionnée ci-dessus il n'y avait de responsable de la protection des végétaux occupé à la vulgarisation.

En résumé, il faut rehausser les programmes de vulgarisation en organisant des programmes de formation pour améliorer la connaissance technique, intéresser les habitants des zones rurales à travailler dans les services de vulgarisation et mettre au point des programmes d'action centrés sur le progrès socio-économique.

Il est important de relever le niveau de la main d'oeuvre qualifiée, et de motiver celle-ci pour qu'elle veille à ce que les cultivateurs soient tenu au courant des progrès scientifiques modernes qui permettent une amélioration régulière et continue de la production agricole.

VII. COORDINATION AVEC LES AUTRES DONATEURS.

Une liste partielle des activités de certains donateurs, présentée à la Conférence sur la Lutte entreprise au Sahel qui s'est tenue à Washington en décembre figure ci-après. Une description complète des activités des donateurs dans ce domaine dans le Sahel sera préparée pour le rapport de projet après la réalisation d'une étude préliminaire en février et mars 1975. En outre, la France qui est le principal donateur pour la protection des végétaux dans le Sahel organise une réunion commune des donateurs avec l'AID, le Canada et le Royaume-Uni, qui se tiendra à Paris en février 1975 pour examiner toutes leurs activités et les mesures en vue de coordonner les efforts.

A. Programmes

1. Organisation Commune de Lutte antiacridienne et de Lutte Antiaviaire (OCLALAV) Cette organisation régionale est chargée principalement de la lutte contre le criquet pèlerin et contre le tisserin. Elle dispose de nombreuses bases opérationnelles situées dans tout le Sahel et son siège est à Dakar, Sénégal.

Bien qu'elle n'ait pas de responsabilités officielles en ce qui concerne les sautériaux, elle a démontré qu'elle était capable et désireuse de mener des campagnes contre les sautériaux, mais cette organisation souffre d'une pénurie chronique de fonds. L'OCLALAV a pris part à l'organisation de cours sur la protection des cultures pour les Etats du Sahel (par exemple, un cours de formation donné en français à Dakar s'ouvrira en février 1975) et ce moyen d'action pourrait être renforcé. L'OCLALAV est dotée d'un réseau radio facilitant les communications dans la région. Grâce à une aide d'urgence provenant de l'extérieur, l'OCLALAV a traité en 1974 20.000 hectares de terrain en vue de la destruction des sautériaux.

2. Organisation Internationale Contre le Criquet Migrateur Africain (OICMA). Cette organisation régionale est chargée du repérage du criquet migrateur africain, et des campagnes à monter dans 20 pays. Dans la zone soudano-sahélienne, elle coordonne ses activités avec celles de l'OCLALAV. Les deux organisations peuvent faire usage de leur matériel, de leurs stocks de pesticides et de leur personnel en cas de lutte d'urgence contre les criquets; cependant, vu que l'OCLALAV est également à cours d'approvisionnements, leurs efforts conjugués sont évidemment loin de suffire. Le siège administratif de l'OICMA est situé à Bamako, au Mali. La base principale de recherche et de lutte préventive se trouve à Kara, au Mali, à environ 400 kilomètres au nord-est de Bamako. Une base satellite est en voie d'établissement à Maiduguri, Nigéria, une base secondaire située à garoua, au Cameroun, s'y rattachant.

3. L'Organisation des Nations unies pour l'Alimentation et l'Agriculture. (FAO)

Pays couverts	Sièges	Sujets	Experts
Pays membres de l'OCLALAV	Dakar Sénégal	Recherche sur le criquet pélerin	1 spécialiste du criquet pélerin
Sénégal	Dakar	Développement horticole	1 phyto-pathologiste
Haute Volta		Phyllodis du coton	1 entomologiste
Pays membres de l'OICMA	Bamako et Kara Macina, Mali	Recherche sur le criquet migrateur	1 directeur de projet 1 écologiste des insectes 1 écologiste des végétaux météorogiste à mi-temps
Pays membres de l'OCLALAV et Soudan	Dakar	Lutte contre les oiseaux granivores	1 directeur de projet 1 écologiste des animaux 1 spécialiste de la lutte contre les oiseaux

En outre, un cours de formation sur les ennemis des cultures et le criquet pélerin doit commencer à Dakar le 17 février pour une durée de 5 semaines; la plupart des pays francophones d'Afrique occidentale y assisteront. Un cours analogue a été donné à Nairobi en 1974 pour les pays anglophones d'Afrique. Le cours mentionné ci-dessus pour les pays francophones d'Afrique occidentale sera donné de nouveau en 1976 ainsi qu'en 1977.

4. L'Association de Développement de la Riziculture de l'Afrique de l'Ouest, dont le siège est situé à Monrovia, au Libéria, a inscrit des cours sur la protection des cultures à son programme visant à accroître la production rizicole dans 13 pays de l'Afrique de l'Ouest.

5. Canada.

Le CIDA aide à l'établissement de programmes d'isolement et de protection des plantes au Niger et en Haute Volta et il envisage d'inclure la protection des cultures dans un projet concernant les graines céréalières au Mali.

6. France.

L'ORSTOM a effectué des recherches sur la protection des cultures dans plusieurs Etats francophones du Sahel. L'ORSTOM et L'IRAT ont des laboratoires, notamment au Sénégal, au Niger et au Mali, dans la région soudano-sahélienne. Une équipe de quatre personnes est en train d'entreprendre des recherches entomologiques et écologiques sur les sautériaux qui attaquent les cultures ainsi que sur les méthodes de lutte.

7. Royaume-uni.

Le CCPR de l'ODA travaille en collaboration étroite avec les organisations régionales de lutte contre les criquets et s'occupe d'autres projets concernant les oiseaux, les sautériaux et les termites dans le nord du Nigéria.

8. Etats-unis.

Au cours des années récentes, l'assistance fournie s'est limitée à la lutte contre les invasions de sautériaux, en grande partie par l'intermédiaire de l'OSRO.

Ces dernières années les activités de protection des végétaux dans le Sahel ont insisté essentiellement sur la recherche et la création de centres d'enseignement, exception faite de l'OCLALAV, de l'OICMA et de quelques grandes exploitations publiques et privées spécialisées dans les cultures de rapport.

Les efforts des E.U. se porteront d'abord sur la protection des cultures vivrières des petits cultivateurs et ensuite sur celle des autres cultures de rapport. Ce programme coordonné utilisera les techniques disponibles découlant des recherches passées et à venir réalisées par d'autres donateurs. Leurs activités et le projet des Etats-unis se compléteront ainsi et éviteront le double emploi dans les efforts.

Une contribution en fonds, équipement ou produits du projet de protection régionale des Végétaux à l'OCLALAV ou à l'OICMA n'est pas envisagée. La contribution des Etats-unis se fera par l'intermédiaire des services consultatifs techniques des experts en protection des végétaux des Etats-unis, en poste dans le pays, ou de services consultatifs d'experts fournis au titre de l'Accord de prestations d'organismes participants du Ministère de l'Agriculture des Etats-unis. Une étude des deux organisations a été effectuée par une équipe d'experts du Ministère de l'Agriculture des Etats-unis en juillet, août et septembre 1974 et elle a recommandé de renforcer les opérations par l'intermédiaire de la FAO et des autres donateurs.*

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* Locust Control in the Sahel, project No 625-11-130-913, July 1-September 10, 1974, Bertholf, D.A., Dyer, R.W., Ibrahikill, R.F.

B. Grandes lignes de la lutte aménagée

Du débat, au sein de la Conférence sur la Lutte aménagée au Sahel en décembre 1974, sur l'enquête et les stratégies de lutte actuelles mises en oeuvre par les organisations nationales et régionales de protection des cultures, les grandes lignes suivantes se dégagent:

1. L'action initiale contre les parasites de la zone soudano-sahélienne est entreprise par les services nationaux de protection des cultures. Ces services sont également responsables des enquêtes

La conférence a recommandé de demander aux pays de la zone de coordonner le rassemblement et la transmission des renseignements, concernant les ravageurs migrateurs en particulier, et d'envoyer des exemplaires des rapports aux organisations régionales.

stocks d'insecticides, de carburant et de matériel de lutte. Elles se chargent du contrôle de toutes infestations qu'elles découvrent directement et de toutes autres lorsqu'il est fait appel à leur aide par deux services nationaux. Les organisations régionales assurent la centralisation et le traitement des information et établissent des prévisions. Les organisations régionales assurent la vulgarisation des informations sur les infestations acridiennes, enseignent comment distinguer les unes des autres les différentes espèces et juger de l'ampleur des infestations tant dans leur propre zone de fonctionnement que par voie de coopération avec des missions nationales. Une certaine formation en cours d'emploi est assurée.

VIII. PLAN FINANCIER

Contribution des E.U.

Personnel(MM/$000)	Ex. 75/76	Ex.77	Ex. 78	Ex.79	Total
DH	12/60	12/60	12/60	12/60	240
PASA	432*	440	450	460	1782
Participants (No/$000)	5/70	10/140	10/140	5/70	420
Produits	223	60	30	60	373
Autres coûts	42	45	48	50	185
Total	827	745	728	700	$000

* Le coefficient standard de coût de $60.000 comprend les allocations, le voyage international, le transport des effets, la contribution envers la retraite, l'assurance médicale, les vaccinations et l'examen médical, l'étude de la langue française, les visas, les passeports, les services publics, le logement, les congés, les allocations d'éducation et de voyages, la majoration pour"conditions de poste exceptionnelles", l'allocation de coût de la vie,les frais de garde-meubles; divers produits et fournitures; USDA, PASA prélève 20% au titre des frais administratifs généraux.

Contributions des pays d'accueil:

Il est difficile de déterminer les contributions des pays d'accueil avant qu'une équipe technique ne se soit réunie sur le terrain avec les gouvernements; l'on s'attend qu'elle soit surtout une contribution " en nature " consistant en personnel, véhicules, fournitures de démonstration, bâtiments et installations de recherches.

IX. CALENDRIER DE DEVELOPPEMENT DU PROJET

Le Document d'Identification de Projet a été élaboré au sein du Bureau AID/AFR/CWR après la Conférence sur la Lutte aménagée au Sahel, qui s'est tenue le 11 et le 12 décembre 1974. C'était le second des deux messages envoyés à tous les pays et organisations du Sahel qui y participèrent. Le premier message résumait la conférence

et expliquait ses recommandations à court terme ainsi que ses propositions pour les plans de la campagne 1975. Il identifiait également les besoins à long terme reconnus nécessaires à l'unanimité pour accroitre la production agricole au Sahel. Ce Document expliquait d'une manière plus détaillée le but fixé pour le projet et ses besoins et demandait aux pays susceptibles d'y participer leurs suggestions et l'ampleur de leur intérêt

1.Le Document d'Identification de Projet a été câblé à toutes les Missions du Sahel le 13 janvier 1975. L'approbation par les Missions CWR indiquera qu'il se dégage un consensus et que la proposition est jugée conforme aux directives de l'Agence en matière de programme et de politique.

2. Le présent Examen de Projet sera définitivement mis au point au siège de l'AID à Washington pour être présenté dans le courant de février 1975, pour être éventuellement financé pendant l'exercice 1975 et être inclus dans le Rapport au Congrès pour l'exercice 1976, qui doit être soumis avant la fin de février 1975.

3. En février une équipe d'experts effectuera un voyage pour rencontrer les RDO/CDO (responsables du développement régional et responsables du développement par pays) et les responsables des pays d'accueil qui s'intéressent à participer à un projet à long terme de Protection des Cultures. Leur but sera l'étude et le rassemblement des données portant sur les espèces nuisibles, les pertes des récoltes, la disponibilité des apports des pays d'accueil et la priorité à leur accorder: par exemple, dotation en personnel, insecticides, formation, véhicules, vulgarisation; ils définiront le rapport coût/avantage et élaboreront les détails du projet. L'équipe retournera

à l'AID/Washington pour terminer un document de Projet avant mai 1975.

4. L'on espère que le Directeur de Projet D.H. sera sur le terrain, probablement à Dakar, au 1er juillet 1975/

5. Le Coordinateur régional de l'USDA et les autres experts en phytoprotection des végétaux devraient arriver à leurs postes respectifs d'une manière échelonnée, le dernier arrivant en janvier 1976.

Il faudra prévoir des délais pour assurer la formation linguistique du personnel avant leur départ.

X. ANALYSES

Afin de mettre au point un Document de Projet rationnel, une équipe technique se rendra en voyage d'étude dans le Sahel pour y réunir les données nécessaires à l'étude de justification et l'analyse économique des avantages qui découleraient de la réalisation des buts du projet. L'information nécessaire à cette fin n'est pas disponible à l'AID/Washington. Les Documents d'Assistance au Développement récemment préparés seront d'une grande utilité pour obtenir les informations provenant de secteurs connexes tels que l'éducation pour la main d'oeuvre et les cadres des unités de phytoprotection des végétaux, industrie ou énergie pour la production éventuelle ou le mélange des insecticides et les transports pour la distribution des produits de lutte contre les parasites.

Les titres des études et projets réalisés précédemment qui se rapportent au projet sont les suivants:

1. Rapport de la Conférence sur la Lutte aménagée au Sahel, 11-12 décembre 1974, Agence pour le Développement international des E.U., Washington, D.C.

2. Crop Protection in Senegal, Niger, Mali, Ghana, Nigeria, Kenya, Tanzania and Ethiopia. J.N.Sasser, H.T. Reynolds, W.F. Meggit, T.T. Herbert. Contrat de l'AID avec l'Université de Californie, No AID/csd-3296 et sous-contrat No 85926 avec l'Université de

Caroline du Nord(North Carolina State).

3. Plant Protection in Turkey, Iran, Afghanistan and Pakistan.
C.S. Koehler, R.D. Wilcoxson, W.F. Mai, R.L. Zimdahl.
Contrat de l'AID avec l'Université de Californie No AID/csd-3296.

4. Locust and Other Insect Control Project in Near East/South Asia/Africa, 1951-1957. AID IASA avec le Ministère de l'Agriculture des E.U., août 1958. Publication No770.

5. Report of African Insect Control Services Seminar, January 25-February 5,1961, Tunis, Tunisie.

APPENDICE I

RESUME DE CONCEPTION DU PROJET

CADRE LOGIQUE

Date: 31/1/75

Titre et numéro du Projet: PROJET DE PROTECTION DES CULTURES VIVRIERES AU SAHEL

DESCRIPTION SOMMAIRE

But de programme ou de Secteur : L'objectif général auquel ce projet contribue: (A -1)

Accroître l' offre et la valeur nutritive des denrées alimentaires en diminuant les pertes et les dégats causés par les ravageurs et les insectes avant ou après la saison des récoltes

INDICATEURS OBJECTIVEMENT VERIFIABLES

Degré de Réalisation du But (A-2)

Les pays participants réduisent la quantité absolue et la valeur des pertes en denrées vivrières attribuables aux parasites et aux insectes.

MOYENS DE VERIFICATION

(A-3)

Comparaison des statistiques de base sur le secteur des cultures de chaque pays.

HYPOTHESES IMPORTANTES

Hypothèses permettant d'atteindre les buts fixés (A-4)

Les gouvernements accordent la priorité à la production agricole comme le prouvent les plans de développement et les budgets annuels.

Absence d'effets extrêmement contraires dans l'environnement.

Les pays participants maintiendront ou établiront des politiques de prix favorisant la production de cultures vivrières.

Des pratiques de protection des cultures seront mises au point que les agriculteurs des pays participants pourront adopter et accepter.

Les Gouvernements d'accueil créent et continuent à prendre en charge des unités de protection des végétaux.

DESCRIPTION SOMMAIRE

Objectif du projet (B-1)

Etablir des organisations de protection des végétaux et renforcer leurs moyens d'action pour qu'elles puissent efficacement combattre les ravageurs.

Implanter sur le terrain un service de protection des végétaux pour guider et aider les cultivateurs dans la lutte envisagée.

Instituer des pratiques de lutte envisagée sur les exploitations pour diminuer les pertes en denrées vivrières et relever les revenus des agriculteurs.

INDICATEURS OBJECTIVEMENT VERIFIABLES

Conditions qui indiqueront que le but a été atteint. Situation en fin de projet. (B -2)

Une unité ou organisation de protection des végétaux est établie, dotée en personnel et fonctionne dans chaque pays participant.

Dans chaque pays participant, un système de vulgarisation, dont les éléments sont formés, équipés et fonctionnent effectivement, est à même de réaliser des démonstrations sur une petite échelle.

Les unités agricoles adoptent les pratiques suggérées dans le domaine de la lutte aménagée.

Une réduction des pertes causées par les ravageurs avant et après les récoltes.

MOYENS DE VERIFICATION

(B-3)

Comparaison dans le pays des progrès vers l'objectif du projet tels qu'ils ressortent des plans nationaux et régionaux.

Comparaison des rendements passés et présents dans des exploitations et des régions sélectionnées, etc..

Quantités de produits de lutte utilisés et nombre d'agents de vulgarisation formés.

Nombre d'agriculteurs (et d'agriculteurs modèles) touchés par les agents de vulgarisation, individuellement et dans l'ensemble.

HYPOTHESES IMPORTANTES

Hypothèses permettant de réaliser l'objectif : (B-4)

Efforts coordonnés de protection des végétaux, comprenant la diffusion des résultats des recherches, la méthodologie et les directives, diminueront les pertes causées par les ravageurs.

Les pays participants prennent en charge les programmes de protection des végétaux qui aideront les petits cultivateurs traditionnels dans la production des cultures vivrières.

Les autres éléments nécessaires à l'adoption des pratiques de protection des végétaux, à savoir, insecticides, crédit, organisation, expertise, sont disponibles.

Un personnel formé en matière de protection des cultures est chargé d'élaborer et de mettre en oeuvre des programmes de vulgarisation de la protection des végétaux ainsi que des cours de formation pour la vulgarisation.

Des liaisons efficaces sont établies entre les organisations régionales et nationales de protection des cultures.

DESCRIPTION SOMMAIRE

Résultats du projet (C-1)

Des unités de protection des végétaux ont été établies et fonctionnent. Elles sont à même de fournir des services mobiles sur le terrain et disposent du matériel, des fournitures et des autres produits nécessaires aux démonstrations sur le terrain.

Il y a un personnel formé dans chaque pays.

Un programme de lutte contre les ravageurs, coordonné au niveau local et régional assure la liaison entre les pays d'accueil et les organisations internationales et les autres donateurs.

Des démonstrations des méthodes et des résultats ont lieu sur exploitations dans les principales zones de production vivrière de chaque pays.

Etablissement d'une liaison intrarégionale et interrégionale avec les autres donateurs pour les questions opérationnelles et administratives.

INDICATEURS OBJECTIVEMENT VERIFIABLES

Ordre de grandeur des résultats (C-2)

Un plan national et régional coordonné et exhaustif est mis sur pied pour chaque pays participant; il identifie les principales contraintes à surmonter, et décrit et prépare le calendrier de travail (dans la mesure du possible) des activités de chaque unité

Un Africain au moins est affecté comme homologue ou remplaçant (s'il n'y a pas de personne qualifiée et formée) à chaque spécialiste en protection des végétaux dans les pays participants.

Trente stagiaires africains commencent la formation universitaire/professionnelle intégrale qui est nécessaire au titre de la participation.

Locaux fournis ou établis dans chaque pays participants, avec le matériel, les fournitures, les produits et les budgets nécessaires.

MOYENS DE VERIFICATION

(C-3)

Mesure en fonction des plans de travail du service de protection des végétaux du pays.

Evaluation par l'AID du programme régional.

Les services de protection des végétaux fonctionnent pleinement.

Les dossiers des services de protection des végétaux dans chaque pays.

HYPOTHESES IMPORTANTES

Hypothèses permettant d'obtenir des résultats (C-4)

Les plans nationaux de protection des cultures sont conçus en vue d'intégrer les efforts régionaux dans le cadre d'un plan coordonné élaboré conjointement par les services nationaux et régionaux de protection des végétaux.

Les équipes nationales, complétées par l'apport d'AID en matière de formation suffisent à concevoir et à diriger les programmes de protection des végétaux.

Le personnel ainsi formé remplit les fonctions prévues au terme du programme de formation.

D'autres donateurs et les gouvernements d'accueil apportent leur contribution comme prévu.

DESCRIPTION SOMMAIRE

Contributions au projet (D-1)

AID - un Directeur de Projet et six experts en protection des végétaux.

Formation universitaire à long terme , formation menant à un remplacement éventuel, pour un personnel africain sélectionné

Pesticides de démonstration; matériel d'application manuelle; souffleurs au sol ou sur camion, ou les deux; pulvérisateurs; petites unités de mélange d'insecticides; véhicules; et tous autres matériels, fournitures et produits nécessaires sur le plan administratif et opérationnel.

Pays d'accueil : personnel; locaux; matériel; budget pour le fond de développement; services connexes

OICMA et OCLALAV : aident à lutter contre les invasions internationales d'insectes et à enseigner les méthodes de lutte contre les criquets et les sauterieaux par des stages de formation pratique dans le pays.

Autres donateurs. Leur contribution se fonde sur des activités autres que celles qui utilisent les contributions AID. Se porteront sur la recherche et la formation alors que les activités AID soulignent la vulgarisation et la formation d'un personnel de campagne.

INDICATEURS OBJECTIVEMENT VÉRIFIABLES

Objectif de mise en oeuvre (Type et quantité) (D-2)

Voir Appendice A pour le calendrier et les coûts pour les programmes de protection des végétaux dans chaque pays.

Un plan de mise en oeuvre plus détaillé comportant les apports et les résultats en vue de dresser le calendrier des objectifs et des activités sera élaboré après approbation du Document de Projet

MOYENS DE VERIFICATION

(D-3)

Plans nationaux de mise en oeuvre et de travail

Accords de projet signés avec les gouvernements d'accueil y compris les dons et les rubriques budgétaires.

Evaluation de fin de projet (EOP) par l'AID

HYPOTHESES IMPORTANTES

Hypothèses permettant d'assurer les contributions : (D-4)

Des spécialistes de protection des cultures sont disponibles et peuvent être recrutés à temps aux niveaux de financement indiqués pour être en poste dans chaque pays.

Obtention à temps du matériel, des fournitures et des produits nécessaires.

Les pays participants sont en mesure d'affecter du personnel pour la formation prévue.

PD-AAB-736 6250916-(8)

AGENCY FOR INTERNATIONAL DEVELOPMENT

PROJECT REVIEW PAPER FACESHEET

1 TRANSACTION CODE: [ ] A ADD C CHANGE D DELETE

PRP 4/P

2 DOCUMENT CODE: 2

3 COUNTRY ENTITY: Regional

4 DOCUMENT REVISION NUMBER: [ ]

5 PROJECT NUMBER (7 digits): 625-916.1

6 BUREAU OFFICE: A SYMBOL: AFR; B CODE: 1

7 PROJECT TITLE (Maximum 40 characters): Integrated Pest Mgmt. (Sorghum, Millet)

8 PROPOSED NEXT DOCUMENT: A [3] PP; B DATE: MM 05 DD 17 YY 77

9 ESTIMATED FY OF AUTHORIZATION/OBLIGATION: A INITIAL FY 78; B FINAL FY 82

10 ESTIMATED COSTS ($000 OR EQUIVALENT $1)

A. FUNDING SOURCE	FIRST FY B. FX	FIRST FY C. L/C	FIRST FY D. TOTAL	LIFE OF PROJECT E. FX	LIFE OF PROJECT F. L/C	LIFE OF PROJECT G. TOTAL
AID APPROPRIATED TOTAL	3,769	1,200	4,969	20,718	3,854	24,572
(GRANT)	(3,769)	(1,200)	(4,969)	(20,718)	(3,854)	(24,572)
(LOANS)	( )	( )	( )	( )	( )	( )
OTHER U.S. 1.						
OTHER U.S. 2.						
HOST COUNTRY						
OTHER DONOR(S)						
TOTALS	3,769	1,200	4,969	20,718	3,854	24,572

11. PROPOSED BUDGET AID APPROPRIATED FUNDS ($000)

A. APPROPRIATION	B. PRIMARY PURPOSE CODE	PRIMARY TECH. CODE C. GRANT	PRIMARY TECH. CODE D. LOAN	E. FIRST FY ___ F. GRANT	E. FIRST FY ___ G. LOAN	LIFE OF PROJECT H. GRANT	LIFE OF PROJECT I. LOAN
(1) FN	150	050		4,969		24,572	
(2)							
(3)							
(4)							
TOTAL							

12. PROJECT PURPOSE (Maximum 480 characters) [ ] "X" IF DIFFERENT FROM PID

This project proposes a threefold approach through research, extension, and coordination to formulate and develop the integrated control techniques against the major pests of sorghum and millet. Direct benefits will be derived by the small subsistence farmer and will enable the CILSS countries to become self sufficient in food grains. The research capability in the concerned countries will be increased and personnel trained in extension activities.

13. DATA CHANGE INDICATOR. WERE CHANGES MADE IN PID FACESHEET DATA, BLOCKS 12, 13, 14, OR 15? IF YES, ATTACH CHANGED PID FACE SHEET.

[ ] 1 = NO 2 = YES

14. PLANNING RESOURCE REQUIREMENTS (Staff/Funds)

15. ORIGINATING OFFICE CLEARANCE

SIGNATURE

TITLE

DATE SIGNED: MM 11 DD 13 YY 76

16. DATE DOCUMENT RECEIVED IN AID/W, OR FOR AID/W DOCUMENTS, DATE OF DISTRIBUTION: MM DD YY

AID 1330-3 (3-76)

Project Review Paper

Title:	Integrated Pest Management for Sorghum and Millet in the Sahel
Fiscal Years Proposed for Financing:	This is proposed to be a 5-year project in the First Phase FY78 to FY82. A second and third phase of 5 years each are planned.
Appropriate Category:	Food Production and Nutrition
Date of submission to bureau:	November 11, 1976
Project Development Team:	1) Channing J. Fredrickson Regional Project Director Sahel Food Crop Protection Project 2) Lukas Brader FAO/UNEP Global Programme Coordinator Integrated Pest Control

I. Priority and Relevance

In the countries of the Sahelian zone pest damage to sorghum and millet crops has dramatically emphasized production drops caused by the recent droughts. To cope with this situation a resolution was adopted at a meeting of Comite Permanent Interetats De Lutte Contre La Secheresse Dans Le Sahel member countries held in Banjul in December 1974, which recommended the reinforcement of national plant protection services and regional plant protection organizations as well as related research and training activities.

A multidisciplinary study team which visited Africa in 1972 under the University of California/AID contract stated that practical programs of total pest management and crop protection integrated completely with improved production systems should be the ultimate goal of any pest control improvement plan. Research programs on pest management strategies should be undertaken immediately but should stress initially the solution of pest problems. The formation of regional research facilities would be an efficient approach to problem solution and development of research information leading eventually to pest management.

These plant protection problems were examined in depth at three technical meetings

- a meeting on integrated pest management in the Sahel, held at the initiative of USAID, U.S. Department of State, in Washington 11 and 12 December 1974. The meeting reviewed plant protection problems in the Sahel and emphasized the need for research as opposed to short-term measures. It was agreed that FAO should play a coordinating role where long-term actions were concerned;

CILSS-OCLALAV meeting on the problems in food crop protection was held in Ouagadougou 17-20 September 1975. Besides the immediate need for equipment and pesticides the meeting noted the necessity of a well-coordinated and intensive research effort;

- on May 20 1976 CEAO and OCLALAV held a meeting on the subject. The same problems were again raised. A grasshopper research and control program was proposed.

Recently the problem of crop protection was brought up at the inaugural meeting of the Club des Amis du Sahel in Dakar on 29-31 March 1976.

The very low yields of the traditionally operated small farm (less than 500 kg/ha) will not economically support a sustained chemical control program. Integrated control, however, which makes maximum use of natural mortality factors, is ideal for such a situation. The integrated control strategy employs the idea of maximizing natural control forces and utilizes other pest management tactics with a minimum of environmental disturbances and only when crop losses justifying action are threatened. Adverse weather factors, while a powerful repressive force for pests in agroecosystems, are not consistent enough to be a reliable suppressor of major pests. One of natural enemies and plant resistance are basically compatible and supportive in the integrated control strategy. Cultural control, a third basically compatible tatic, is commonly used in ways to expose the pests to adverse weather, to disrupt their natural development, to increase the action of natural enemies, or to increase the crop's resistance. Chemicals, although not always compatible with the use of natural enemies, often can furnish a reliable immediate solution to a problem. Thus, pesticide are an important and necessary element in integrated control programs. Finally, a basic fund of ecological and biological knowledge is needed to guide decision-making in the integrated control strategy.

Cultivation of sorghum and millet has been going on for many centuries in Africa and it is certain that a biological and ecological balance has been established between pests of these crops and their natural enemies over the course of time. It is critical to discern the relationships in this balance so that the knowledge can be used to develop pest control strategies. Experience shows that unfortunately these balances can be easily destroyed through general use of broad spectrum pesticides. Moreover the general spread of these pesticides inevitably incurs environmental pollution, making the practice a threat to the general public.

The development and application of a program of integrated control in sorghum and millet in the Sahel would enable these countries to avoid some of the unfortunate experiences of other countries, where widespread and indiscriminate pesticide use prevented the application of integrated pest control programs.

The basic information for the current proposal was collected within the framework of the FAO/UNEP Cooperative Global Programme on Integrated Pest Control by a five-member study team which visited the area from 23 May to 5 June 1976. Members of the team were:

1) L. Brader, Chief. FAO/UNEP Cooperative Global Programme for the Development and Application of Integrated Pest Control in Agriculture, Plant Protection Service, FAO, Rome.

2) C.H. Caswell, Professor of Entomology, Ahmadu Bello University, Nigeria.

3) J.F. Duranton, Entomologist, Groupement d'Etudes et de Recherches pour le Developpement de l'Agronomie Tropicale (GERDAT), Upper Volta.

4) G. Popov, Entomologist, Centre for Overseas Pest Research (COPR), London.

5) N. von Keyserlinck, Plant Pathologist. German Agency for Technical Cooperation, Frankfurt, German Federal Republic.

The team was well-versed in existing documentation on Sahelian agriculture, especially plant protection. Four of the five team members had many years of previous experience in Sahelian agriculture.

The team set forth on the pre-supposition that the implementation of integrated pest control was in the long run the best solution for effective crop protection, for the following reasons:

- being based as much as possible on methods adapted to local conditions (resistant varieties, cultural methods, natural enemies), integrated control is least costly ;

- it has been sufficiently demonstrated that integrated pest control avoids the necessity of ever more frequent pesticide applications, a problem which often arises when chemical control alone is used;

- widespread use of pesticides on areas as vast as those under sorghum and millet in the Sahel would lead to considerable environmental disturbance (upset of biological and ecological balances, appearances of new pests or strains resistant to pesticides, etc.), making it essential to have access to the larger choice of control alternatives offered by the integrated control method.

This inter-country program for the development and application of integrated pest control in sorghum and millet in the Sahel countries would be established in the framework of the "FAO/UNEP Cooperative Global Program for the Development and application of integrated pest control in agriculture". The FAO Panel of Experts on Integrated Pest Control would serve as an advisory body.

The proposed program will have close ties with the FAO program on the development of crop loss assessment methods.

For the sake of practicality and efficiency this project will focus on sedentary pests attacking sorghum and millet in the field, and emphasis will be on arthropod pests. They are the most important pests and a group of principles of integrated pest control developed in other crop situations can be applied for their control. For the control of other major pests of importance to agricultural production in the Sahel, proposals will be put forward in the "FAO Government Consultation on crop and post-harvest protection needs in the Sahel" to be held in Rome from 13 to 17 December 1976.

This is a technical assistance grant project. AID will establish a trust fund for an administrative agency, such as FAO, who in turn will administer the program within the framework of the FAO/UNEP Cooperative Global Programme for the Development and Application of Integrated Pest Control in Agriculture. It is proposed that the FAO Panel of Experts on Integrated Pest Control function as the technical advisory body to the project. A coordinating Committee will be established including AID representatives.

II. Description of the Project

A. Crop protection actions presently being undertaken except for the AID Sahel Food Crop Protection Project are oriented essentially towards a short-term solution with particular emphasis on the supply of pesticides and equipment for their application. Present training programs aim to improve the structure and operations of national plant protection services. In by far the majority of cases, research programs are limited to a superficial examination of the most important pests and efficacy tests of pesticides, mainly for commercial crops. Generally speaking, basic studies are not undertaken due to lack of funds, competent personnel, equipment, or well-coordinated programs at either national or regional level. The result is that there is application of pesticides without proper regard for the environment and related ecological factors, although the amount of pesticides is negligible.

The project will improve this situation by providing a structure that will increase our knowledge on the economic importance of the major pests in sorghum and millet. It will also include an effective system for surveillance and forecasting of pest development and carry out the necessary applied research to develop a comprehensive integrated pest control program.

Project objectives in each of the participating countries will be to:

- set up a surveillance system on the occurrence of major pests;
- evaluate the relative economic importance of these pests through the organization of crop loss assessment experiments;
- establish demonstration study areas to study and demonstrate the benefits to be drawn from integrated pest control;
- develop, in close collaboration with national plant protection services,

a mechanism to implement results at the farmer level;

at the Regional level:

- to establish a research team to study the bionomics of the major pests and develop the best integrated control techniques as a support to national activities.

B. Plans for Achieving Objectives

In order to reduce substantial losses to pests in sorghum and millet the following activities will be carried out:

1) Survey continuously and identify the various sorghum and millet pests in the Sahel countries;

2) Determine the relative economic importance of each species and damage caused;

3) Study the biology and ecology of the major pests to develop a surveillance and reporting system;

4) Determine the economic damage threshold for each species in order to guide optimum application of control measures;

5) Determine which control methods or series of control is most efficacious under the prevailing ecological and economic conditions, i.e., use of resistant varieties, cultural biological or chemical control;

6) Train personnel at academic levels to create the research capability required to continue activities initiated by the project. Qualified candidates may be available from the Regional Plant Protection Training Centers established in Dakar and Yaoundé under the USAID Sahel Food Crop Protection Project;

7) Collect, classify and publish previous and current research results as necessary.

8) Coordinate related national, bilateral and multinational activities directed toward improvement of sorghum and millet protection in the Sahel;

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

III. AID and Other Relevant Experience

With the advent of the Sahel Food Crop Protection Project, undertaken in FY76 by USAID a major contribution was made to develop the capabilities of the Sahelian countries to control crop pests. The Sahel Food Crop Protection Project is designed essentially to strengthen National crop protection services through training in the United States, third countries and at the Dakar and Yaoundé Training Centers. It was assumed that the integrated pest management

approach to food crop protection would be the general policy for assistance to the small farmer.

It is therefore opportune for the program on integrated pest control for sorghum and millet for the Sahel proposed by FAO/UNEP to be undertaken at the earliest possible time so that it can link up with and serve as an excellent complement to the activities of ongoing projects such as the Sahel Food Crop Protection Project.

The proposed project is the first regional undertaking under the Global Program proposed by FAO/UNED for integrated Pest Control and has the support of the Advisory Panel of Experts to FAO on Integrated Pest Management as well as the Advisory Group under the University of California contract on Pest Management and Environmental Protection.

IV. Beneficiary

The primary benefits of this program will go to the small farmer.

In a study on prospects for agricultural development in the Sahelian zone 1975-1990 (FAO, Rome 1976, PS/SAH/76/ESP/1) it is stated that: "According to studies and observations to date, cereals form the basis of the food supply. They furnish an average of 60-70% of the energy supply ... This group of food-stuffs is the primary source of energy and proteins and in some countries the first or second source of carbohydrates." (See Annex I) Sorghum and millet will still be the principal food crops for most of these countries in 1990 and beyond.

The study also predicts that the cereal food demands by 1990 will be as follows:

	(000's tons)		
	Wheat	Rice	Sorghum, millet & corn
Senegal	202	603	738
the Gambia	8	84	58
Mauritania	37	64	208
Mali	41	232	1405
Upper Volta	50	71	1265
Niger	15	65	1202
Chad	41	81	1026

The cultivation of sorghum, millet and corn will cover approximately 8,600,000 hectares by 1990. It is therefore considered to be fully justified

at this stage to concentrate efforts on these crops, but it is evident that experience gathered in integrated pest management in these crops will also contribute significantly to the introduction of such methods in other crops. As this project is part of the FAO/UNEP Cooperative Global Program on the Development and Application of Integrated Pest Control, the mechanism is already available to transfer knowledge gained on other crops under consideration in this global program to other parts of the world.

Food crops in the Sahel countries and elsewhere have not yet had the same benefit that commercial crops have had from intensive research and extension activity. Our current knowledge is therefore limited, and progress can be expected only when a considerable effort which embraces many aspects at the same time is undertaken.

Any program to be effective in a developing country should be adapted to the culture of the target group. The target group in this project is rural small farmers engaged in the cultivation of food crops, especially millet, sorghum, maize and other cereals. Programs designed without regard for the farm culture and mentality will likely be regarded as foreign and not as readily received.

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 drop 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 pertility 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 are intended.

Farmers were interviewed by the Sahel Food Crop Protection Team about their perception of that 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 resistance is not considered to be a strong factor. Commercial farmers are accustomed to pest management programs. In terms of investments costs, our economic analysis indicates that given present prices, with other factors remaining constant, the use of chemicals in an integrated pest control system is practical.

In all countries the farm family is the primary production unit, with an extended family responsibility through matriarchal or patricarchal 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. The project's objectives 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 infestabions, 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 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.

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 individuals selected by village and tribal leaders will become the conduit for conveying information and practices designed to assist in the protection from pest and disease damage. The highlight of this process occurs when comparisons are made of yields from stands 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 during the crop (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.

Role of Women

In some of the Sahel countries women have the responsiblity for food crop production which includes protecting them from pests. If there is a surplus of those food crops produced in excess of family and/or tribal requirements, they are sometimes considered to be the property of women. They may trade or sell this surplus, which creates a motivation factor for trying better methods of pest control to increase production. Wherever possible, depending on a country's policy for hiring women to work in plant protection services and research teams an effort will be made to encourage and assist in employing women for the extension field services to work with farmers and in other project activities.

Benefits from these project activities can be summarized as follows:

- development of research capabilities in integrated pest management in participating countries. This will also allow the development of better crop protection methods for other crops with improved protection of sorghum and millet, resulting in an improved food situation and increased income to the small farmer at lowest cost and minimal environmental disturbance.

V - FEASIBILITY ISSUES

A. PEST PROBLEMS

The quasi-total lack of biological and ecological information on various sorghum and millet pests and reliable statistics on losses incurred by them in the Sahelian countries is a major hindrance to the proper evaluation of their economic importance. However, on the basis of a number of reports and discussions with responsable people in the area, it is possible to identify the major pests of sorghum and millet. For the purposes of this proposal they are divided into five groups:

- stemborers
- earworms
- gall midges
- shootflies
- various pathogens, nematodes and weeds.

The last group is seldom mentioned in discussions, mainly due to an almost total lack of knowledge about them in the Sahelian countries. This does not mean that this group of pests is not economically important.

Stemborers

The stemborers occuring in sorghum and millet in the Sahelian zone belong to at least three different Lepidoptera species. They feed on the interior of the stem and mechanically weaken it. Some authors also consider them to be one of the indirect causes for flower sterility. They are considered to be important sorghim and millet pests, especially since there are currently no effective chemical control means. To our knowledge no research is currently being undertaken on these insects in the Sahelian zone.

Earworms

This pest belongs to several unidentified Lepidoptera species of the genus Masalia, the larvae of which feed on the flowers and grains, mainly of millet. They seem to be a problem unique to the Sahelian countries, as they are mentioned nowhere else as being important pests. Three to five different species have been mentioned in some conversations, but a detailed inventory still needs to be carried out. The caterpillar of this pest destroys flowers and feeds on the grain when it is in the milk ripe stage. Losses up to 80 percent of potential harvest have been noted. Knowledge on the biology and ecology of the earnworm is extremely limited and the correct scientific names are not yet know. There is some information on the types of pesticides that will control it. Studies are currently being undertaken at Tarna (Niger) by two Canadian entomologists who are studying the distribution of outbreaks and possible control means. Observations on some of its mortality factors are also being carried out at the IRAT Station at Farako Ba in Upper Volta and the general biology of this pest is being studied at the Bambey Research Station in Senegal.

Gallmidge

This pest is encountered regularly in sorghum and millet in the tropical zone and causes sterility of the flower. Because it is so small the insect is observed only by trained observers. This is the reason it is rarely noted in general estimates of crop losses in sorghum and millet. However, a recent mission report by Brenière names the gallmidge, along with stemborers as the major pest species. Earlier studies in Senegal indicate that parasites play an important role in the regulation of gallmidge populations. Detailed estimates of damage are however lacking.

There is a good deal of literature on gallmidge in other areas, which should serve as a basis for the work to be undertaken in this program. Some work is currently going on at the IRAT Research Stations, mainly concerned with observing population fluctuations and the impact of natural enemies.

Shootflies

The larvae of these Diptera feed on young shoots which cause them to die. These insects attack sorghum and millet extensively, but at this stage it is impossible to give an objective damage estimate. IRAT trials in Upper Volta in 1974 indicate losses of about 20 percent. The shootfly causes the most severe damage to late sowings. Abundant literature from other tropical regions is available. Selection for resistant varieties is currently being undertake, mainly by ICRISAT.

Pathogens, nematodes and weeds

This group of pest problems is rarely mentioned in discussions on crop losses in sorghum and millet in the Sahelian zone. However, there are many reasons to believe that their impact on crop performance is considerable and will become even more so when the overall production pattern is improved. The integrated pest control approach can be successfully undertaken only when pests other than arthropods are also given due consideration. Study of these pests will allow their relative importance to be evaluated, so that they can be fitted into a comprehensive crop protection program. The major pathogens recognized in sorghum and millet are smuts. At least five different species are recognized to be of importance. Downy mildew is also a serious problem on millet. A program of breeding for resistance to these diseases is underway at the Bambey station.

Investigations concerning plant pathogenic nematodes are being carried out mostly in the more humid regions of West and Central Africa. Root-knot nematodes seem to be widely distributed. Information is lacking on nematodes in sorghum and millet.

Striga is the major weed problem in the Sahelian countries; it is widely distributed in sorghum and millet fields. It is particularly damaging on poorer soils and yield reduction of up to 50 percent has been noted. Effective control means have so far not been developed, and the present agricultural system cannot support the use of herbicides, as there is no significant capital output from subsistence agriculture. A possible

answer to the Striga problem is fast growing early sorghum that could be harvested before Striga has time to become a serious problem

B. ECONOMIC ISSUES

1. Macro-economic Effect of Pests

The recurrent shortages of food in the Sahel countries of Africa are due in part to the heavy food crop losses caused by insects, plant diseases and weeds. Apart from catastrophic infestations of insects such as has occurred in parts of the Sahel during the past few crop years, loss estimates have not been made in these countries for food crops, different causal factors. In this analysis, the available data will to the extent possible be summarized and evaluated without regard to weight of very considerable uncertainty factors. 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 192, "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 percent or more, the validity of the loss estimates compiled for the participating countries becomes more apparent. In collecting information for this project, the focus is on three principal crops: millet, sorghum and maize. 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. An A.I.D. project design team for the Sahel Food Crop Protection Project visited seven countries in March and April of 1975. Damage estimates due to pests, diseases and weeds were made from the estimates and interpolation of crop loss appraisals and are summarized below in percentages for 1974:

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

A brief note on 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 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 are not included, the estimates of high losses are extremely conservative.

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

Country	Recorded Yield (kg/ha)	Potential Yield (kg/ha)	Loss differential (kg.ha)
Cameroon	650	1,007	357
Chad	475	760	285
Mauritania	350	542	192
Senegal	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 integrated control measures, dependent upon the number of hectares cultivated and the size of the family unit. A 50 percent reduction in damages would have negated the need for external grain donations and imports of food grains to met domestic production in Chad and the Cameroons and would have reduced Senegal needs by some 25 percent. In Mauritania, the ratio of population to cultivable land (given yield factors), would not mathematically allow such spectacular results.

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

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 in an integrated control program depends largely on the margin of profits 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 corresponding 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, we find that response to optimum application in a particular agro-climatic region is 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 1kg of BHC:
1) 152 CFA, 3) 150 CFA.
Optimum treatment for 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	122%
Chad	20 kg/ha BHC	143 kg/ha	225 CFA	7%
Senegal	20 kg/ha BHC	138 kg/ha	840 CFA	25%

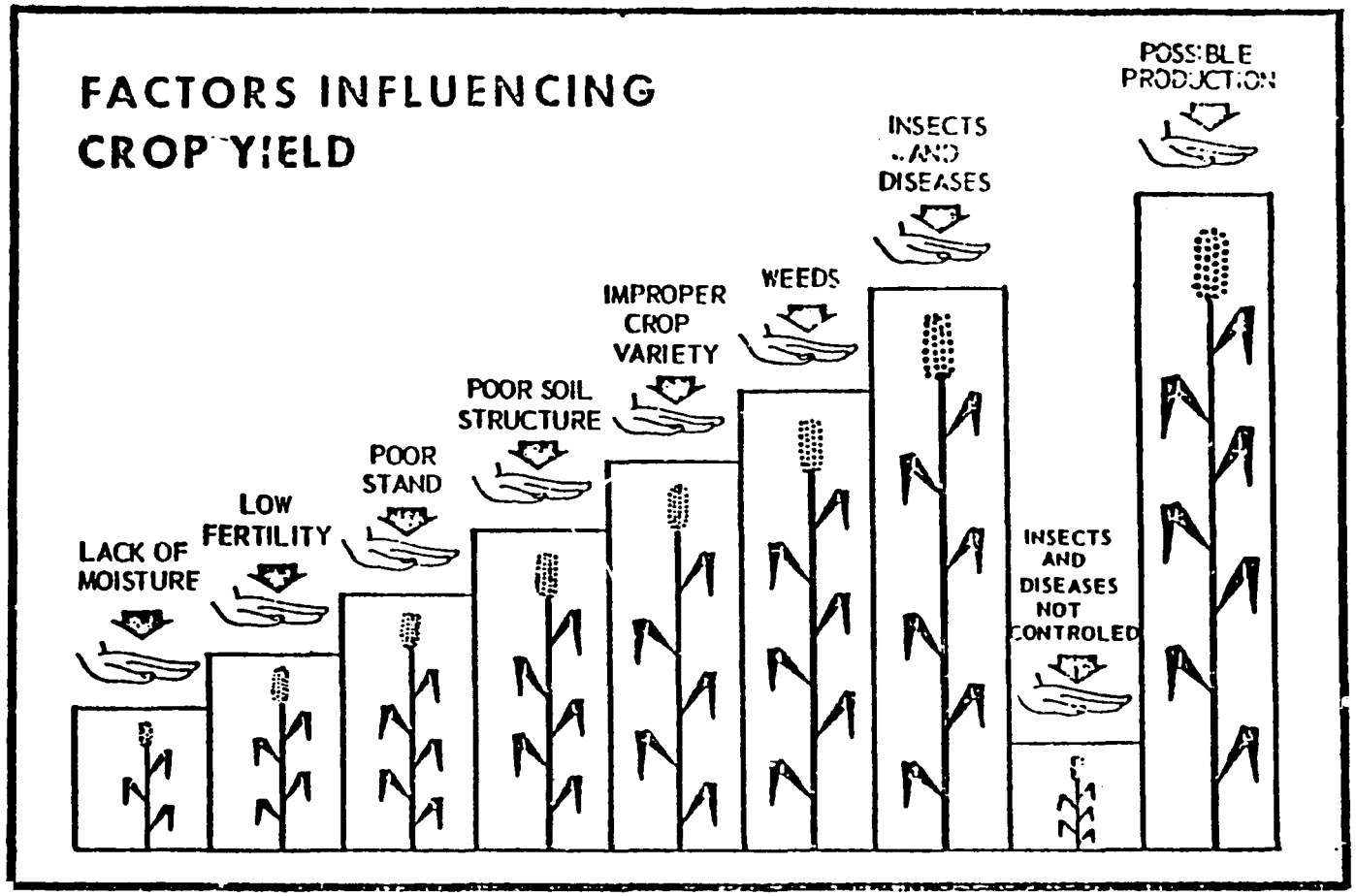
In calculating the margin of profit above, only the cost of pesticide, sprayer, duster and the price of output have been taken into account. The optimum treatment is assumed as given. The margin of profit will be further reduced if account is taken of labor costs, other costs of pesticide application, 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 application 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 Sahel countries have not been conducted for food crops. It is necessary that the project's work plans include farmer field method and result demonstrations to determine response curves with different levels of integrated pest control techniques for selected food crops, in different agro-climatic zones, using different pest management techniques 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.

There is no doubt that improved 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 warrant the cost of insect, disease and weed control. See following chart depicting factors influencing crop yields.



PAI design as modified by Dr S Pradhan

Yields can be increased in succession if the three essential inputs - improved seeds, irrigation and fertilisers - are used in proper sequence and in timely and balanced quantities. If any of these inputs is denied, the yield increase gets arrested at pre-determined level. If plant protection input is denied, the yield potential created by other inputs not only does get arrested at the pre-determined level, but registers a steep-fall. Once high yielding varieties and multiple cropping are adopted on a wide scale together with irrigation and complementary inputs, pests and disease problems begin to escalate and can become a major limiting factor to further increases in productivity. Thus, under the new agricultural strategy, the pest control measures must be given special urgency.

C. Technical Analysis Entomology

1. Insect Pest Problems and Potential for Pest Management

Most major insect species have been identified in the Sahel countries, but in many food crop areas, beneficial as well as harmful insects and their interrelationships are not 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 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 in the case of 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 placing a reduced demand on 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, biological controls, early and late planting or maturing varieties.

There is therefore a 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 carry-over of the stem borer species so damaging and common to millet, sorghum, maize and other crops is important.

The first and most important basic element in integrated pest control systems is the principle of economic thresholds. An economic threshold in this context is the level at which damange 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 damange 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 affort 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 por 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 generally been few analysis of the economics of crop production relative to pest problems and none in the Sahel countries. Principles have rarely been developed or 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 invaribly 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 takes on 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 confront 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 the 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.

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.

VI - OTHER DONOR COORDINATION

After consultation with those responsible for various donor activities for the control of the pests mentioned above and study of reports on sorghum and millet pests, we would like to draw special attention to the following activities:

UNDP (United Nations Development Program)

UNDP currently has no project at the regional level.

A UNDA/FAO plant protection project for the South and Southwestern areas of Upper Volta has just been set up. This project is the extension of a previous UNDP/FAO project for the study of control means for the cotton phyllody. The current project is especially aimed towards the training of technicians. A research programme is planned.

OSRO (Office for Sahel Relief Operations)

OSRO has assisted plant protection in the Sahel countries through the supplying of pesticides and equipment. This aid was possible through the assistance of several donor countries. It also furnished a mechanism to coordinate various control activities by maintaining a relationship between national and regional organizations furnishing technical support. This is short term emergency assistance that is being phased out.

OCLALAV (Organisation Commune de Lutte Antiacridienne et Antiaviaire)

This organization is responsible mainly for control of desert locust (Schistocerca gregaria) and grain-eating birds (Quelea quelea). Its work is meant to supplement that of national services. Its scope includes the preparation of technical notes on control methods, contribution to training national personnel, set-up of survey teams and direct intervention in instances where national services are over-loaded or airplanes are required. OCLALAV has been able in this way to assist in grasshopper control.

OICMA (Organisation Internationale contre le criquet migrateur africain)

OICMA is responsible for predicting outbreaks of African migratory locust (Locusta migratoria migratorioides) and implementing campaigns for the control of this pest. In the past two years, OICMA, like OCLALAV, has assisted national services in grasshopper control.

EDF (European Development Funds)

EDF has helped to establish integrated rural development projects in the CILLS countries, including some plant pathology activities. Within the framework of these projects EDF furnishes pesticides and equipment.

ICRISAT (International Crops Research Institute for the Semi-Arid Tropics)

ICRISAT was established in 1975 in Upper Volta. It is developing a program of varietal selection and introduction for sorghum and millet

with the aim of higher production and resistance to different pests. This activity will be supplemented by sending other research workers (agronomists, entomologists and plant pathologists) to Western Africa under the proposed project.

CIDA (Canadian International Development Agency)

In Niger and Upper Volta the Canadian government is setting up programs for assistance in crop protection. It is also studying the prospects for doing the same in Mali. CIDA aid goes directly to national plant protection services. This includes equipment (offices, storage facilities, transport materials, etc.), pesticides, technical assistance for equipment maintenance and technician training. Canadian research workers have also undertaken various studies of crop pests (pest inventory, growth cycles, pesticide efficacy). African research workers are being trained in Canadian universities. CIDA is re-evaluating its whole aid strategy on the basis of results obtained in Niger.

USAID (United States Agence for International Development)

USAID plans to continue to provide assistance through the Crop Protection Project in six Sahel countries: Cameroon, Cape Verde, Chad, Gambia, Mauritania and Senegal. Its assistance is oriented towards training of plant protection personnel at all levels. Grants are made for organized training programs in the United States and training centers are being set up in Dakar and Youandé. Training in these centers will focus on the areas of pesticide use, toxicology, equipment maintenance, efficacy tests, pesticide legislation, etc. In some countries equipment and personnel will be furnished as well. Mobile control units to demonstrate control methods are included.

GERDAT (Groupement d'Etudes et de Recherches pour le développement de l'Agronomie tropicale)

GERDAT has been working on grasshopper control in Sudano-sahelian Africa since 1975. Teams of two research workers have been sent to Maradi in Niger and Saria in Upper Volta for two years each. The objectives of the project are to:

- study grasshopper outbreaks;
- find means to predict their occurrence;
- find the most effective and economical means for their control.

COPR (Centre for Overseas Pest Research)

COPR will continue to work closely with OCLALAV in the grasshopper suveillance activities begun by OSRO in the Niger river valley. Three scientists are taking part in this project to ensure that plant protection service personnel are trained in the best techniques of pesticide application.

IRAT (Institut de Recherche en Agronomie Tropicale)

Apart from work to improve local varieties and agricultural practice, I.R.A.T. scientists are also studying the biology of different parasites in food crops.

OMVS (Organisation pour la Mise en Valeur du Fleuve Sénégal)

Some activities are undertaken in developing improved methods for rat control and bird control in rice and cane, mainly through chemical means.

VII - FINANCIAL PLAN

This project proposal has been developed as a grant through FAO as the Executing Agency. The rationale for this action relates to the progress already made by that organization in the realm of integrated pest control on a global scale. FAO possesses the required capable staff at the highest level and requires the resources to staff out the project with the necessary expertise at the sophisticated research level. It is considered unlikely that host countries can absorb any considerable amount of local support costs and therefore the budget reflects this premise

It is not possible at this time to present a more detailed budget until a project design team makes the required studies in each of the CILSS countries. (See Part IX Project Development Schedule).

Estimated costs as shown in the Summary Cost Estimate and Financial Plan were based upon the best combined estimates of both AID and FAO experts.

A 10 percent inflation factor has been considered in the project and an overhead of 14 percent is allowed for.

VIII - IMPLEMENTATION PLAN

A. RESEARCH AND TRAINING PROGRAM

As mentioned in the project description research on major pests is proposed. The best way to achieve early results will be to set up research teams for the five major pest groups described. They will then complement activities carried out at the national level. Each of these research projects should be carried out in one of the countries participating in the programme, thus distributing them over the whole Sahelian zone. They should be integrated as much as possible with the national research activities. Choice of the location of each project should be made with regard for the possibilities to carry out the work most effectively.

SUMMARY COST ESTIMATE AND FINANCIAL PLAN

INTEGRATED PEST MANAGEMENT FOR SORGHUM AND MILLET IN THE SAHEL

	FY 78	FY 79	FY 80	FY 81	FY 82
PERSONNEL					
Research Project	827,000	909,700	1,000,670	1,100,737	1,210,811
National Project	987,200	1,085,920	1,194,512	1,313,963	1,445,359
Coordination	387,400	426,140	468,754	515,629	567,192
	2,201,600	2,421,760	2,663,936	2,930,329	3,223,362
TRAINING					
Research Project	240,000	264,000	290,600	319,440	351,384
National Project	160,000	176,000	193,600	212,960	234,256
Coordination	25,000	27,500	30,250	33,275	36,603
	425,000	467,500	514,250	565,675	622,243
COMMODITIES					
Research Project	200,000	200,000	60,000	100,000	85,000
National Project	210,000	210,000	60,000	105,000	105,000
Coordination	85,000	85,000	50,000	55,000	55,000
	495,000	495,000	170,000	260,000	245,000
OTHER COSTS					
Research Project	130,000	143,000	157,300	173,030	190,333
National Project	140,000	154,000	169,400	186,340	204,974
Coordination	50,000	55,000	60,500	66,550	73,205
	320,000	352,000	387,200	425,920	468,512
CONSTRUCTION	900,000	500,000	500,000		
OVERHEAD (14%)	607,824	593,076	592,954	585,469	638,276
TOTAL	4,969,424	4,829,336	4,828,340	4,767,393	5,197,393

1/ a 10 percent annual inflation factor has been incorporated.

GRAND TOTAL : $24,571,886

These projects should lead to a considerable increase in research capability in the countries concerned. To achieve this goal it is however necessary to assure the training of an adequate number of local research workers. This training should be seen as taking place in two stages. During the first two years candidates will be chosen and grants accorded to them for academic study with the aim of forming high-level researchers. This training will take place in a university or equivalent institution. Twenty study grants of two years duration each are planned, preferably up to the M.Sc. level. After this the trainees will be associated with various program experts in order to complete the practical aspect of their scientific education.

A description of the compoments of each of the five research projects follows:

Stemborers

This project activity should include an agronomist/entomologist who will study the economic importance of different species, economic damage thresholds, and methods of control; an ecologist/entomologist who will undertake study of the biology and ecology of the most destructive species emphasis on population dynamics; an agrophysiologist/entomologist whose task will be to study the insect-host plant relationship, the selection of resistant varieties, the impact of growing conditions and the role of alternate host plants. It is suggested that this team be located in Chad.

Each expert should have two technicians and two skilled laborers. The team should have an all-purpose vehicle and two light vans. It should have an adequately equipped laboratory.

Total project personnel will be three experts, six technicians and six skilled laborers.

Earworms

This project activity should include an agronomist/entomologist who will study the economic importance of different species, economic damage thresholds and methods of control; an ecologist/entomologist who will undertake study of the biology and ecology of the most destructive species with special emphasis on population dynamics; an agrophysiologist/entomologist whose task will be to study the insect-host plant relationship, the selection of resistant varieties, the impact of growing conditions and the role of wild host plants. Mali has a severe problem with these pests and could serve as a center for this project.

Each expert should have two technicians and two skilled laborers. This team should have an all-purpose vehicle and two light vans. It should have an adequately equipped laboratory.

Total project personnel will be comprised of three experts, six technicians and six skilled laborers.

Gall midge project

This project activity will include two experts: one agronomist/entomologist who will study the economic importance of the species concerned, economic damage thresholds, and methods of control, and; one ecologist/entomologist who will work on the ecology of the different species and the possibilities for biological control.

This team should work in close cooperation with the ICRISAT program, especially as regards the introduction of resistant varieties. Two assistants and two technicians will be necessary for each expert. This team should have an all-purpose vehicle and a light van, as well as an adequately equipped laboratory.

In view of the importance of this pest and of previous work done in Bambey, Senegal, this team could be stationed there.

Total project personnel will be comprised of two experts, four technicians and four skilled laborers.

Shootfly project

This project will include two experts: one agronomist/entomologist who will study the economic importance of the species concerned, economic damage thresholds, and methods of control; one ecologist/entomologist who will work on the ecology of the different species and the possibilities for biological control.

This team should work in close cooperation with the ICRISAT program especially in the introduction of resistant varieties. Two technicians and two skilled laborers will be necessary for each expert. This team should have available to it an all-purpose vehicle and a light van, as well as an adequately equipped laboratory.

This team could be stationed in southwestern Upper Volta, as the shootfly is a very important pest in this region.

Sorghum/millet agroecosystem

For the development of a reliable and effective integrated pest control program a detailed analysis of the various elements is essential. However, it has also become evident in various programs in other parts of the world that success can best be achieved by (1) early evaluation of individual results within the overall crop protection program, and (2) full recognition of the interrelationship between control activities against arthropod and non-arthropod pests. Alternative control techniques for pathogens, nematodes and weeds shculd be found. The set-up of a team to study this entire complex is therefore suggested. It will have to workclosely with the other research teams and should play a leading role in the development of a comprehensive integrated pest control program. The experts needed in this team are as follows:

- one weed scientist to work on control of Striga;
- one plant pathologist to evaluate the relative importance of various diseases and test the possible use of resistant varieties and other selective control means;
- one nematologist to study the significance of nematodes and analyze the impact of various crop rotation systems;
- one economic entomologist who will evaluate the practicality of proposed control solutions.

These four experts should operate as a unit and preferably have sufficient knowledge of the other areas concerned. Two assistants and two skilled laborers will be necessary for each expert. This team should have available two all-purpose vehicles and two light vans, as well as an adequately equipped laboratory.

It is proposed that this team be located in Maradi (Niger) where they could work closely with the CIDA experts and the GERDAT grasshopper team. This location will also provide an excellent opportunity to establish regular contacts with workers in Northern Nigeria.

Where possible liaison will be maintained with the FAO/multi-donor programs to study new techniques for the control of the Quelea bird which is prevalent and damaging throughout the Sahel.

B. NATIONAL APPLICATION AND COORDINATION PROGRAMS

At the outset of the program two plant protection experts should be stationed in the CILSS countries. They should work in national plant protection services in close collaboration with the agricultural administration and national research institutes. The purpose of their activities will be to ensure the earliest implementation of integrated pest control practice at the farmer level. Their task will be as follows:

1) Assist and coordinate national research and extension activities with other activities of the inter-country program.

2) Ensure that results of the various research projects are put into practice through extension, demonstration, etc.

3) Organize a surveillance network to monitor population changes of major pest species, evaluate crop losses and synthesize information collected. This will ultimately lead to a system for forecasting pest attack.

4) Set up and maintain integrated pest control demonstration study areas.

5) Study and evaluate traditional methods of pest control.

6) Collect information needed for the various research teams of the overall inter-country program.

7) Participate in the implementation of the national integrated pest control programs.

8) Train technical personnel to participate in forecasting activities and crop loss experiments.

9) Conduct field trials for various ecological zones.

Setting up of a pest surveillance network, crop loss experiments and demonstration study areas will require sufficient support personnel. It is to be expected that at least 10 technicians and 10 skilled laborers will be needed in each of the participating countries. They should be provided at least in part by the host country involved.

C. COORDINATION

An efficient project coordination mechanism will be required to ensure correct implementation and optimum productivity. The following considerations should be taken into account:

1) FAO is proposing a comprehensive action plan for improvement of crop and post-harvest protection in the Sahelian countries. It is therefore evident that the final proposals for this project should be made in full recognitionof the other elements of this action plan. Proposals for the improvement of infrastructure in particular, as well as for the construction of laboratory facilities and maintenance of equipment and vehicles, should be complementary to other project proposals.

2) The proposed program will fall in the framework of the FAO/UNEP Cooperative Global Programme for the Development and Application of Integrated Pest Control in Agriculture, within which the beginning of a coordination mechanism has already been established on a global scale.

3) The Sahel Food Crop Protection Project undertaken by USAID is already creating a mechanism to develop pest and disease control in the Sahel countries, mainly through training.

4) Particular care should be taken that proposed activities fit in with existing and planned national, sub-regional and regional structures and capabilities.

5) Conditions for the technical staff of the project should be such that they will devote the maximum of their time to the tasks they are nominated to fulfill. Their involvement in administrative activities should be minimal.

6) In the first phase of the project five research teams are proposed, each to work on a major group of pest problems. Within the framework of the integrated pest control approach, the whole sorghum/millet ecosystem will have to be considered. This will be done partly by the team working on the sorghum/millet agroecosystem. However, to ensure a common approach between the proposed research teams it is essential that effective collaboration and cooperation be established among them. In this first phase this can probably best be done

through an annual workshop where results are analyzed and plans for future work are discussed. Regular contact will also have to be established between research teams and the technical staff working at the national level. This will allow field trials on results of research in the demonstration study areas, thus guaranteeing early evaluation of their validity within the total complex of the sorghum/millet production process.

The following personnel is considered necessary for support and coordination of project activities:

- one project leader who will have overall responsibility for project activities and particular responsibility for relations with national multinational and international organizations;
- one coordinator to ensure cooperation between various project activities. He will also draw together information on pest surveillance in order to develop an effective pest forecasting system on a sub-regional or regional basis;
- one training/liaison officer to organize training courses and information seminars in close collaboration with existing programs and coordinate the training of research workers and field trial specialists;
- one documentalist to collect and evaluate existing information, organize a documentation center, and disseminate necessary information to technical staff;
- one administrator;
- two bi-lingual secretaries, typists, clerks, drivers, etc.

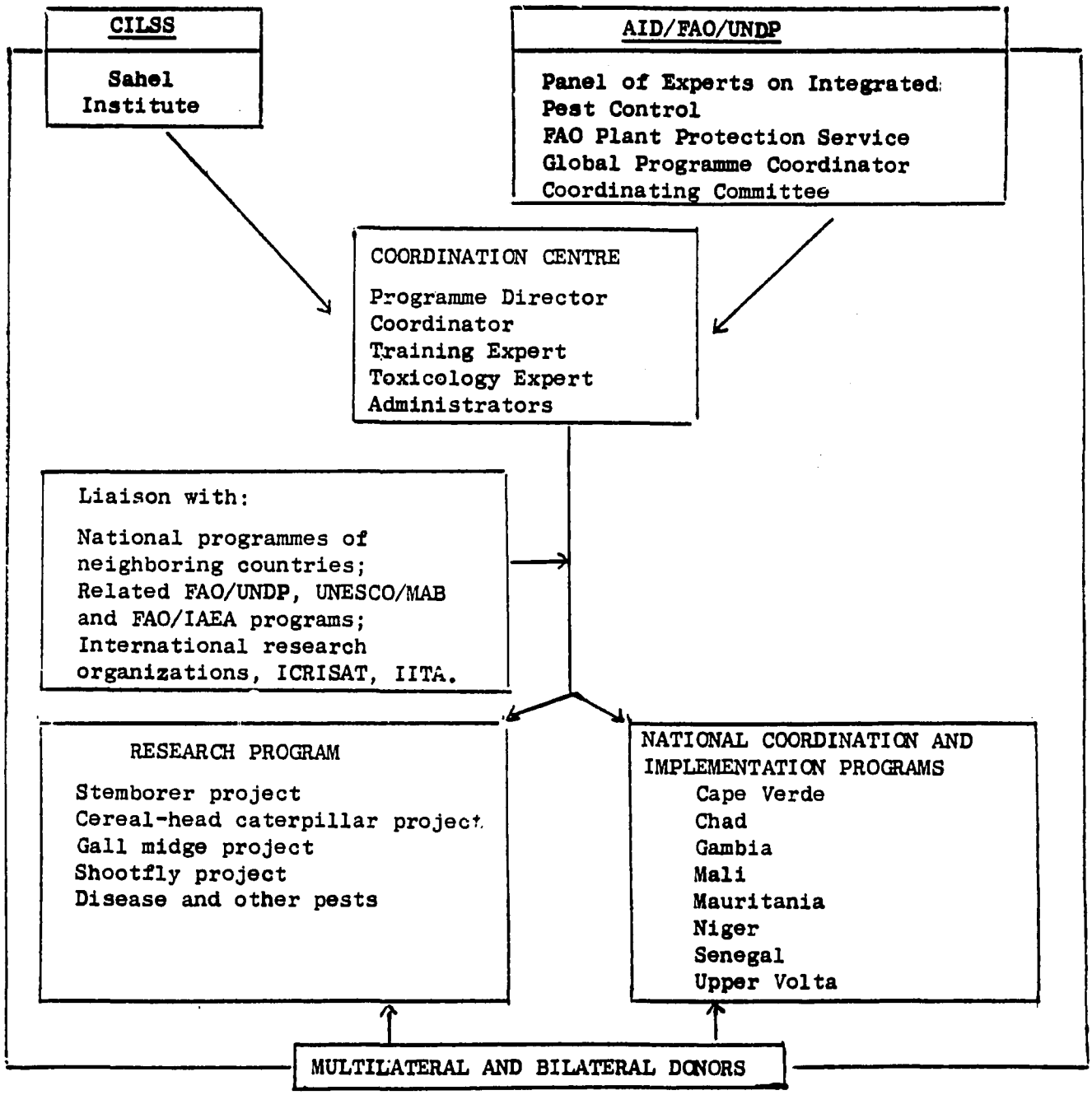
Coordination will be strengthened by the extensive use of consultants. Provision is made for one man/month of consultantship per year for each expert. Use should be made of this mechanism to establish a permanent link between program activities and research institutes elsewhere in the world. The same consultants should therefore be used for each aspect for the duration of the program.

A Coordinating Committee should be set up composed of representatives of the participating governments, donor agencies and executing agency. Its main functions will be to advise on:

1) means of relating project operations to the development programs of participating countries;
2) coordination of the activities of government services concerned with those of project teams;
3) necessary steps to ensure timely fulfillment of counterpart obligations.

The Committee will inform government authorities concerned on the progress in the project by releasing official information on project activities and results.

Proposed operating structure for the inter-country programme for the development and application of integrated pest control in sorghum and millet in the Sahelian zone.



IX - PROJECT DEVELOPMENT SCHEDULE

The FAO Panel of Experts on Integrated Pest Control met in Rome October 15-25, 1974, and formulated the Cooperative Global Program for the Development and Application of Integrated Pest Control in Agriculture. The recommendations of this Panel as stated in Section 6, pages 21 and 22 of attachment D, strongly endorse the concept of integrated pest management and encourage the world community to participate in the Global Program.

A team sponsored by FAO visited the Sahel from May 23 to June 5, 1976 (see Section I, Priority and Relevance, pages 4 and 5). This team recommended a long term program in the Sahel to combat the serious pest losses in sorghum and millet.

In late September AID/W requested the Regional Project Manager of the Sahel Food Crop Protection Project based in Dakar to undertake consultation in Rome to develop an expanded crop protection program under the Sahel Development Program.

The present Project Review Paper was therefore prepared by Channing J. Fredrickson, Regional Project Manager in Dakar and Lukas Brader, Coordinator for the Global Program.

It is intended that this project be discussed at the Government Consultation on Crop Protection Needs in the Sahel at the meeting to be held December 13-17, 1976 at which time the CILSS country representatives and others can evaluate the project.

A team of experts should visit the CILSS countries and other countries in the region in early 1977 to develop further details with respect to facilities, budget and possible future collaboration with other donors and institutions and prepare a final Project Paper.

Suggested members for this team are

- Dr. Lukas Brader, Team Leader
- Mr. Robert Wesselmann, Consultant with TAB/AGR
- Mr. Ernest Gibson, Agricultural Economist, AID/Tunisia
- Mr. Channing J. Fredrickson, Regional Project Manager, to assist as time allows.

A completed Project Paper should be ready for review in May 1977.

ANNEX A

TABLE 3(b) CEREAL PRODUCTION (1.000 T and %)
TABLEAU 3(b) PRODUCTION CEREALIERE (1.000 T et %)

GROUP(E) II MILLET AND SORGHUM/MILS ET SORGHO

PAYS COUNTRY	ORGE & AVOINE BARLEY & OATS		MAIS/MAIZE		MILS/MILLET		SORGHO/SORGHUM		RIZ RICE (total)		RIZ (irrigué) RICE (irrigated)		WHEAT/BLE	
MALI (a)			110	10 %	800	73 %			200	18 %	69	6 %		
UPPER VOLTA			54	5 %	350	32 %	650	60 %	32	3 %	6	1 %		
NIGER			3		897	77 %	237	20 %	28	2 %			1	
CHAD					450**	89 %	*		51	10 %	5	1 %	5	1 %
TANZANIA			800	65 %	81	7 %	165	13 %	185	15 %	160	13 %		
BOTSWANA			10	12 %	6	7 %	68	81 %						
SENEGAL (b)			42	5 %	680	81 %	*		114	14 %	76	9 %		
GAMBIA			10	14 %	33	45 %	9	12 %	21	29 %				
ETHIOPIA	607	16 %	827	22 %	1174	31 %	613	16 %					576	15%
MAURITANIA (c)			5	10 %	40	83 %	*		3	6 %	3	6 %		
SUDAN					741	24 %	2333	75 %	2				51	2 %
SOMALIA			150	45 %			160	48 %	12	3 %	11	3 %	10	3 %
NIGERIA (d)			1100	14 %	3000	37 %	3500	43 %	535	7 %				
CAMEROON			298	50 %	270	45 %	*		19	4 %	4	1 %		
UGANDA			430	33 %	635	49 %	230	18 %	4					

See notes to following page/Voir notes page suivante

TABLE 3(b) CEREAL PRODUCTION (1.000 T and %) (continue)
TABLEAU 3(b) PRODUCTION CEREALIERE (1.000 T et %) (suite)

GROUP(E) II MILLET AND SORGHUM/MILS ET SORGHO (notes concernant tableau 3(b)) (footnotes to table 3(b))

* Sorghum and millet under the column Sorghum/Sorgho et petit mil sous la rubrique Sorgho
** Unreliable data that probably takes into account onlythe production in the South (see source mentioned below)/Chiffre douteux peut-être ne tenant compte que de la production du Sud (voir source mentionnée ci-dessous)

Mali: maize and millet/maïs et petit mil: estimations of "Afrique agriculture" Nov. 1975 estimations d'"Afrique agriculture", Nov. 1975.
rice/riz: WARDA (rice statistics yearbook), 1974 (*)
irrigated rice/riz irrigué: estimations of "L'agriculture africaine 1975" ("Office du Niger" production) (**)/estimations de "L'agriculture africaine 1975" (production de l'"Office du Niger") (**)

Upper Volta: maize and rice/maïs et riz: agricultural statistics 1971-1972
millet and sorghum/ petit mil et sorgho: FAO estimations of "Monthly bulletin on economy and agricultural statistics (FAO)", Nov. 1975, Estimations for 1975-1976. (+) Estimations FAO du "Montly bulletin on economy and agricultural statistics (FAO)", Nov. 1975, Estimations pour 1975-1976 (+).

Niger: source: see Mali (**)/ voir Mali (**)

Chad: sources: for millet/pour petit mil: see Upper Volta/voir Haute Volta (+), for rice and wheat/pour riz et blé: see Mali/voir Mali (**).

Tanzania: survey report; suspected to be completely wrong for maize, millet and sorghum. rapport d'enquete: on suspecte que ce rapport est erroné pour ce qui concerne le maïs, le petit mil et le sorgho.

Botswana: agricultural statistics 1971-1972.

Senegal: source: see Mali/voir Mali; irrigated rice/riz irrigué: estimations from Warda(*) data/ estimations des données de Warda (*).

Gambia: survey report/ rapport d'enquête. Season 1974-1975: tef and millet together/Saison 1974-1975: le tef et le petit mil ensemble.

Mauritania: maize/maïs: agricultural statistics 1971-1972.
millet/petit mil: see Upper Volta/voir Haute Volta (+)
rice/riz: Warda (rice statistics yearbook), 1973.

Sudan: see Mali/voir Mali (**); survey report for rice and wheat/ pour le riz et le blé: voir le rapport d'enquête.

Somalia: agricultural statistics 1971-1972, except for sorghum: see Upper Volta (+)/ agricultural statistics 1971-1972, à l'exception de sorgho: voir Haute Volta (+)

Nigeria: rice/riz: see Mali/voir Mali (*); others/autres: see Upper Volta/voir Haute Volta(+)

ANNEX A

TABLE 3(b) CEREAL PRODUCTION (1.000 T and %)

TABLEAU 3(b) PRODUCTION CEREALIERE (1.000 T et %)

GROUP(E) II MILLET AND SORGHUM/MILS ET SORGHO

Footnotes to table 3(b) continue
Suite notes concernant tableau 3(b)

Cameroon: survey report /rapport d'enquête. Season 1974-1975
Saison 1974-1975.

Uganda: survey report /rapport d'enquête. Season 1974-1975
Saison 1974-1975.

ANNEX B

PROJECT TITLE: Sahel Food Crop Protection under FY78 (SDP) for Sorghum and Millet

October 1976

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
Programme or Sector Goal: **To increase food crop production in the Sahel countries.**	Measure of Goal Achievement: Participating countries reduce the absolute amount and value of losses in sorghum and millet due to pests.	Comparison of base line statistics on the agricultural crop sector of each country.	Assumptions for achieving goal targets: (A-4) Government give priority to agriculture production as evidenced by development plans and FY budgets. Lack of extremely adverse environmental effects. Participating countries will maintain or initiate price policies conducive to food crop production. Crop production practices will be developed which are adaptable and acceptable to farmers in participating countries. Host Government establish and continue to support plant protection units and integrated pest management programmes.

PROJECT TITLE: Sahel Food Crop Protection under FY 78(SDP) for Sorghum and Miller

ANNEX B

October 1976

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
Project Prupose: 1. Establish and strengthen the capacity of plant protection and research organizations in the CILSS countries to effectively combat the pests of sorghum and millet. 2. Develop a cadre of integrated pest management research and extension specialists to guide and assist farmers in combatting pests. 3. To institute on-far integrated pest control practices to decrease losses and increase food crop yields and farmers' income.	Conditions that will indicate purpose has been achieved: An established and operating integrated pest management program in each participating country. A trained, equipped and functioning research and extension system capable of carrying out on-going research and extension for integrated pest management. Farmers adopting integrated pest control as standard practice. Reduction in crop losses due to pest damage.	In-country comparison of achievements toward project purpose as indicated in national and regional plans. Comparison of crop yields from selected farms or areas. Number of people trained under the project. Number of farmers benefitted.	Coordinated efforts, including sharing of research results, methodology, and policies, will decrease crop losses. Participating countries will support program. Other inputs for implementation of programmes are available to the farmer, i.e., insecticides, credit and expertise. Linkages will be developed between countries, institutions, etc.

PROJECT TITLE: Sahel Food Crop Protection under FY 78 (SDP) for Sorghum and Millet

ANNEX B

October, 1976

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
Project Outputs: Established and functioning research and extension units in the CILSS countries capable of carrying out programs. Trained staff in each country. A coordinated country and regional integrated pest management program linking host countries, international organizations and donors. On-the-farm method and result programs. Increase yields of sorghum and millet.	Magnitude of output: Four research units established for major pests of sorghum and millet. Twenty trained research experts. 120 field technicians for surveillance and reporting. A Documentation Center is established for collecting, cataloging and disseminating information.	Advisory Group evaluation of program on yearly basis. Assessment against each unit's Annual Work Plans. Research units and surveillance staff under full operation.	Assumption for Achieving Outputs: Participating countries commit themselves to undertake the program in their development plans. Person trained will continue to function in their assigned positions. Host governments supply necessary personnel and inputs agreed upon.

PROJECT TITLE: Sahel Food Crop Protection Under FY78 (SDP) for Sorghum and Millet

ANNEX B

October 1976

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
Project inputs: One Project Director One Coordinator One Documentarian One Training/Liaison Officer Eight technical experts Eighteen research workers Long-term academic and under study training for selected African personnel Laboratory equipment, vehicles and other equipment supplies and material as necessary for administrative and operational support. Expertise and resources of the FAO/UNEP Cooperative Global Program for Integrated pest Control and Advisory services and consultants under the UC/AID contract on pest management. Host countries: personnel, buildings for establishing laboratories, development plan support, etc.	Implementation Target: To be developed by a Design Team of experts who will visit the host countries and discuss project with local officials, local AID and FAO personnel, etc. A more detailed input/output implementation plan to schedule targets and activities will be developed following PP approval.	Project agreements Work plans Annual Advisory Group reviews Regular Project Appraisal report reviews	Assumptions for providing inputs: Participating countries provide necessary personnel and candidates for training. Equipment, vehicles and supplies ordered on schedule. Participating countries can provide necessary facilities for establishment of laboratories, etc.

ANNEX C

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.

New concepts of pest management include the integrated approach to pest control to which this proposed project addresses itself. Normally without interference from man; crops and pests survive in a natural balance due to ecological factors in the environment; however with man's propensity to distrub 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 conditions run wild, resulting in disastrous, intolerable losses.

It has been learned that through the introduction of integrated pest-control probrams in a number of crop situations that even in modern agriculture, we can rely to a large extent on the factors governing these national balances. The so-called natural enemies play a far larger role than wa even expected. The judiciary choice of control measures which will allow these regulatory mechanisms to exercise fully their action will consequently enable man to achieve optimal agricultural production with a minimum of environmentally disruptive chemicals.

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 latitutde for other strategies in the integrated pest m anagement framework and gives some measure of relief for a few years until new biotypes develop.

Cultural measures are an important factor of integrated pest management and suppression of pests can be obtained by rotation of crops, sanitation, choice of sites, sterilization etc. These measures can be useful under certain 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, tehreby interfering with the reproduction of the nest. Likewise, use of hormones to upset maturation and sex attractants is another means. Biological controls through parasites and predators can be most effective in integrated programs.

Even with the foregoing practices adoptes, conditions still develop whereby pests multiply explosively because of inevitable shifts in the environmental conditions regulating pest development, changes in physio-

logical resistance, etc. All the evidence suggests that pesticides will need to be 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 and sorghum. Likewise, environmental side effects have also been minimal as a result of under-utilization of pesticides.

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 poisoning of humans, livestock and wildlife. 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 chemicals 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 pesticies, or on any other single technique above.

The expertise under the proposed project will develop the theme of integrated pest management and will be an integral part of the project endeavour to minimize pesticide usage and consequently avoid adverse environmental effects.