PERMANENT INTERSTATE COMMITTEE FOR DROUGHT CONTROL IN THE SAHEL
CILSS

CROP PROTECTION

1988 - 1991

SYNTHESIS DOCUMENT

NOVEMBER '1986

PERMANENT INTERSTATE COMMITTEE FOR DROUGHT CONTROL IN THE SAHEL

(C. I. L. S. S.)

S Y N T H E S I S D O C U M E N T

C R O P P R O T E C T I O N P R O G R A M M E

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November 1986

A C R O N Y M S

CIDA	Canadian International Development Agency
ATA	Agent Technique d'Agriculture
ECA	Economic Commission for Africa
CILSS	Comité Permanent Interétats de Lutte contre la Sécheresse dans le Sahel
CTA	Conducteur de Travaux Agricoles
ENSUT	Ecole Nationale Supérieure Universitaire de Technologie
ESAT	Ecole Supérieure d'Agronomie Tropicale
FAO	Food and Agriculture Organisation
FSR	Farming Systems Research (=RSP)
GTZ	Agence ALlemande de Coopération Technique
ICRISAT	International Crop Research Institute for the Semi-arid Tropics
INSAH	Institut du Sahel
IPM	Integrated Pest Management
IPDR	Institut Pratique de Développement Rural
ITA	Ingénieur des Travaux Agricoles
OCLALAV	Organisation Commune de Lutte Antiacridienne et Antiaviaire
RFCP	Regional Food Crop Protection Project
CPS	Crop Protection Service
TS	Technicien Supérieur
USAID	United States Agency for International Development
USED	Unité Socio-Economique et de Démographie (de l'INSAH)

MEETING OF CROP PROTECTION OFFICERS AND THE FORMULATION MISSION OF THE CROP PROTECTION PROGRAMME

OUAGADOUGOU, 17 - 18/11/1986

LIST OF PARTICIPANTS

NAMES & OTHER(S)	COUNTRY	FUNCTION
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FOREWORD

MISSION FOR THE FORMULATION OF THE CROP PROTECTION PROGRAMME (1988 - 1991)

(CILSS - OUAGADOUGOU - 29 OCTOBER - 29 NOVEMBER 1986)

1) OBJECT OF MISSION

Details of the object of the mission in charge of formulating the Crop Protection Programme (1988-1991)have been provided in the terms of reference appended to this document.

The programme in question was elaborated on the basis of the common Strategy adopted by the CILSS Heads of States' summit in Dakar in January 1986.

2) COMPOSITION OF TEAM

The programme formulation mission was entrusted to a team with the following composition :

- ALLADOUMNGUE Nadingar (Chad), Agronomist - CILSS Consultant
- SERE Yacouba (Burkina), Plant Pathologist - CILSS Consultant
- GRUYS Peter (Netherlands), Entomologist - IPM Specialist FAO Consultant
- PASCHKE J.D. (Don) (USA), Entomologist, IPM Specialist AID Consultant.

3) WORKING METHODS

From various documents relating to the crop protection programme in CILSS member countries, particularly the IPM evaluation report, and on the basis of evaluations of national needs, the team proceeded to the formulation of the general programme and national projects.

The formulation mission prepared a synthesis document explaining the recommended crop protection development strategy. This document finally helped in formulating the needs in terms of national projects.

I. INTRODUCTION

For about twenty years, Sahelian countries have experienced periods of exceptional drought which sharply reduced crop harvests. Attacks by different food crop pests further accentuated this decline.

This report seeks to highlight the protection of crops against these pests. Before entering upon this subject, it is deemed appropriate to give an insight into the countries concerned.

I.1. GEOGRAPHICAL AND DEMOGRAPHIC SITUATION

The Sahelian member countries of CILSS, nine (9) in number : Burkina, Cape Verde, The Gambia, Guinea-Bissau (joined in 1985), Mali, Mauritania, Niger, Senegal and Chad stretch over a total area of 3.5 million km2 with a population of 32.6 million inhabitants from 1982 estimates (Annex 6:1). This is a strip stretching from Mauritania to Chad, bordering the southern part of the Sahara and where rainfall in the agricultural zones ranges between 150 mm and 1,300 with a distribution over a period of 1 to 5 months.

According to INSAH/ECA sources, population distribution by age groups indicates a very high youth proportion: the youth from 0 to 14 years constitute 43.8 % of the total population whiles 46 to 55 % is made up of ages between 15 and 59 years. This population is characterised by a high growth rate of around 2.7 % on the average.

It is estimated that by 1998 the Sahelian population would reach 48 to 49 million inhabitants.

I.2. ECONOMIC SITUATION

The economy of CILSS countries is essentially dominated by agro-pastoral activities. These activities are very vulnerable to climatic vicissitudes and the consequent fall in production often poses a threat to millions of human beings. Most of these countries figure on the United Nations' list of least developed countries.

According to the ECA, from 1973 to 1983, the contribution of the agricultural sector to the GDP of these countries was around 34.6 % as against 21.8 % from the commercial sector, 15.2 % from other services, 9.7 % from the industrial sector, 8.3 % from transport and communication, 6.3 % from building and public works and only 4.2 % from manufacturing. In recent times there has

been a decline in the contribution of agriculture to GDP which is certainly due to the fall in production brought about by the series of natural disasters that have befallen the Sahelian region.

I.3. STAPLE FOOD

All these countries have identical culture, economy and particularly staple foods. As demonstrated in table n° 1, the staple foods in the Sahelian countries are millet and sorghum.

I.4. FACTORS LIMITING AGRICULTURAL PRODUCTION

The decline in agricultural production recorded in the Sahel can be traced to several limiting factors. Most notable among these factors are :

- the climate
- the soils
- the low literacy rate
- the phytosanitary situation

I.4.1. The climate

The climate varies from country to country and from zone to zone within a country. It is dominated by a random rainfall pattern whose effects are very alarming.

This climate is of the Sahara type in the northern part of certain states, Sahelian in other parts and then Sahelo-sudanian or sudanian in the southern parts of other states. It comprises a series of isohyets ranging from 100 mm to over 1 300 mm in the extreme south.

The severe drought that has been raging in the Sahel for over the past decade has been giving rise to the southward advancement of the desert with attendant plagues such as losses of human lives, the decimation of cattle and fauna and the disapearance of the vegetative cover.

This situation has been further worsened by an alarming recrudescence of crop pests including insects, birds, diseases, rodents and the permanent problem of weeds.

I.4.2. The soils

With the exception of Cape Verde where the soils are of basically volcanic origin (Andosoils), the soils in almost all the CILSS countries often comprises these different types :

- crude mineral soils
- isohumic soils
- hydromorphic soils
- vertisoils
- tropical ferruginous soils
- ferralitic soils

There are also the mangroves in the coastal areas of Senegal, The Gambia and Guinea-Bissau.

These soils are unsuitable for purposes of agricultural exploitation either because of their physical characteristics or their low content of nutritive substances.

I.4.3. Literacy rate

Education in the Sahel is seriously retarded as compared to other parts of the developing world. The retardation is confirmed by the relatively low rate of enrolment for primary and secondary education in the whole region and the low literacy rate. For some time now, considerable efforts have been made towards the enrolment and education of children.

In all the Sahelian countries, boys sent to school outnumber the girls and teatching facilities in the urban areas are more developed than in the villages where schooling and educational facilities are often lacking.

Literacy rate still remains very low for the entire Sahelian region. It was estimated at 14.8 % in 1982 with the following distribution per country;

BURKINA FASO	10 %
CAPE VERDE	37 %
THE GAMBIA	15 %
GUINEA BISSAU	...
MALI	10 %
MAURITANIA	17 %
NIGER	10 %
SENEGAL	25 %
CHAD	10 to 15 %

Source : World Bank.

I.4.4. Phytosanitary situation

Besides the drought, losses resulting from pest depredations constitute the major factor affecting food crop production. Higher rainfalls obtained in the past two years have led to a recrudescence of pest attacks in the Sahel.

These pests can be categorised into two broad groups :

a) Polyphagous pests namely: granivorous birds, grasshoppers, locusts, rodents.

b) Crop-specific pests:

- stem borer caterpillars and flower beetles
- borers of cereal stems
- several insects attacking cowpea and other leguminous plants
- diseases such as sorghum and millet smuts, rice blast, viruses
- weeds.

II. CROP PROTECTION PROGRAMME

II.1. HISTORICAL BACKGROUND

To prevent considerable crop losses caused by pests, CILSS, meeting in Banjul in December 1974, recommended the reinforcement of crop protection services and regional migratory pest control institutions as well as the development of crop protection research and training.

The CILSS-OCLALAV meeting on food crop protection problems, held in Ouagadougou in September 1975, gave priority to the reinforcement of national and regional crop protection services stressing the need for increased coordination in terms of research and training.

In December 1976, the FAO organized a consultation among donors and Sahelian countries on the needs and means required for protecting crops and harvests.

The donors proposed sending an important formulation mission to the field in February 1977 to work out an overall programme, comprising projects.

This programme formulated in Dakar in March 1977 was presented to the "Club du Sahel" in May 1977 and adopted by the CILSS Council of Ministers in April 1977. The Council of Ministers and the Club du Sahel requested that the management of this programme be delegated to Sahelian bodies.

The components of the programme are :

- Reinforcement of national crop protection services (Annex A)
- Research and development of integrated pest management for food crops in the Sahel (Annex B)
- Research for migratory pest control :
  1. Locusts (Annex C)
  2. Granivorous birds (Annex D)
- Research for the improvement of rodent control (Annex F)
- Crop protection training and information

II.2. REVIEW OF PHASE I

Various evaluation reports (Annex 6: 3, 4, 5, 6) broadly highlight the achievements and shortcomings of the programme as designed and implemented. We restate here, the broad outlines.

II.2.1. Annex A: Reinforcement of Crop Protection Services

This component was catered for by several donors whiles the USAID carried it out (RFCP Project) in Gambia, Cape Verde and Senegal. In Mauritania, the Project was terminated one year after it commenced, while in Mali fellowships were awarded to four students for studies in USA.

In Burkina and Niger, Annex A was financed by the Canadian Agency for International Development. Niger also received support from the FRG (GTZ).

Generally, CPS organisation and equipment in the benefitting countries were reinforced through the project. The project also helped train University graduates and technicians.

However, if we consider the initial objective of the project which was to promote and extend IPM concepts to small scale farmers, then there has been a failure. In effect, the project depended on the IPM project for technological transfer. But it was unrealistic to imagine that within such a short time, the IPM project could possibly provide the RFCP project with the necessary technological package.

II.2.1. Annex B: IPM Research and Development for basic crops in the Sahel

This component, entirely financed by USAID, helped in setting up a research and surveillance infrastructure. It also helped in maintaining collaborations between a network of researchers and in strengthening this network. Some control methods were successfully experimented. The introduction of pilot millet schemes paved the way for a new era in the application of IPM methods among farmers for an increased food crop production.

However, due to the heavy structure of the project at the initial stages and in view of the complexity of certain local situations, the project could not be perfectly and harmoniously implemented in each of the 8 CILSS countries.

II.2.3. Annex G1 - Information

While the funding provided by AID to INSAH for the implementation of this component can be described as relatively useful, it did not offer INSAH the capacity to analyse the results and to communicate them to the countries for research and extension purposes (Annex 6:4).

The mission (Annex 6:4) find it necessary that AID continue to support the efforts of INSAH through a sustained and increased financial aid. This will enable INSAH to improve and widen the diffusion of crop protection information for research.

II.2.4. Annex G2 - Training

The Annex G2 evaluation mission (Annex 6:6) pointed out that the training component has been almost completely carried out and has provided good quality officials and technicians.

A comparative analysis of results and objectives and of achievements and means, clearly indicate a satisfactory conduct of the project in a spirit of understanding and collaboration between all parties involved.

The need for training more crop protection personnel is still obvious throughout the CILSS countries, particularly, the type of training offered at the IPDR in Kolo and UAB in Zaria (Nigeria). On the other hand, in spite of the quality of training offered at the ENSUT and the appreciable technical level of its graduates, the evaluation mission has come to the conclusion that this training is no longer justified.

For the proper conduct of the project and for a better consolidation of a programme meeting the needs of all member countries, the mission stressed the need for guaranteeing the regional dimension of the project.

Generally, in all the member countries where this project is being run, the need has been expressed for the training of specialised crop protection technicians so as to strengthen the capacities of strucutres in charge of controlling crop pests (CPS and agronomic research); this need being strongly expressed, is considered justifiable, in view of the extent of damages caused to crops and harvest and the deficiency of crop protection services in handling the situation.

II.3. CONCLUSION

Considering, on one hand, that certain components of the crop protection programme - phase I could not function, and that those that functioned met difficulties, and on the other hand, that the phytosanitary situation is still alarming, it is necessary to elaborate a new common crop protection strategy as provided for in the programme formulated in 1977 (Annex 6:7).

Meeting in Ouagadougou from january 6 to 10, 1986, the Directors of crop protection services and those of the national components of the IPM project developed the elements of a common strategy for the furtherance of crop protection efforts ("Common Crop Protection Strategy - 1987-1990 Programme; CILSS, January 1986).

This strategy was adopted by the Heads of state of CILSS member countries. Then in the course of the year 1986, the different countries detailed their proposals in various documentary forms.

On the basis of all these informations, the mission proposes the following programme.

III. CROP PROTECTION PROGRAMME - PHASE II

III.1. OBJECTIVES OF THE PROGRAMME

The general theme of the programme for the next four consecutive years will be ADEQUATE PROTECTION FOR FARMERS FOOD CROPS with the following development objectives:

- at farmers' level: an increase in production so as to generate higher incomes.
- at the national level: an increase in the extent of food self-sufficiency.

It must be emphasised here that these two objectives can be achieved on condition that food crop distribution and marketing would be better organised at both the national and regional levels. Moreover, this condition is independent of the proposed programme.

The immediate objectives of the programme are :

- to give adequate protection for farmers' crops by establishing an experimental diffusion system of integrated food crop techniques.
- to increase the capacity of Crop Protection Services in controlling certain natural disasters.

The major outputs of the programme will include:

- the creation and operation of an extension team comprising CPS agents, agricultural extensionists and farmers.
- the establishment of decentralised surveillance and intervention structures within crop protection services:
- reliable IPM techniques

The outputs will be described in general terms, applying to all Sahelian countries, in chapters 4 to 7; details will be specified in the national programmes.

III.2. STRATEGY OF THE CROP PROTECTION PROGRAMME

III.2.1. Basic considerations

In view of the fragility of the Sahelian ecosystem and the need for it to be maintained in a balance, the protection of food crops and harvest in the Sahel will be effected in an IPM perspective.

Since the producer has the highest responsibility in matters relating to the protection of his crops, farmers will have to be associated in the surveillance and execution of most parts of the pest control operations whiles ensuring, at the same time, that the necessary precautions are taken to safeguard the environment in general and the useful crop fauna in particular.

The transfer of the developed IPM methods to farmers will have to be ensured, particularly, through the intermediary of existing extension structures.

In the case of certain natural disasters whose control is largely beyond the control capacilities of the individual farmer, competent structures are to handle the surveillance and execution of control operations.

There is the need for a decentralised surveillance network equipped with efficient communication systems to provide prompt warnings for interventions if it really becomes necessary.

A phytosanitary inspection structure including a quarantine is to be created to help check the quality of plant materials that are introduced.

Researches have to be continued on the development of IPM systems, including researches on forecasting and traditional control methods as well as pesticides with the least adverse environmental effects.

Personnel training and the means of information are to be identified.

Training will include personnel drawn from different levels, but more attention must go to farmers.

As regards information, special efforts must be made for farmers.

The scope and complexity of the programme will require a competent strucutre for regional coordination. Among several other duties to be specified hereafter, this structure must take the initiative to elaborate a harmonised phytosanitary legislation for Sahelian countries in order that particularly the conditions for pesticide approval could be unified throughout the Sahelian region.

III.2.2. General structure of the programme

Since the farmer is the immediate beneficiary of the programme, as well as being responsible for and the principal agent of crop protection, it seems logical for the development of the programme structure to be focussed on the farmer who is to be the pivot of the extension structure. The objective of the programme must be finally accomplished by means of these structures whiles ensuring that the farmer derives benefit from the means, technologies and capacities provided by the various components namely : CPS Reinforcement, Research, and Training - Information. All along, there has to be cooperation with agricultural extension bodies (Fig.1).

Chapters 4 to 8 focuss on the level of extension and the three components of the programme.

IV. EXTENSION

IV.1. GENERAL SCHEME

The proposed extension structure envisages that the flow of information will be channelled through a team composed of CPS agents and agricultural extension personnel who then pass it over to the farming masses, through the intermediary of groups of farmers.

This, of course, involves a procedure which must be adapted to national realities. For example, depending on both the extension structure existing in each country and the preoccupations of the nation, one can envisage the restriction or extension of the area to be covered by the extension. This presupposes the creation of a limited number of strong and functional nuclei.

With regards to activities to be carried out among farmers, two types of actions need to be distinguished:

1) Research pilot actions

2) The diffusion of integrated techniques through the extension channel.

The first actions represent the final research phase and are indispensable for testing the practical validity of recommended technologies, so as to adapt them if necessary and to precisely assess their advantages in terms of production. Moreover, as models for the strict application of integrated techniques, the pilot projects have considerable experimental potential, and must be used for this purpose in the extension actions.

On the other hand, while the extension of integrated techniques is addressed to a large number of farmers, they neither have that rigidity of pilot actions nor the capability for precise measurement of effects.

The relationship between these two types of action is that at the level of farmers, the pilot projects constitute a generative nucleus for the gradual spread of integrated techniques and that this spread is sustained and controlled by the extension action. Nevertheless these two actions are distinct so far as their aims and working methods are concerned.

The pilot projects will still be needed in the next programme because control systems still remain to be tested and, so far, research has not sufficiently dealt with these systems.

A diagram illustrating the relationships between monitors, extensionists, "elite" farmers and ordinary farmers is provided in figure 2. This diagram is general and has to be modified in accordance with the situation.

Within the framework of the programme, there would be different types of farmers: the "pilot" farmers who are a research component; the "elite" farmers who play an essential role in the extension network; farmers in short. The latter represent the ordinary farming masses and they are the ultimate target of the programme.

IV.2. OBJECTIVES

Since extension serves as the component through which the programme ultimately achieves its aims, the objectives of extension are the same as those specified for the programme in general.

IV.3. OUTPUTS

The outputs to be generated through extension must be specified in the specific national programmes in terms of :

- the adopted extension scheme ie. the adaptations made and precise information added into the general diagram in Fig.2, in accordance with the specific national situation (for example in certain countries there are plans for cooperation with functional literacy - drive bodies).

- the area to be covered, the number of cores of elites farmers to be created and their geographical distribution.

Moreover, the description of outputs in the national programmes must be realistic and correspond with inputs emanating from the various components namely: Research, CPS and Training - Information.

In the description of the next project, it is difficult at the moment, to specify the number of ordinary farmers to be targeted. On the other hand, the number of elite farmers has to be specified. For the ordinary farmers success more or less depends on exogenous factors (eg. social factors) whose influence on the progress of extension is presently difficult to determine.

IV.4. ACTIVITIES

In course of the project, the following will be the major extension activities:

- in the immediate period, ie. before bilateral negociations with donors, a plan for the integration of crop protection extension into existing extension systems need to be elaborated. There is also the need for negociations between several bodies for their cooperation. For this purpose, one can envisage the creation of a national coordination unit which would embody, for example, the CPS, Agricultural Development Companies concerned, Research and Agrometeorology. The plan for the final extension system must be ready during the bilateral projects preparation phase.

- during years 1 to 4 of the programme, extension teams are to be created and be made to function. The teams must comprise CPS and agricultural extension agents using the potential of the personnel already available. This must go with the promotion of training for monitors, extensionists and elite farmers in IPM techniques while at the same time stimulating research so as to provide reliable control techiques. All these are to be done in accordance with balanced, careful and gradual plans of activities that are to be specified at the national level.

- active support and follow-up of activities by the national and regional coordination units (refer to paragraphs on the Regional Coordination Unit).

IV.5. INPUTS

The inputs needed for the successful conduct of these activities are the outputs of other components, inputs provided by other national cooperating bodies and equipment supplied from national or external financial resources:

- Agents from agricultural extension services who could be actively cooperating, their number, geographical distribution, area of activity (farming acreage and number of farmers), time available for this programme.

- CPS agents including research observers who would be actively participating, their number, geographical location in relation to that of the extension agents with whom they will be cooperating, area of activity, time available.

- Elite farmers, their number per village, number of villages to be considered, their duties, responsibilities and training.

- Reliable crop treatment protocols including simple surveillance techniques and intervention thresholds.

- Training sessions for elite farmers, extensionists and CPS agents.

- Adapted means of information for farmers and extensionists.

- A structure to provide farmers with farming means (such as inputs and equipment) for pesticide application under acceptable terms. The mission emphasises that this is a delicate problem. On one hand, these inputs have to be placed at farmers' disposal; on the other hand, there is the need to avoid stimulating preventive chemical treatments. It is indispensable, that the coordination units monitor the programme, that there should be reports on pesticide utilisation by the farmers involved in the programme, and that donors maintain a critical attitude towards pesticide procurement.

- A radio transmission system linking the crop protection phytosanitary bases and crop protection surveillance posts.

- Equipment necessary for the extensionists and monitors and operating funds.

IV.6. INDICATORS

From the extension point of view as well as the general plan of the programme, the following can be considered as indicators:

- the impact on farmers; the potential of this impact, in terms of production, has been precisely determined through the pilot projects; the impact currently made has to be estimated through surveys to be conducted among farmers involved in the programme, by making a comparison with non affected farmers.

- the impact at the national level; the potential of the impact on food self-sufficiency can also be estimated on the basis of pilot projects results (refer to the reports on pilot projects in Mali); the impact made so far, has to be measured on the basis of statistical data on the degree of food self-suffiency, but it will be difficult to distinguish the effects of this programme from those of other development programmes.

At the national level, the effectiveness of extension will be determined by:

- The number of IPM extension teams set up
- The quality of the functioning of these teams
- The number of functional groups of elite farmers
- The number of ordinary farmers affected by the programme (this is to be determined through surveys).

It can be remarked that the idea of extending the attainments of researches made in integrated techniques to farmers, was part of the design of phase I of the CILSS Crop Protection Programme and that this idea was not accomplished.

However, the situation is different at present because decentralised CPS structures are now available - though they are yet to be reinforced- and preliminary protocols of integrated cropping techniques have been developed and tested - even if a lot of research still remain to be done. Accordingly, activities that were not feasible 5 or 10 years ago, can be attempted in the coming programme.

There is also the fact that the strategy anticipated in the coming programme can only succeed with a structure designed after careful and mature considerations. Moreover, this structure has to be strictly maintained throughout the programme. Herein lies the major task of the national and regional coordination units.

V. REINFORCEMENT OF CROP PROTECTION SERVICES

V.1. AIMS

Within the context of this programme CPS reinforcement implies two aspects in particular :

1) the creation or reinforcement of a decentralized structure that enables the crop protection services to contribute effectively to extension activities;

2) the creation or reinforcement of a team to take care of surveillance or control operations in cases where the magnitude of the pest problem exceeds the control capabilities of the individual farmer.

Since a decentralized structure presupposes the existence of a central base, there is also the need to consider the structure of the latter.

Within the logical structure of the programme considerations can be limited to the outputs and activities of this component, since these outputs are the inputs necessary for the attainment of the general objective of the programme, which is to be accomplished from the extension point of view.

V.2. CPS CENTRAL BASE

As a general model, the central base located in the capital will have the following functions :

- Management of the CPS
- Internal coordination
- Liaison with research and agricultural extension bodies; within the context of this programme, the central base will be participating in the national coordination unit to be created for this programme;
- Adaptation of the crop protection strategy at the national level, in accordance with the recommendations of the coordination unit;
- Adaptation of the national strategy to the specific conditions of regions in the country; this strategy will endeavour to express in concrete terms, the techniques of prospection, surveillance and warning as well as integrated cropping techniques.
- Preparation of a crop protection legislation by adapting the general model to be prepared (by the Regional Coordination Unit) for all the Sahelian countries.
- Liaison with regional crop protection bodies such as the Regional Coordination Unit of the Programme and organisations in charge of the surveillance and control of large scale pest outbreaks.

Three sections are attached to the central base :

V.2.1. "Prospection, Surveillance, Warning and Extension" Section

- To support the directorate in adapting prospection, surveillance and intregrated cropping techniques to the conditions of different regions in the country as well as to develop a warning system based on IPM research; this is for crop pests, on one hand, and special natural disasters on the other hand ;

- To develop and coordinate the decentralised system of prospection, surveillance, warning and extension ;

- Production - adaptation of documents (technical pamphlets, sheets) supporting the extension activities by decentralised CPS structures ;

- Liaison between research and decentralised structures in the collection and transfer of observations necessary for research ;

- Development of an intra and inter-service system of IPM training and information.

V.2.2. "Intervention" Section

- To support the directorate in developing IPM intervention techniques;

- To contribute to the production of the documents mentioned above ;

- Acquisition and maintenance of intervention equipment and coordination of regional duties on this issue ;

- Storage of pesticides and coordination of regional duties on this issue;

- To support the structures (to be developed) in providing farmers with the means of intervention to be used as part of the application of integrated cropping systems; in line with what the Evaluation Report of Annex A had to say on this issue, the mission contends that the price to be paid by the farmer for pesticides, must reflect their real costs ;

- Training and extension in the field of pesticide application. Special emphasis will have to be put on the dangers involved in the abusive use of pesticides.

V.2.3. "Phytosanitary" Section

- To see to the development and functioning of a phytosanitary inspection system for both imports and exports (quarantine centre, treatment, etc). The system must be adapted to the exigencies of the phytosanitary legislation to be adopted.

V.3. DECENTRALISED STRUCTURES

V.3.1. Phytosanitary bases

The crop protection bases established at the regional level will take care of :

- the operation of forecasting, surveillance and warning systems in the region, by coordinating the activities of the local surveillance posts ;
- the intervention structures either through the service itself or by supporting the farmers ;
- the collection and oversight of observations made by local posts and their transfer to the central base ;
- the coordination of training and extension at the level of agents in charge of surveillance posts.

With regards to the personnel the following structure is proposed for adaptation to the conditions of each country:

1 Chief (senior official or "ITA"), agronomist versed in crop protection (desirable);
2 Assistants ("ITA") one to take care of prospection, surveillance, warning and extension and the other to handle control operations;
1 or 2 Monitoring technicians;
1 Secretary
Drivers, sentries

V.3.2. Surveillance posts

The local crop protection surveillance posts will be in charge of :

- local surveillance and warnings
- the extension of integrated techniques to farmers
- the transfer of observations to phytosanitary bases. This refers to observations needed by the CPS or research unit for forecasting purposes.

It is necessary for the surveillance posts to be linked to the phytosanitary bases by radio. Transmissions between the phytosanitary bases and the central base will also be effected by radio.

The personnel of the surveillance posts will comprise :

1 - 2 Monitors (surbordinate personnel) to be in charge of the extension and observation needed for local forecasting and warnings.

It will be desirable for the observation and surveillance posts as well as extension units to be located on the same premises.

The agricultural importance of a site has to be taken into consideration in the establishment of surveillance posts.

The situation whereby the flow of information was mainly effected from crop fields towards central research stations during phase I, has to be reversed in phase II, to enable farmers immediately utilise surveillance systems developed through research. Of course the surveillance posts will continue the collection and transfer of data that are needed to help improve these systems through research.

V.4. OUTPUTS

The outputs to be generated by the CPS Reinforcement Component can be summarised as follows :

- Regional phytosanitary bases and functional local surveillance posts in terms of :
  - . extension of integrated techniques by oral means, radio, bulletins, and demonstration farms ;
  - . correct transmission of data required for research purposes.
  - . justified interventions based on pest surveillance.
- Documents specifying the crop protection strategy in concrete terms for the countries and for the different regions.
- Technical pamphlets and sheets in support of the activities.
- Intra and inter-services training sessions for monitors, extensionists and farmers.

The specific outputs quantified for each country as well as their corresponding activities and inputs required, must be specified in the national programmes.

V.5. INDICATORS

For each country, the success of this component is to be verified in terms of the quantity (in relation to the envisaged programmes) and quality of the outputs mentioned above.

V.6. SURVEILLANCE AND INTERVENTION DIRECTED TOWARDS LARGE - SCALE PEST OUTBREAKS

The delicate problem of approach in cases of large scale pest outbreaks, especially grasshoppers and locusts, still remains to be discussed. It is being suggested here, that at the national level, efficient surveillance and alarm structures will have to be developed in this respect and that the data from this surveillance are to be transmitted to the regional coordination unit which will specify (using forecast models and other means) the intervention strategy to be followed. The surveillance structures mentioned above will be in charge of pest surveillance. Where it is considered necessary for the intervention to be on a large scale, it will be effected under the responsibility of crop protection services (intervention section) of the different countries. The mission considered two possible intervention models. It can be envisaged, on one hand, that certain countries that are highly susceptible to the development of these pests are to be equiped with planes for intervention purposes. On the other hand, and for economic reasons the mission considered the possibility of equipping a number of countries - or a regional structure - with spray planes. The maintenance of the required aircrafts is going to be very costly since such planes are expected to be operational all the time, whereas in our case they are only going to be used sporadically for treatments. In this vein, the mission also consider the possibility of subcontracting the treatment operations to specialised companies. Since the data required for a detailed analysis of this issue is presently unavailable, the team suggest that this problem be taken up again, without delay. In the interim, the team suggest, that countries particularly vulnerable to such attacks be equipped with planes, while the other countries receive an estimated budgetary allocation to enable them call upon specialised companies when the need arises.

V.7. GENERAL CONSIDERATIONS ON CPS REINFORCEMENT

The costs of investments and for operating the structures to be set up, are indicatively presented in Annex 3. These are maximum figures because the costs of constructions and equipment already installed will have to be subtracted from these figures. The mission does not possess the complete inventory needed to help make these calculations.

However, the set of structures to be set up obviously requires considerable resources in terms of both financial investments and qualified personnel.

If we assume the average number of phytosanitary bases and surveillance posts to be 10 and 30 respectively, it implies that 60 top and mid-level staff and 90 subordinate personnel will have to be trained in crop protection.

Given the low potential in trained personnel and training capacity (cf chapter 7), it is necessary that in their bilateral negociations on the projects, the Sahelian countries and donors meticulously work out a scheme for the installation of the required structures, taking into account these limited capacities.

As indicated elsewhere in this report, it will be preferable to proceed slowly ie. to install the required structures within a period of over 4 years, rather than to hasten things and then finally create unsuitable structures.

It must be emphasised, once again, that the CPS structures to be set up are mainly meant for pest surveillance, forecast and warning. They must provide the "scientific" certainty, serving as a strong basis upon which the decision can be taken not to effect treatment in unjustified cases. One only needs to consider certain costly and probably unjustified grasshopper control operations carried out in 1986, to be convinced that a good surveillance network is beneficial both financially and ecologically. The effects of large scale interventions are detrimental to the environment and where they are prolonged to cover several years there will certainly be adverse effects on useful fauna.

VI. RESEARCH

VI.1. OBJECTIVES AND HYPOTHESES

The development objectives of the Research Component are the same as those of the general programme. The immediate objective is to elaborate reliable IPM systems for basic crops.

By reliable, we refer to the fact that the research output must harmoniously fit into the farmer's production system.

Taking a cue from the implementation of the crop protection programme - phase I, it seems indispensable to lay emphasis on two essential points:

1) The steps to be followed in the elaboration of the IPM system, must derive from the needs and socio-economic conditions of the farmer. The technological package, thus elaborated, will be transmitted to the farmer through the channel of the extension system.

2) The elaboration of the appropriate technology requires a multidisciplinary approach. This calls for close collaborations at two different levels:

a) Collaborations between various crop protection disciplines

b) Collaborations between crop protection disciplines and other agricultural sciences disciplines (cultural agronomy and techniques, socio-economics, etc.). This being the case, it will be beneficial to draw inspiration from the approach used in the Farming Systems Research (FSR).

VI.2. RESEARCH STRATEGY

VI.2.1. Phase I attainments using monodisciplinary research

Recent evaluations (1984 and 1986) of the Regional IPM programme - phase I, stressed the need for continuing crop protection research in the Sahelian region, though on a bilateral basis (host country - donor). The evaluation also pointed out that member countries have made considerable progress in personnel training and accumulation of crop protection data.

The national components of the project prepared considerable data on biology, ecology, bioclimatology and pesticides using a monodisciplinary research approach. In other words, each researcher worked independently in his discipline rather than using a team or multidisciplinary approach ; the only exceptions are the initiation of the pilot programme in 1984 and in the cases of countries where there existed research teams per crop production.

VI.2.2. Phase II Research using a multidisciplinary strategy

A multidisciplinary research approach is to be used in phase II to pave the way for the introduction of a new IPM technology in the farmer's production system. This does not imply the elimination of monodisciplinary research since station experiments are to provide data that can be used for the development of new crop protection methods within the unstable and dynamic environment of the Sahelian farmer.

The next logical stage is the use of the data acquired, by using monodisciplinary research as well as new data obtained from these methods, to develop new technologies meeting the needs of Sahelian farmers. One strategy by which this can be accomplished and which has been successfully tried (FSR) has been presented in the annex and illustrated in figures 3 and 4.

This strategy is a viable approach for the elaboration of new appropriate technologies for subsistence farmers. The IPM approach is not different from the approach used by the farming systems research.

This strategy has the advantage of producing new technologies acceptable to farmers. Moreover, it requires little time and personnel, because, being multidisciplinary, it reduces the number of trials required.

VI.3. RESEARCH OUTPUTS

Research outputs, like extension inputs, are the following :

- In general, the concrete development of IPM systems for basic food crops.
- Specifically, the techniques and methods of surveillance (including intervention thresholds), prevention and control of various crop pests.

In phase I, a relatively large part of research was devoted to the acquisition of knowledge on pests, their distribution, biology, surveillance techniques and the collection of data which serves as a basis for specifying tolerance and intervention thresholds. In phase II, the attention given to these research themes can be reduced, since this set of data will be made available to the extension system in the final form of technical pamphlets, sheets, etc. By reducing the research themes mentioned above, more emphasis can be given, in phase II, to researches in the prevention of swarming, i. cultural methods, variety resistance and biological control. The economi conditions in the Sahel are such that emphasis must rather be put on th methods than on costly chemical intervention techniques.

Scientific resources currently available have been specified 2 and 3 which summarize the researches conducted and results achi as the number of researchers who will be utilised in phase II.

It will be difficult here to propose a detailed list of spe research outputs to be generated and activities to be undertaken in the different countries during phase II. Nevertheless, various documents made available to the team (Annex 6: 8, 9, 10, 11), have made it possible to determine the priority themes (Table 4).

This list could be adapted to the conditions of each country depending on the decided order of priorities. The themes mentioned will be studied on a multidisciplinary basis and on experimental farms of research stations.

As indicated in section 6.2, there will be additional research in the form of "pilot actions among farmers" to help in integrating all the recommended techniques. The mission suggest the continuation of pilot actions on millet and its extension to other regions. Similar actions, should also be set up on sorghum, irrigated rice and lowland rice.

The team stress the fact that the introduction of pilot actions must be based on agronomic and socio-economic analysis of farmers' constraints in the region concerned (refer to Section VI.2). The mission also insist on the fact that researches to be conducted "in stations" must be based on the socio-economic conditions of the farmer for the solutions elaborated to be realistic.

With reference to table 4, the mission proposes that certain themes that were not studied in detail in phase I, be given more attention in phase II:

- flower beetle control by trapping
- "Classical" biological control i.e. by importation of natural enemies that prey on similar pests in other regions (East Africa), methods to be studied for Raghuva (refer to the report written by D.J. Greathed - Annex 6:15).

In phase II, there will be a possible division of work to some extent, in accordance with the groundwork already developed in phase I. For example, Senegal will continue to provide baseline data for biological control of Raghuva. As regards variety resistance, countries where considerable varieties have been collected can take care of the screening of this material vis-à-vis with pests, while as well, taking into consideration the local phytosanitary situation which must be conducive for a level of attack permitting the screening. Niger, for example, is in possession of a substantial collection of millet varieties at the ICRISAT Sahelian Centre.

However, in view of the ecological conditions varying from one country to the other, the division of work in research between countries cannot and must not go too far. In the case of resistant varieties, for example, a good collection of interesting varieties coming from screening have to be tested in each country preoccupied by the pest in question, in view of the differences in resistance that can be demonstrated for a given variety from one region to the other.

VI.4. RESEARCH ACTIVITIES

Research activities in the countries have to be specified in the form of descriptions of specific research projects. Special emphasis must be placed on the finalisation of the modelisation of grasshopper swarming and on the development of strategies for controlling these pests.

VI.5. RESEARCH INPUTS

Inputs must also be specified for each country. Preliminary budgets have been prepared in the documents for each country.

It is worthwhile, at this juncture to make some considerations on the human resources available for crop protection research (table 4). The number of entomologists and phytopathologists is more or less statisfactory. Considering the large effects of weeds on agricultural production, the number of weed scientists is too low. At the moment there is practically no agronomist and in fact no socio-economist working in the IPM programme. For reasons already discussed on this issue, the team stress the need to improve this situation. At least one agronomist and one socio-economist are needed for each national component.

Finally, the mission stresses the need for establishing collaborative links between the IPM programme and other national and international programmes concerned with food crops in the different countries. Since such collaborative links are often difficult to establish, the Regional Coordination Unit will have to play the big role of stimulation in this regards.

VII. TRAINING

VII.1. OBJECTIVES

In spite of the considerable financial and material means made available to the Crop Protection Project, the success of the latter is hampered by the qualitative and quantitative deficiency of the human means available to the project.

The CILSS/FAO/USAID, tripartite evaluation mission of April 1986 commended the laudable achievements made in phase I of the IPM project, upon their observation that during this phase, about 67 Sahelians received crop protection training (including technicians and senior staff).

However, since this capacity still appears insufficient vis-a-vis with the scope of the problem, the same mission recommends the continuation of training efforts, by laying more emphasis, this time, on the training of farmers not only in their capacity as beneficiaries of the output generated by the project, but particularly to make them really responsible in the defense of their food crops.

In effect, training efforts need to be continued or began at all levels: top-level staff (CPS agents; researchers), mid-level personnel, CPS monitors, extensionists from the extension services and farmers.

The immediate objective of the training component is that by the end of phase II, a minimum force of well trained officials/farmers must be established to form the pivot of structures required for the execution of plant protection duties in accordance with the outlines drawn in this report.

A summary of the various levels of officials and the Sahelian Schools for their training, has been presented in Annex 5.

VII.2. TRAINING OF TOP LEVEL PERSONNEL

VII.2.1. Researchers

Through the efforts of IPM project phase I, a nucleus of researchers will be established on the return of those currently in training (refer to table 3). In this regard, two aspects can be distinguished: strengthening of the scientific force by offering new training, and refresher courses for existing researchers.

a) Training of researchers

Since a considerable number of researchers mentioned in table 4 only hold bachelor's degrees, it will be necessary to continue by giving them more training.

b) Refresher course for researchers

The conditions under which the crop protection researchers in the Sahel carry out their work are not conducive for completing and maintaining their knowledge and aptitudes. They are really isolated, from the scientific point of view. For those who have completed their formal training, a system that offers scientific stimulation and retraining for roughly 2-4 years, will be desirable. These periods of retraining have to be spent in a recognised research institute abroad. For a maximum benefit to derived from these refresher courses, continuous links must be established between the research group and the Institute offering the course. It will be desirable for the consultations planned,as part of the different national crop protection projects, to help in establishing similar links between the institutions providing the consultants and the national researchers.

Phase II of the crop protection programme must provide national researchers with fellowships for refresher courses. It will be indispensable for these courses to be properly prepared. The regional technical coordination unit will have to play a major role in this respect.

Besides this refresher course, seminairs on specific themes will have to be organised by the Regional Technical Coordination Unit for researchers.

VII.2.2. CPS Senior staff (Agronomist, ITA)

Considering the fact that, at the moment, neither the central structures nor the decentralised structures of the CPS have been set up, and that several senior CPS staff have not received adequate crop protection training, it becomes obvious that there is a real need for training for these officials. They would require crop protection training at the bachelor or masters level. Fellowships will have to be provided to this effect.

As is the case for researchers, seminars will have to be organised under the auspices of the Regional Technical Coordination Unit.

Short training in well structured and functional crop protection services must be planned for CPS agents from Sahelian countries.

VII.3. TRAINING OF MID-LEVEL PERSONNEL (CTA, ATA)

While there exist agricultural training schools for mid-level personnel in most of the Sahelian countries, none of these national schools (refer to Annex 5) run a crop protection specialisation programme.

Only the Practical Institute for Rural Development (IPDR) in Kolo (Niger) is running a crop protection programme, within the framework of the CILSS Crop Protection Training Project (Financed by Netherlands). The results obtained by the IPDR can be summarised as follows :

- the establishment of a qualified team of tutors and infrastructures comprising, inter alia, two classrooms, one laboratory with offices and stores and dormitories for students.

- the training of 17 technicians as the first batch (1982-1984). The admission of 22 students as the second batch (1983-1985). Out of this batch, 20 were promoted to the second year. Another batch of 20 students have been selected for the 1984-1986 programme.

Other achievements made in the training of technicians in recent years include :

- "Ecole Nationale Supérieure Universitaire de Technologie" (Dakar).
- Ahmadu Bello University. Studies planned for six Gambians. 3 took the course and received certificates.

- Since October 1983, two Gambians have been receiving a technicians' laboratory training at the Commonwealth Agricultural Bureau.

- An advanced level trainer is receiving further training at the ESAT, Montpellier, France. He will complete this course at the end of the year 1986.

The development of certain crops (irrigated crops in particular) has brought about an increase in attacks by pests and diseases in recent years. This situation also gave rise to an increasing demand for qualified personnel capable of dealing with these numerous attacks as well as preventing the resultant losses in terms of agricultural products. Accordingly, the Crop Protection Training Project plans to develop, quite apart from the training of rural development technicians specialised in crop protection, the training of other categories of personnel (trainers on one hand and agricultural engineers and/or senior technicians on the other hand) in accordance with the recommendations of the evaluation mission.

The training of trainers (teachers who give tuition in crop protection in the various agricultural schools in member countries) in particular, will enable the project achieve multiple effects. This also applies to the training of ITA/TS who belong to national crop protection services and other agricultural services.

The crop protection Training Project (Financed by Netherlands) will become a permanent structure from 1987 onwards. The following are the activities planned and results expected from the training of mid-level personnel :

(1) The Crop Protection Training Project (IPDR-Kolo) will be transferred to the AGRHYMET Centre and will take the form of a Crop Protection Department. The department will be established under the auspices of CILSS and will provide crop protection training in the Sahelian region. The proper functioning of the department will be ensured by setting up the necessary infrastructure, equipment and personnel.

(2) A programme comprising different lessons will be implemented. The activities of the programme for the period 1985-1990 must yield the following results:

- Training of eighty rural development technicians specialised in crop protection (four batches, each with twenty students for a duration of two years) ;

- Additional training for tutors who give tuition in crop protection, in agricultural schools. Two sessions of short courses have been planned, each with a duration of 4 months to be held in 1988 and 1990 respectively. Each session will have 10 participants.

- Training in crop protection for senior technicians (TS) and agricultural engineers (ITA) working in crop protection services or agricultural services. This training will be meted out in the form of two courses each for a period of 4 months in 1987 and 1989. Each course will admit 20 people ;

- Strengthening of knowledge in certain specilised crop protection domains through short courses, refreser courses and seminars. Each year, one of the activities has to be carried out for a total number of 20 people.

- Training of 6 Gambian technicians in a course leading to the award of a certificate in crop protection, in an Anglophone country ;

- Training of 6 technicians from Cape Verde in crop protection and in a Lusophone country.

It is highly recommended that tuition in crop protection be reinforced in national schools that train senior agricultural technicians (Agricultural engineers, technical Agricultural Assistants, Agric. Officers).

VII.4. TRAINING OF MONITORS

At present , in the monitors/extensionists training schools, there is practically no specialised crop protection course (Annex 5 gives information on these schools). Training materials will have to be developed in this direction. As mentioned above, this programme plans to train 20 tutors who will receive further training in crop protection to help in strengthening the agricultural schools.

The mission feels that this number, for all the 9 CILSS countries, is insufficient. Additional means of training in terms of tutors, must be developed. Tuition in crop protection must be strengthened in schools that provide training for monitors.

VII.5. TRAINING OF FARMERS

Farmers must be technically armed to enable them play their role as being principally responsible in the protection of their crops. The international seminar of the CILSS IPM Project (Niamey, 6-13 December 1984) drew attention to the fact that one of the constraints to the application of IPM techniques in crop protection, emanates from the characteristic illeteracy of most Sahelian farmers.

In phase II, special attention is to be given to the training of farmers This training will be meted out from two perspectives ;

1) A short term training intended for a broad mass of farmers within a relatively short time. It is meant for a broader sensitisation of farmers to the problems caused by large scale pest outbreaks in the Sahel in recent years.

The number of farmers to receive such a training depends on each country, but the duration should in fact, not exceed four days per training session.

2) The training of elite farmers.

The training of farmers in this phase must be conducted in the following manner :

Phase II will set up decentralised crop protection structures, comprising phytosanitary bases and surveillance posts. Each surveillance post, with the help of extension agents and administrative authorities in the locality, will select "elite" farmers. 10 farmers will be chosen at each post and sent to the chief town of the bases. The trainers will be drawn from among CPS agents and agents from extension bodies or agricultural training schools working in the domain of crop protection.

A two weeks' training (15 days) will be given to these "elite" farmers before the beginning of the cropping season. They will then be released to go and take care of their farming activities. This will give them the opportunity to put their training knowledge to test.

After the harvesting period, the same elite farmers will return to the base for another training session of two weeks, where they will reveive additional training :

The farmers thus trained will finally return to their villages. They will continue to be monitored by CPS agents and will in turn become the trainers of other ordinary farmers.

Crop protection agents will carry out evaluation missions among the trained farmers.

This means that within a year and for a country having twenty (20) surveillance posts, 200 farmers will be trained yearly.

If we assume an extension coefficient of 5, it means that 1 000 farmers will be sensitized each year to crop protection methods and techniques.

Refresher courses for elite farmers will be ensured through follow-ups on the application of integrated techniques, to be carried out by extensionist as described in the chapter on extension.

VIII. INFORMATION

VIII.1. OBJECTIVES

In phase I of the crop protection programme, a lot of knowledge were accumulated on both the inventory of pests and the methods and techniques for controlling certain crop pests.

These attainments were published in the form of technical sheets, bi-monthly Crop Protection Information bulletins and various evaluation reports.

The team commend the work done, but feel that these diverse publications could be better exploited especially by extension agents, teaching corps of establishments providing tuition in crop protection disciplines and particularly farmers.

Furthermore, efforts made in the first phase have to be continued with the objective of producing and animating documents and other means by which the information that summarise the attainments of research in both phases I and II of the programme, can be diffused. These means of information must also be adapted to the needs of various categories of beneficiaries : farmers, extensionists, CPS agents, tutors, researchers etc.

VIII.2. OUTPUTS AND ACTIVITIES

In phase II, more emphasis is to be placed on the following outputs and activities :

a) the expression of publications in terms that can be more readily understood by extension agents, and especially farmers and other users:

b) more efficient means of message transmission need to be exploited for example :

1) The Rural radio programme is well developed in all the CILSS countries. Crop Protection extension themes will be developed and entrusted to national components for diffusion through this channel.

2) Experience has demonstrated that posters also consitute a powerful tool for the transmission of messages, provided that, they are well elaborated and presented. Posters also have the advantage of being easily translated into vernacular languages by the national components or extension agencies in each country.

3) In certain Sahelian countries, there are public screens whic can be valuably exploited.

4) One can even envisage proposing film sessions or slide shows for certain extension themes. These sessions must take place, preferably, in village places where the crowd can be pulled.

5) Bulletins translated into vernacular languages can also play an important role in this phase. They are also efficient for a certain category of targets.

However, there are some constraints that need to be taken into consideration

- the effect of such a practice depends on the literacy level among the farming masses in the sub-region.
- the diversity and multitude of vernacular languages in the sub-region are such that the use of this method will require a lot of work.

However there are CILSS countries like Mali or Senegal where the literacy drive campaign is at an advanced stage. It will therefore be advisable to try this experiment in such countries and to evaluate the impact.

c) Specific publications need to be improved to enable INSAH capture the audience of the international scientific community. To this effect, such publications must pass through a proof-reading committee, to be set up by the Regional Coordination Unit, for prior approval.

VIII.3. ASSIGNMENT OF RESPONSIBILITY

All this information work must be elaborated and coordinated by the Regional Coordination Unit with the collaboration of national components using the means of information already installed at the Sahel Institute (refer to chapter on the Regional Coordination Unit).

The mission learnt of a proposal to assign the Information Component of the programme to the Department of Crop Protection Training in Niamey. The mission cannot recommend such a structure since the baseline data to be diffused by the information structures are generated, particularly, through the Research Component of the programme.

An indirect channel : national components - Regional Coordination Unit - Training Centre - Beneficiaries will be detrimental to the quality of diffusion. Of course since the teaching centres will be significant beneficiaries of the outputs of the Information Component, a collaboration between the Regional Coordination Unit and the Department of Crop Protection Training, in information matters, will be necessary.

IX. REGIONAL COORDINATION UNIT

In the preparation (by CILSS and the Sahelian countries) phase of the coming crop protection programme, CILSS was mandated to ensure the technical coordination of the whole programme. The mission would like to emphasise that such a coordination is indispensable.

IX.1. RESPONSIBILITIES OF THE UNIT

The Regional Coordination Unit to be created will have the following responsibilities :

(1) To ensure the follow-up and internal evaluation of the programme

(2) To give technical support to the different national projects through the intermediary of Sahelian experts in the unit to be created and by the recruitment of consultants.

With regards to consultants, the mission suggest that continuous links be established between Sahelian research groups and appropriate scientific groups abroad. Such a system would permit the training of senior officials and the holding of refresher courses in research centres abroad (Proposed in the chapter on Training).

(3) To animate and organise seminars intended for :

(3.1) The trainers of farmers. One seminar is planned annually for each Sahelian country (9 seminars/year). This training is very important in so far as the strategy anticipates the progressive take-over of the major part of control operations by the farmer. These trainers provide training for the largest possible number of farmers at the national level. The assistance of the Regional Coordination Unit will ensure the homogeneity of training throughout the Sahelian region.

Seminars will be organised by the Crop Protection Services with the support of the Regional COordination Unit.

(3.2) Senior staff.

(3.2.1) An annual meeting will be held on crop protection research to review the results of the past year and to draw programmes for the following cropping season. This will enable Sahelian researchers to be informed of the results obtained in each country and will help in working out supplementary programmes and in identifying the areas for possible collaboration between the projects and the research system.

During this meeting, colloquia will be organised on sector by sector basis, in order to acquire more knowledge in specific areas. At the same time, observation protocols will be harmonised, new pre-extension actions defined and themes identified for technical sheets.

(3.2.2) To organise an annual meeting of senior CPS officials in order to examine the phytosanitary situation of the year, to determine control strategies, to outline proposals for extension by taking into consideration IPM research achievements, to outline themes for future seminars and to analyse crop protection training.

This meeting will include sessions on special themes so as to widen the knowledge of these officials on specific fields.

(4) To collect data on certain well chosen pests emanating from surveillance posts and to proceed to a regional analysis of these data with a view to developing models for forecasting attacks by these key food crop pests (grasshopper, Raghuva).

(5) To prepare the following documents :

(5.1.) Technical sheets and posters to be drafted according to the different categories of users: technicians, extensionists and literate farmers; for the latter group, the papers will be prepared in local languages in collaboration with the countries and literacy - drive services.

More attention must be given to posters that are completely pictorial, because it seems to be the most effective type of document to win the farming masses.

(5.2) Models of manuals that can be translated into local languages in the various countries and in collaboration with literacy - drive services. Since farmers are to gradually take over most of the control operations, there is the need to give them crop protection training. These manuals will help the trainers of farmers in acquiring tools for this training.

(5.3) Standardised observation recording books for all the 9 CILSS countries. At the end of a cropping season, these documents will help in making a regional analysis of bioclimatological data.

(5.4) Annual reports on the phytosanitary situation. This document will help in providing knowledge of the phytosanitary problems that cropped up within the year, the treatments made, IPM approaches tried by the national crop protection services, training provided and the participation of farmers in control operations.

(5.5.) Synthesis of researchworks. This document will highlight researches conducted in the region and will be distributed to researchers, heads of national crop protection services, and international research Insitutes collaborating with Sahelian research structures.

(5.6) Stimulation of researchers and collaboration with them for the publication of research results. The unit must ensure that documents for publications pass through a proof-reading committee that appreciates the quality of work. The unit is to contribute to the development of accessible publication channels with a large diffusion and within a Sahelian framework.

(5.7) Documents for seminars: As the unit is responsible for organising and animating seminars, it must see to the preparation of documents to introduce the subjects to be discussed.

(6) The preparation and diffusion of a scientific documentation record file to researchers and Heads of national crop protection services, with a view to providing them with recent scientific information on pests that are of interest to the Sahelian region.

(7) Participation in regional or international crop protection meetings, together with national experts for the exchange of scientific ideas between the Sahelian region and other regions facing the same problems.

(8) Elaboration of a regional outline, of the phytosanitary legislation, using existing models.

(9) Approval of refresher courses to be attended by senior officials abroad (refer to chapter on training).

IX.2. TUTELAGE OF THE UNIT

The problem of tutelage for the unit is posed under different aspects, butthe mission could only consider the technical aspects.

(1) Since several tasks of the unit involve the coordination of aspects relating to research, training and information, it is viewed economical for the unit to be located in an Insitute where structures in support of these 3 aspects, have been already established.

(2) Considering the fact that information, including the production of various documents, constitute a major preoccupation of the coordination unit, there has to be a necessary collaboration with the information unit created, at the Sahel Institute, for this purpose. Direct contacts between the two units will pave the way for efficiency in production and the quality of products.

(3) Several tasks of the Unit require the use of a library and the means for record-keeping. All these are available at the Sahel Institute.

(4) The need for an integration of crop protection into the whole rural agricultural and socio-economic set-up has been stressed for the next programme. In this respect, the proximity of research programmes to INSAH (Millet, sorghum, maize, cowpea, USED Project) will go to sustain the recommended multidisciplinary approach.

While institutional set-up other than INSAH can be considered, they fail to provide all the advantages indicated above.

The mission therefore concludes, in line with the suggestion made in the report, "Mid-term evaluation - Integrated Pest Management Project and Final Evaluation Regional Food Crop Protection Project - 626.0928" (December, 1984) of the USAID, that it will be more efficient to place the Regional Coordination Unit under the auspices of the Sahel Institute.

IX.3. PERSONNEL REQUIREMENTS

The Regional Coordination Unit will need the following personnel :

- 1 Coordinator
- 1 Agricultural Zoology Assistant
- 1 Phytopathologist
- 1 Bioclimatology and Surveillance Assistant
- 1 Administrative and Financial Assistant
- 1 Secretary
- 1 Driver
- 1 Sentry
- 1 Watchman

The budget for running the Unit is presented in table 5.

A N N E X E S

ANNEX 1

GLOSSARY

Project	:	Operation aimed at achieving some specific objectives with a given budget and within a determined time-limit.
Programme	:	An organized set of activities, projects, processes or services aiming at specific objectives.
Process	:	A continuous organisational operation meant to ensure a support
Strategy	:	A concrete set of measures to serve as linking the variables of the project and determining the execution trajectory for achieving the immediate objective.
Objective	:	Operational articulation of the finality and aims of an activity representing the desired final state with the realisations expected from this activity. A programme/project must have at least two objectives : one is immediate while the other is spread over the long term. The objectives could even be more.
Development objective	:	Ultimate aim of the project. Normally it directly follows the immediate objective.
Immediate objective	:	Effect being sought for, on or soon after the successful completion of the project.
Outputs	:	Specific and directs results expected from an activity to enable it achieve its objective with the provided inputs. In the context of the programme/project, the output constitutes the first stage of results.
Activity	:	Action necessary for the transformation of a given set of inputs into planned outputs, within a determined period.
Inputs	:	Goods, services, personnel, money etc... furnished for an activity with a view to achieving certain results and fixed objectives.

Working Schedule : Operational programme for the implementation of a project. It associates the inputs, activities and outputs within a given period (e.g. one year, duration of project).

Effect : Consequence upon using the output of the programme/project. It is the second stage of results involving the way through which the outputs are transformed into desired aims.

Impact : Expression of the ultimate modifications in development resulting from a programme/project specifically undertaken to produce these modifications. It is the highest stage of results. The impact is the consequence of the effects of the programme/project and it reflects the degree of accomplishment of the long term development objectives.

Aim : Specific grandeur of the outputs, effects and impact expected from a programme/project.

Beneficiaries The target group (s) for whom a programme/project is carried out. This may involve persons, homes, organisations or communities.

Hypotheses : Exogenous facts or actions which must exist or take place for the programme/project to produce the expected results. The programme/project has very little or no control over these facts or actions.

Indicators : Specific variables and factors to be measured to help in determining whether the changes or results being expected from a programme have been realised. The indicators provide a scale for measuring the changes that have taken place.

Follow-up : Continuous or periodic surveillance of the implementation of an activity (and its components) to ensure that the inputs provided, the works programmed, the expected outputs and all the required actions are carried out as scheduled.

Evaluation : Process aimed at determining as systematically as possible, the relevance, efficiency and impact of activities carried out in relation to the set objectives.

SOURCE : Directives for the evaluation of technical cooperation projects, FAO Rome, 1985.

ANNEX 2

COMPARATIVE TABLE OF THE CATEGORY OF CIVIL SERVANTS IN THE CROP PROTECTION FIELD AS WELL AS THEIR EDUCATIONAL BACKGROUND

BURKINA FASO

Senior cadres :	- Agronomist Ingineer - PhD holder: BSc, MSc, PhD - Rural Development engineer (Institut Supérieur Polytechnique - Université de Ouagadougou = 13 years of basic education = GCE + 5 years of University studies)
Middle level cadres:	- Specialist in Agricultural works (see Mali) - Specialist in Development techniques (13 years of basic education = GCE + 3 years of University) - Senior Technicians or leader in Specialized Agricultural Workds (Polyvalent Agricultural Centre of Matourkou) 10 years of basic eduaction + 3 years at the PAC of Matourkou.
Junior Staff:	- Agricultural Technical Officer (PAC of Matourkou= 8 years basic education + 4 years at Matourkou). - FJA Supervisor (Training of Young Farmers)

CAPE VERDE

Senor cadres:	- BSc, MSc, PhD (or equivalents) Lusophone (foreign Universities)
Middle level cadres	- Agricultural Technical Engineer Training School for Technicians in Rural Development (EFTDR) of San Jorge; 9 years + 4 years)
Junior Staff	- Professional technicians. Training School for technicians in Rural Development (EFTDR) of San Jorge; 9 years + 2 years)

THE GAMBIA

Senior Cadres:	- BSc, MSc, PhD (Foreign Universities) - Scientific Officers (Senior Staff)
Middle level cadres:	- Super Intendents (Ahmadou Bello University 2 years)
Junior Staff	- Yundum College (Certificate in Agriculture)

MALI

Senior level Cadres:	- Agronomist Engineer Doctorate in Agricultural engineering BSc, MSc, PhD (Foreign Universities) - Engineers in Applied Sciences (Rural Polytechnic Institute of Katibougou, ISA Cycle = GCE (12 years + 4 years).
Middle cadres:	- Engineer in Agricultural Works (Rural Polytechnic Institute, ITA cycle = level of basic education (9 years) + 4 years)
Junior Staff:	- Agricultural Supervisors (Agricultural Extension Centre of Samanko and M'Pessoba; 6 years of basic education + 2 years at AEC)

MAURITANIA

Senior Cadres:	- Agronomist-Engineer BSc, MSc (Foreign Universities)
Middle level cadres:	- Agricultural Supervisors (National Institute on Training in Agricultural Popularization of Kaedi, Supervisors cycle)
Junior Staff:	- Agricultural Extension workers (NITAP of Kaedi, Extension workers cycle)

NIGER

Senior Cadres:	- Agronomist Engineer PhD Agricultural Engineering BSc, MSc, PhD (University of Niamey); Foreign Universities

Middle level Cadres: - Agricultural Adviser (Institute for Practice in Rural Development of Niamey Kolo, CA cycle)

Junior Staff: - Technical Officers (IPDR, AT cycle)

SENEGAL

Senior Cadres: - Agronomist Engineer
PhD Agric Engineering
BSc, MSc, PhD (National Higher Institute and Foreign Universities)
- Engineer in Applied Science (National Institute in Rural Development of Thiès, ISA cycle)

Middle level Cadres: - Engineer in Agricultural works (School of Rural Cadres of Bambey, ITA cycle)
- Agricultural Technician (E.C.R.- ATA cycle- Bambey)

Junior Staff: - Supervisor (School for Supervisors)

CHAD

Senior Cadres: - Agronomist-Engineer
PhD in Agric. Engineering
BSc, MSc, PhD (Foreign Universities)

Middle level cadres: - Engineers in Agricultural works (Agricultural Technicians Training Centre of Doyaba; ITA cycle)
- Extension worker
- Agricultural Technique (CFTA, CTA cycle)

Junior Staff: - Agricultural Technician (Agricultural technical Education College of Ba-Ille, ATA cycle)
- Supervisor
(CETA, supervisor cycle).

ANNEX 3

A NATIONAL IPM RESEARCH STRATEGY USING THE FARMING SYSTEM RESEARCH (FSR) APPROACH

INTRODUCTION

The research strategy described below is based on the Farming Systems Research approach in the development of new appropriate technologies for farmers using traditional farming practices.

Initially, a general view of the Farming Systems approach is presented followed by the crop protection research as related to the FSR approach. Finaly, we present the means for implementing such programmes in Phase II of the IPM research. This is followed by a consideration of major pests and potential constraints to be explored using multidisciplinary approaches.

The FSR usually comprises three levels :

A. Base surveys
B. Field trials
C. Evaluation and development.

A. BASE SURVEYS

The conditions of the farmer including his objectives and constraints to the improvement of his welfare are all defined at this firts extremely important level. In most cases, it involves a description of all the operations and preoccupations of the farmer as well as his immediate and long term aims.

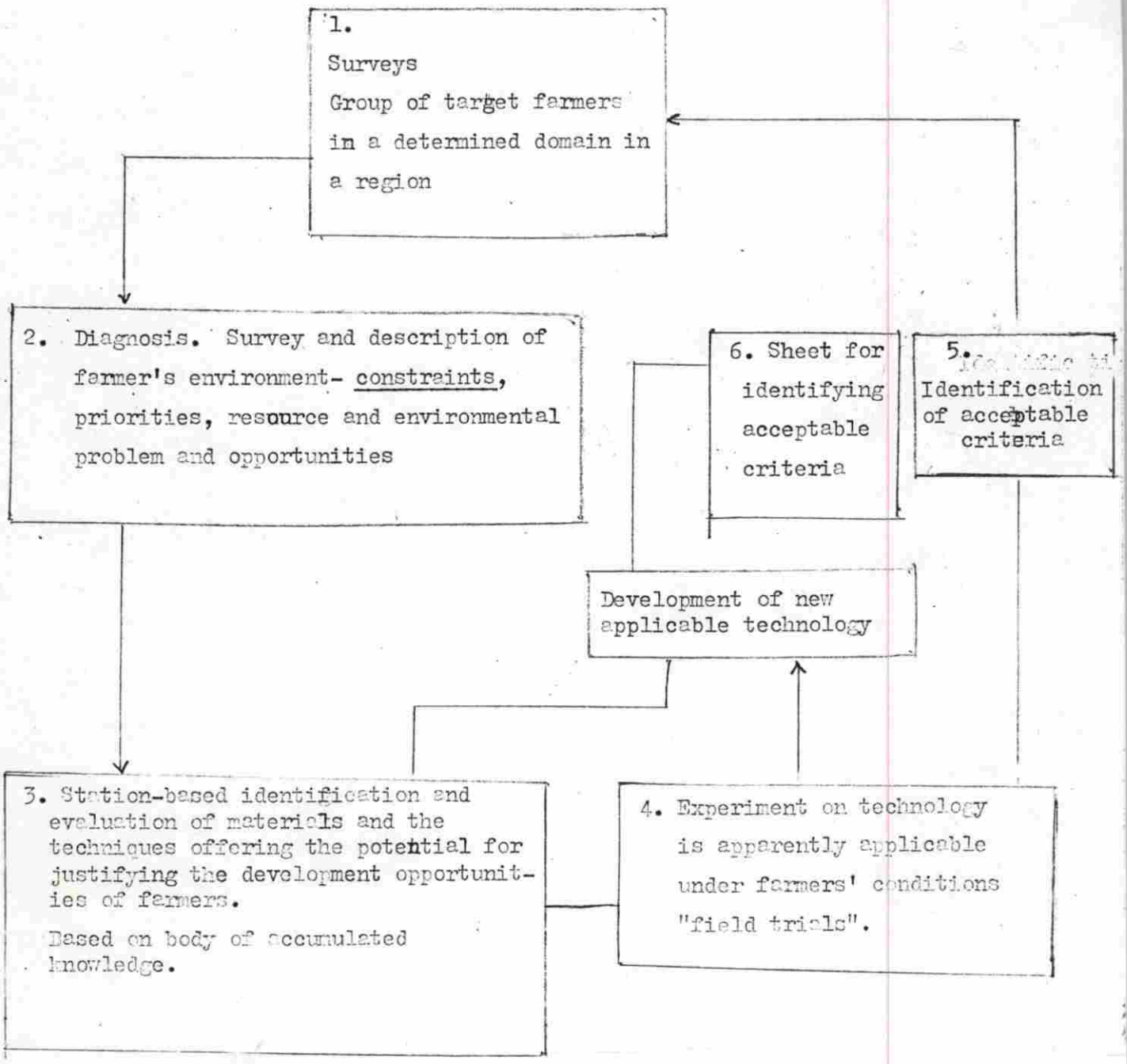
The procedure for obtaining the survey informations could be through rapid informal surveys or more formal survey techniques using long protocols to acquire more complete informations. Such surveys are normally conducted by a socio-economist assisted by scientists. The surveys help in determining the environment within which the farmer carries out his activities and are connected with sociological and financial considerations as well as biological factors having an impact on these activities.

On the basis of the surveys, field trials will be prepared as described below. The surveys also help in defining recommendatory fields. These fields determine the consideration areas of a particular technology. For example, in defining the field tests for a new technology in Niger, the area was divided into rainfall regions and this indicated a high concentration of millet where the rainfall is between 350 - 500 mm, sorghum in regions with an annual rainfall of 500 - 750 mm and maize where rainfall is above 750 mm. Rainfall distribution during the cropping season and soil characteristics including water retention and fertility are other important factors. Other agronomic and field characteristics can also be important in the definition of areas where a new technology is to be considered. In Burkina for example, the preference of farmers for the long stem sorghum variety in the eastern areas of the country stems from the need for construction materials that are very scarse due to the lack of trees to supply these materials. This is the opposite in the western regions where construction materials are adequately available without using long stem sorghum varieties. Thus, new short stem varieties could be accepted in one area and rejected in the other.

Studies made earlier under the auspices of the IPM Project have already defined some of these important fields.

B. FIELD TRIALS

It is generally supposed that farmers' incomes can be increased through the adoption of new technologies. Most of the new technologies emanate from the experiment stations. The principal clients for the information on the performances of new technologies in farmers' fields are the farmers themselves and the personnel of the experiment stations. However, the process of field trials is a repetitive approach to the solution of problems, with the research experiment station, providing technologies as solutions to problems identified by farmers with the subsequent acceptance or rejection by the farmer, researcher or both. The rejection of the technology by one of the two necessitates the development of a new or modified technology. The process is repeated until the establishment of an acceptable technology meeting the identified criteria. The following diagram illustrates the stages of the process.


1.
Surveys
Group of target farmers in a determined domain in a region
2. Diagnosis. Survey and description of farmer's environment- constraints, priorities, resource and environmental problem and opportunities
6. Sheet for identifying acceptable criteria
5. Identification of acceptable criteria
Development of new applicable technology
3. Station-based identification and evaluation of materials and the techniques offering the potential for justifying the development opportunities of farmers.
Based on body of accumulated knowledge.
4. Experiment on technology is apparently applicable under farmers' conditions "field trials".

Thus the new technology emanates from the experiment station after a separate analysis of factors under optimal conditions and usually of mono-disciplinary origin.

The field trials assemble these input combinations and evaluate whether or not these combinations function under farmers' conditions. They are of two types :

1) Trials managed by the researcher with the participation of farmers
2) Trials managed by the farmer with the assistance of the researcher.

The field trials managed by the researcher help in determining whether or not a new technology demonstrates a significantly higher yield as compared to the traditional practices of the farmer, as well as ascertaining whether the technology suits the farmer's cropping system. Trials conducted by the farmer can provide the means for diffusing the technology and also furnish information on the acceptability to the farmer, the diffusion process and the modifications made in the components of the combinations by the farmer.

C. EVALUATION

It is important that the data obtained from the field trials and then analysed and interpreted, provide a feedback to the researcher and replenish the extension services.

The field trials are simply developed i.e. with a minimum of independent variables and most of them with replications. The replications are intentionally made throughout a domain for a better knowledge of the performance of the technology under various conditions. The comparison of yields and simple budgets are necessary but are often not sufficient data. The mathematical models of agro-economists including the new technologies may also be required in considering the interactions and constraints to the evaluation of increases in incomes, the effects of new technologies and the potentialities of various agricultural policies for removing these constraints.

At the initial stage of the researcher-managed trial, the principal client is the research station, whiles the principal output is the feedback of results. At more advanced stages and in the farmer-managed trials, the principal clients are the farmers and the extension services.

A greater participation of the extension services personnel in the two types of field trials will enhance a better communication between the farmers and researchers and will include the extension personnel as active partners in the development process. Often, the participation only involves the supply of information to the researchers, as is the case with observations of the IPM Project.

BASIC PROPOSALS ON THE FSR APPROACH

1. Focusses on the farmer : the focus of the research is defined by the present and anticipated constraints to an increase in farmers' income. The identification of the constraints tend to vary with the scientific discipline. It is therefore, necessary to adopt a multidisciplinary approach to the definition of constraints.

2. The new agricultural technology emanates from experiment stations : Once the components of the improved technology are identified with the section, their field performance needs to be identified. The components of the new technology must be used in as many experiment station sources as possible e.g. national, regional and international sources. These inputs are constantly necessary to sustain the farming system which changes dynamically.

3. The general approach : The field trials combine the component parts into a new technology to be tested. These field trials are therefore, multidisciplinary in the sense that they associate agronomists, socio-economists and other agricultural scientists involved in the technological change.

4. Difference in field trials in the statistical approach and in the research plan between station trials : The field trials are used in determining the conditions of the farmer under which the technology can or cannot perform. Consequently, the sources of non-treatment variances must be systematically analysed. Instead of replicating the treatments on each farm, this research problem calls for an increase in the number of field trials.

This is contrary to station trials where emphasis is laid on the minimisation of non treatment variance through several plots replicated at the station.

5. The need for analysis and interpretation : The data obtained must furnish information to researchers as inputs in the future research plans at the experiment station and in the organisation of extension of the potential utility of the new technology.

The preceding analysis emphasises collaboration between various biological disciplines and socio-economics. Each has its body of litterature, statistical plan and methods of analysis usually dominated by its practitioners and by its philosophical attitudes involves agricultural development research and process. Breaking these barriers for a collaborative efforts calls for a strong institutional support and continuous personal relations between individual scientists.

These major differences between an agricultural biologist and a socio-economist lie in the experimental plan and the processing of their data. Agricultural biologists are extremely careful when generating their data. Accordingly, they reduce the variances to a minimum and wait for some years to verify the results. They also use a number of techniques to demonstrate statistical reliability before adopting a new technology.

The farmers as well as decision makers need suggestions for profitable new technologies which fall within their sphere of operations rather than identifying the level of significance of processings and their operations. Socio-economists with simple modelisations and synthetic estimations can help in filling the gap between farmers' demands for data on new technologies and the output of agricultural and biological research.

This implies an effective interdisciplinary collaboration which calls for a continuous interaction between scientists in experimental planning and data analysis. The success of this interaction requires a detailed understanding of each discipline and the desire to address expeditiously, the problem involved in the domain of technology evaluation.

The analysis of data on field trials which constitute new technological package is more qualitative on the basis of the data required. The evaluation criterion is an answer to the question as to what has been learnt that was neither known in experiment station trials nor by policy makers but was important for feedback purposes. The results published are available to stress the importance and usefulness of data acquired using the FSR approach in agricultural development projects based on projects in West Africa, Central Africa, South America and to a lesser degree in Asia.

The following figure is a graphical illustration of the FSR approach with decision making points depending on the acceptance or rejection of the new technology by the researcher and/or the farmer.

FARMING SYSTEMS RESEARCHER AND PEST CONTROL RESEARCH

Crop Protection (≙ Pest Control = Integrated Pest Management) in agricultural production is complex even in its simplest perception. Several pests are implicated in the farmer's production process and generally, the crop damage potentials of these pests are not independent. The farming system may be sole cropping or intercropping practices. The absence of the latter system raises susceptibility to certain pest combinations.

The word "Pest" is used in a wide sense to include all organisms that are pre-harvest pests and pose constraints to productivity (weeds, insects, diseases and vertebrates). Post-harvest pests constitute another important factor in the overall and useful farming system.

The susceptibility of the cropping system to pest damages depends, to some extent, not only on the crops growing but also on the way the crops are combined in the farming system, the farming practice, as well as the environment in which the crops grow. There are several pest control means for reducing crop losses ; Biological control, chemical control, cultural control and resistant varieties are the major examples. Each of these measures has its own series of cost and benefit. The cost/benefits ratio of any simple means of protection is not independent of other means which are or could be used.

Simple crop protection methods rarely involve the lowest cost for carrying out control operations against pests associated with individual farmers. It is far more probable that certain combinations of control measures will be used and will tend to be specific for some cropping systems in specific agro-ecosystems.

The identification of a particular group of control measures which will be "best suitable" for the characteristics of the physical, biological, economic, social and cultural environment of various cropping systems constitute the contemporary crop protection research. This is the logically optimal conduct of pest control deemed sound from the economic, social and ecological points of view.

An efficient research towards the development of more strategies that can be applied by the ordinary farmer, must seek to determine what "the consumers" want. The farming systems (FSR) approach provides the link between the ordinary farmer and the research institution. It also offers the means of communication between farmers and researchers as well as providing the extension system.

FSR emphasises the global approach of research. Pest control also emphasises the global approach of crop protection research and is thus considered as a sub system of FSR. As a sub system of the FSR, pest control provides a farming system technology which takes into consideration, not only the technical elements but also the human element i.e. the socio-economic element of the farmer"s environment.

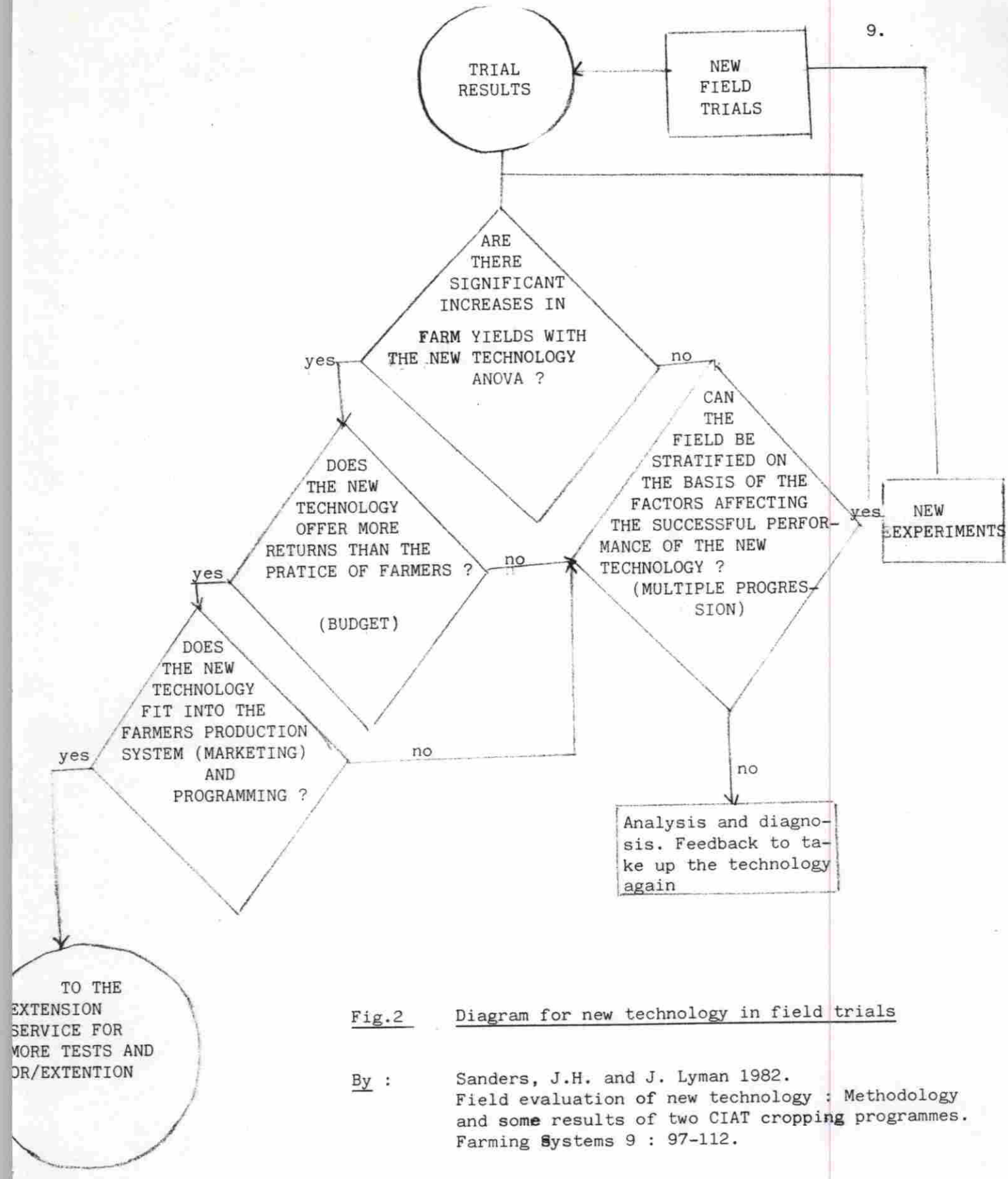


Fig.2 Diagram for new technology in field trials

By : Sanders, J.H. and J. Lyman 1982.
Field evaluation of new technology : Methodology and some results of two CIAT cropping programmes.
Farming Systems 9 : 97-112.

RELATIONSHIP OF THE IPM PROJECT PHASE I WITH THE CONTINUATION OF CROP PROTECTION PROJECTS PHASE II

Recent evaluations (1984 and 1986) of the Integrated Pest Management Project stressed the need for the pursuance of crop protection research in the Sahelian region. The evaluation team also emphasised the fact that excellent progress has been made in the countries in the development of personnel training and crop protection data but that there was the need for continuous financial assistance to sustain the on-going efforts.

The national components of the regional project have prepared considerable data on biology, ecology, bioclimatology and pesticides. This package of knowledge was mostly prepared through a monodisciplinary work rather than a multidisciplinary approach meaning that each discipline worked independently instead of working together in a team. The major exception was with the pilot programme initiated for the first time in the Gambia in 1984. The research was also dominated by entomologist probably because integrated pest management initially concerned this discipline.

In Phase II, it will be necessary to continue with the basic sciences through the monodisciplinary approach. Since the control programmes are dynamic in nature, there is the need for a constant development of new key tactics that can be devised in appropriate technology (control methods) to fit into farmers' production systems. In certain countries, particularly, Mauritania and Chad, there may be the need for more emphasis on basic studies because the involvement of each of these countries in the IPM project was delayed by circumstances beyond their control.

The next logical stage in Phase II is to embody the package of knowledge developed in Phase I as well as the data of Phase II (using the farming system research strategy) in the multidisciplinary development of appropriate technology.

This will necessitate an active and collaborative participation of crop protection specialists (plant pathologists, entomologists, weed scientists- working together with agronomists, breeders and socio-economists in a team. Projects carried out in Phase II must employ a socio-economist as part of its national project.

This collaboration must be linked to each stage of the FSR strategy even though some will have different responsabilities in the research process.

There are two possible research models :

1) Formalized team comprising a multidisciplinary personnel i.e. socio-economist working in collaboration with agricultural scientists.

Advantage : well organised, stable and concentrated effort

Disadvantage : economically, it consumes time and labour. Moreover, it discards crop protection to the benefits of other disciplines.

2) Informal development of a multidisciplinary team above administrative constraints. The members of the team are to work together on a collaborative basis.

Advantage : saves time and labour. Draws attention of all the disciplines to the usefulness of multidisciplinary research and the importance of crop protection technology based on FSR strategy.

Disadvantage : It can be difficult to have collaborators from various disciplines to develop the multidisciplinary teams. This model also calls for much administrative and institutional support.

GENERAL CONSIDERATIONS ON THE RESEARCH STRATEGY

The importance of the use of the FSR strategy in the development of new technologies for subsistence farmers has been well proved by the examples of Central and South America and more recently in West Africa. Presently, there is an on-going FSR project in Burkina under the auspices of SAFGRAD as well as FSR research in the national programme on subsistence farming. The SAFGRAD project was initiated in 1979 whereas the national programme did not come out until 1984. None of these programmes did include the participation of crop protection specialists and this constitutes an obvious short-coming.

In Niger, a USAID-financed grains project commenced in 1980 has an FSR component which did not employ crop protection specialists but used breeders.

A new project financed by the USAID in the Gambia with the FSR as major effort could include crop protection personnel. A donor also financed an FSR programme in Mali.

A lot is to be learnt from results of projects mentioned above. In some cases, there is an active collaboration with some already established projects. At least a discussion of the FSR strategy with people who are actively engaged already in the implementation of the FSR programme, will help in the establishment of new programmes using the crop protection approach in the national projects.

As indicated earlier on, the national research team must use the data already generated in Phase I of the IPM Project as well as the new data developed (Phase II) as they are produced. In addition to that, researchers must exploit for their own benefit, all the sources of technology developed by the International Research Centres namely IITA, ICRISAT, CIMMYT and other researches supported by donors. Examples of biological control and/or useful tactics comprise germplasm sources of agents of biological control and FSR data in their programmes as well as crop protection data.

This implies the testing of new cultivars, incorporation of resistant germplasm in established lines, and exploration of various cultural modifications for example : mixed cropping, plant spacing and density etc... classic mechanical control as well as traditional methods can be modified e.g. trap plant.

The latter methods require a perfect knowledge of traditional farming practices (of special importance) before introducing the new technology in the system.

The preservation of scientific personnel must be practised meaning that research must be geared towards the duplication of disciplines. For instance, where a national component was on top for example, in the modelisation of losses caused by insects in relation to pest density, it seems recommendable to continue with this emphasis in this appropriate national programme. This prevents duplication and releases scientific expertise which can be used by other national programmes.

New technological innovations can be combined and tested in each national programme.

ANNEX 4

PRELIMINARY LIST OF NECESSARY EQUIPMENT AND OPERATING COSTS OF CROP PROTECTION SERVICES.

	Unit Price in $ US	Total $ US
1. Central base		To be evaluated
1.1. Constructions to be specified for each country		
1.2. Means of transport		
2 liaison-vehicles	17,000	34,000
2 17-tonne trucks	50,000	100,000
2 land cruisers	20,000	40,000
5 bicycles	250	1,250
1.3. Treatment equipment (refer to phytosanitary bases)		
1000 manual equipment	100	100,000
20-50,000 dusting sacks	0.35	7,000-17,500
2 dusting machines (to be renewed every 2 years).....	3,000	12,000
1.4. Central lab equipment (only for certain countries particularly Chad and Mali	20,000	20,000
1.5. Office equipment : mini computer with sofwares	15,000	15,000
1.6. Operating costs (annual)		
Motor fuel, 4 years		132,000
Vehicle maintenance = 15 % of purchasing price 4 years		8,500
Bicycle maintenance, 4years		2,600
Office supplies, 4 years		40,000
Documentation, 4 years		24,000
Water, electricity, telephone, postal services, 4 years		80,000
Miscellaneous items, 4 years		16,000
TOTAL INVESTMENTS		309,250-/ 324,750 + To be evaluated
Total operating costs, 4 years		302,700

	Unit Price in $ US	Total $ US
2. Phytosanitary base : for 1 base		
2.1. Construction		
1 Office)		
1 working room (	60,000	
1 store)		
1 furnished accomodation	45,000	
1 vehicle shed	2,000	
1 fence	5,000	112,000
2.2. Mobile equipment		
2 land cruiser pickups	20,000	40,000
1 Unimog	50,000	50,000
2 motor-bikes to be replaced every 2 years	2,000	8,000
2.3. Lab equipment	10,000	10,000
2.4. Office equipment	7,000	7,000
2.5. Treatment equipment (refer as well to Central base)		
1 ULV sprayer, to be renewed every 2 years	10,000	20,000
2 dusting machines, to be renewed every 2 years	3,000	12,000
2.6. Transreceiver	3,700	3,700
2.7. Operating costs fuel, 4 years		76,400
Vehicle maintenance : 15 % purchasing price (total 4 years)		13,500
motor-bike maintenance : 15 % of purchasing price (total 4 years)		1,200
Office supplies, 4 years		4,000
Water, electricity, telephone, postal services, 4 years		13,200
Miscellaneous items, 4 years		4,000
per (1) base : total investments		262,700
Total operating costs, 4 years		112,300
3. Surveillance post		
3.1. COnstructions		
1 solid building with working room/office	60,000	60,000

	Unit price in $ US	Total $ US
Store	5,000	5,000
Accomodation	10,700	10,700
1 fence	2,000	2,000
3.2. Equipment		
2 motor-bikes to be renewed after 2 years	2,000	8,000
1 transceiver	3,700	3,700
Office equipment	4,000	4,000
3.3. Operating costs (4 years)		
Motor - fuel		5,600
Motor maintenance, 15 % of purchasing price for 2 years		1,200
Office supplies		2,000
Water, electricity		6,000
Miscellaneous items		2,000
Per 1 post : total investment		77,000
Total operating costs, 4 years		16,800

ANNEX 5

MISSION FOR THE FORMULATION OF NATIONAL CROP PROTECTION PROJECTS

TERMS OF REFERENCE

The Crop Protection Programme prepared in 1977 for the CILSS member countries comprises9 projects out of which 2 could not be set up for lack of funds. Some of the projects have already come to an end and the IPM Project will terminate in March 1987. This will leave only the reinforcement of Crop Protection Services and the Technicians Training Project financed by Canada and the Netherlands respectively.

In view of the Sahelian phytosanitary situation which is still alarming, the officials in charge of National Crop Protection Services in the Sahelian countries, meeting in Ouagadougou from January 6 to 10 1986, defined a pest control strategy and worked out a Crop Protection Programme for the period 1987-1990. This programme is made up of 3 components :

- Reinforcement of National Crop Protection Services.
- Research in Integrated Pest Management for food crops.
- Crop Protection Training and Information.

This programme will be implemented by the Sahelian countries in the form of National Crop Protection Projects.

For each Sahelian country and on the basis of documents and data available at the Regional Directorate of the IPM Project, the mission was to :

1. Define a national institutional framework which will be responsible for carrying out the project.

2. Identify and assess the real need for an adequate reinforcement of the National Crop Protection Service to enable the latter to carry out :

- surveillance and prospection in the areas subjected to pest threats
- inspection of the quality of plants introduced
- treatments in cases of infestations
- training for farmers to enable them participate effectively in pest control.

3. Use the results of the Regional IPM Project as a basis for defining and preparing a working schedule for the applied research and pre-extension component.

4. Determine additional needs in terms of crop protection training and information. (The Netherlands is already financing the training of technicians).

5. Determine the duties and composition of the Regional Technical Coordination Unit.

6. Make proposals regarding the institutions to which the Regional Technical Coordination Unit will be attached.

The mission was to receive the technical support of the Regional Directorate of the IPM Project. At the end of the mission, a meeting was to be held with the participation of members of the formulation mission, National Crop Protection Officers and the Regional Directorate of the IPM Project. Proposals made by the mission were to be examined at the meeting, Officers in charge of National Crop Protection Services were entitled to discuss the proposals on behalf of their respective countries.

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T A B L E S

TABLE 1 . : BASIC FOOD INTAKE OF CILSS COUNTRIES IN 1982

(measured in Kg/year/person)

COUNTRIES	MILLET/ SORGHUM	RICE	MAIZE	WHEAT	TOTAL
BURKINA FASO	181.9	5.9	10.8	3.5	202.1
CAPE VERDE	-	7.6	112.3	13.7	133.6
GAMBIA	73.7	88.4	10.4	7.3	179.8
MALI	140.0	24.6	15.5	9.0	189.1
MAURITANIA	82.5	17.3	5.6	14.8	120.2
NIGER	240.9	4.5	2.1	2.6	250.1
SENEGAL	110.6	47.3	12.4	27.9	198.2
CHAD	136.6	5.6	2.5	3.9	148.5
AVERAGE	120.7	25.15	21.45	10.33	177.7

SOURCE : INSAH/ECA - Bilan du développement économique des pays du Sahel- Etudes et travaux de l'USED N° 2.

TABLE 2 : SCIENTIFIC RESOURCES

RESEARCHES CONDUCTED AND RESULTS ACHIEVED IN PHASE I

CROPS	PESTS	RESEARCHES CONDUCTED - RESULTS ACHIEVED
MILLET	RAGHUVA	BURKINA : * Knowledge of highly infested regions * Identification of resistance varieties * Identification of natural enemies * Beginning of biological control experiment GAMBIA : * Knowledge of damages and distribution of attacks * Study on the dynamics of populations (eggs and nymphs) * Observation of high correlation between incidence of egg-laying and incidence of attacked heads MALI : * Knowledge of distribution of attacks * Bio-ecological study (deep pupation, effect of sandy and sandy-clayey soils) * Study on the dynamics of populations (eggs and nymphs) * Identification of resistant varieties, and effect of earliness MAURITANIA : * Knowledge of distribution of attacks NIGER : * Mapping of the distribution of attacks * Dynamics of adult populations : no correlation between moth catches and level of attacks * Dynamics of damages : early heading farms are most attacked Good correlation between early heading and egg-laying * Study on variety resistance including research on correlation between morphological features and attacks (no influence on plant height nor aristate feature of earheads, but compact heads carry more eggs than loose heads) * Chemical control trials SENEGAL : * Dynamics of adult populations and establishment of periods of large numbers * Dynamics of nymphal populations * Profile of losses (quest for forecast methods and determination of threshold) * Recording of natural enemies * Cultural control (reduction of residual population through post-harvest plowing) * Biological control and conduct of experiments among farmers * Chemical control * Biological studies in the lab CHAD : * Knowledge of Raghuva incidence

CROPS	PESTS	RESEARCHES CONDUCTED - RESULTS ACHIEVED
MILLET	FLOWER BEETLES	GAMBIA : * Distribution and identification of species * Population dynamics (two peaks) Few catches after October 20 (advantage of late millet) * Study of sampling methods * Establishment of threshold for damages : 5 % with 1 flower beetle per 25 heads for 15 days * Aristate varieties less attacked * Traditional control (positive effect of repulsive action of smoke, attractive effects of baobab fruits) * Chemical control : effectiveness of carbaryl * Identification of host plants MALI : * Distribution and identification of species * Bio-ecological researches * Aristate varieties advantageous MAURITANIA : * Distribution and identification of species * Traditional control through the repulsive action of smoke CHAD : * Incidence of flower beetles * Traditional control with different ingredients in the fires to increase smoke density
	OTHER INSECTS	MALI : * Large population of borers (Acigona) and grasshoppers(OSE) MAURITANIA : * High incidence of grasshoppers (OSE) and caterpillars (Nolla genus) SENEGAL : * Positive effects of two methods as a physical control of Acigona ignefusalis CHAD : * Importance of grasshoppers and heteroptera (Dysdercus and Agnoscelis)
	MILDEW	BURKINA : * Knowledge of distribution and importance * Identification of slightly attacked varieties GAMBIA : * Knowledge of distribution and importance MALI : * Knowledge of distribution and importance * Identification of lines of international nursery as well as tolerant varieties * Chemical control : metalaxyl effective (1 to 2 g a.i./kg NIGER : * Low incidence SENEGAL : * Epidemiology and variety resistance CHAD : * Low incidence

CROPS	PESTS	RESEARCHES CONDUCTED - RESULTS ACHIEVED
MILLET (continued)	SMUT	BURKINA : * Disease is widespread but losses are slight * Resistance of 3/4 M12 variety GAMBIA : * Knowledge of disease distribution : 8 % losses recorded * Resistance of 3/4 M 12 variety * Chemical control (soaking, metalaxyl) = increase in yield without reduction in attack MALI : *Knowledge of distribution and importance * Identification of tolerant varieties MAURITANIA :* Susceptibility of 3/4 M12 = racial problem probable * Slight losses on farmers' fields NIGER : * Slight importance of smut CHAD : * The most severe millet disease (grain losses up to 16 %)
	OTHER DISEASES (ERGOT)	Reported in BURKINA MALI SENEGAL CHAD
	STRIGA AND WEEDS	GAMBIA : * Millet weeds control techniques * Improved weeding effect * Positive effect of Paraquat NIGER : * Striga more frequent on millet than on Sorghum * Inventory of weeds * Cultural control of Striga * Biological control of Striga * Variety resistance
SORGHUM	SORGHUM MIDGE	BURKINA : * Knowledge of the importance of the midge through the evaluation of losses * Variety resistance * Sampling technique MALI : * Knowledge of distribution and importance NIGER : * Surveys = the midge is an occasional sorghum parasite

CROPS	PESTS	RESEARCHES CONDUCTED - RESULTS ACHIEVED
SORGHUM (continued)	OTHER INSECTS	BURKINA : * Knowledge of entomofauna * Identification of Atherigona species MALI : * Knowledge of major and secondary panicles and their predators * Minor losses caused by Atherigona GAMBIA : * Inventory of harmful insects = importance of Dysdercus Voelkeri and Heliothis armigera
	DISEASES	BURKINA : * Smut distribution and incidence * Importance of charcoal rot and red rot * Identification of tolerant varieties GAMBIA : * Importance of covered kernel smut in the Western Division MALI : * Distribution and economic importance of smuts * Chemical control by seed treatment = effects of treatments on yields but not on smut incidence * Identification of tolerant varieties NIGER : * Knowledge of smut distribution and importance (préponderance of long smut)
	STRIGA AND WEEDS	BURKINA : * Knowledge of Striga distribution and importance * Identification of resistance varieties * Identification of natural enemies GAMBIA : * Surveillance and importance of Striga assessment of losses on the basis of the date of emergence) * ISCV 100 HV and ISCV 1002 HV highly resistant * Timely weeding advantageous and cultural control by intercropping MALI : * Precise knowledge of distribution and importance of Striga (% of attacked sorghum field lower than % of millet field) * No effect of nitrogeneous fertilizer (50 or 100 kg/ha of urea) nor cropping under mulching or with "néré" powder but positive effect of sorghum-cowpea intercropping * ICVS 1001 HV and local variety are resistant but ICVS 1002 is not NIGER : * Striga less frequent on sorghum than on millet * Relatively late emergence on sorghum CHAD : * Surveillance of Striga importance

CROPS	PESTS	RESEARCHES CONDUCTED - RESULTS ACHIEVED
RICE	MIDGE	BURKINA : * Knowledge of importance and losses * Population dynamics * Knowledge of natural enemies * Identification of chemical control methods * Variety resistance : identification of slightly attacked cultivars MALI : * Resistance of early Diurado
	STEM BORERS	BURKINA : * Knowledge of species and importance of irrigated crop * Identification of chemical control method MALI : * Godd behaviour of IET 2885 and Gambiaka GAMBIA : * Knowledge of species = Chilosp the most abundant MAURITANIA * Identification of Chilo zaconnius
	BLAST RICE	BURKINA :* Knowledge of distribution and importance (losses) * Knowledge of period conducive for diseases (evaluation methods established) * Identification of efficient chemicals (Pelt 44, Kitazine) and profitable mode of application * Efficient farming practices (sowing dates, additional irrigation) * Studies on distribution of races * Importance of inoculum GAMBIA : * Knowledge of importance (over 10 % losses observed) * Imprtance of nitrogenous fertilizer on leaf blast * Evaluation of variety resistance MALI : * Knowledge of importance (over 50 % losses observed in production areas) * Evaluation of variety resistance = identification of several resistant varieties SENEGAL : * Importance of Casamance well known * Knowledge of P. oryzae pathotype * Study of variety resistance depending on environmental factors, level of manuring, intensification and level of farming practice * Efficiency of Beam in chemical control * Estimation and profile of losses

CROPS	PESTS	RESEARCHES CONDUCTED - RESULTS ACHIEVED
RICE (continued)	WEEDS	GAMBIA : * Identification of adventitious flora on rice-fields * Development of cultural control : advantage of timely weeding * The use of Propanil + Thiobencarb beneficial MALI : * Knowledge of rice weeds * Advantage of using Monilate 300 + Propanil 360 in controlling adventitious flora excluding Oryza barthii and Eschacmum nigozum * Propanil + Thiobencarb beneficial SENEGAL : * Knowledge of rice weeds * Knowledge of weeding periods * Identification of efficient herbicides depending on the type of rice-growing
MAIZE	STREAK	BURKINA : * Knowledge of streak distribution and evaluation of losses * Identification of resistant varieties * Identification of the Inoculum (grasses) * Identification of vector species and leafhopper population dynamics * Epidemiology MALI : * Distribution and importance * Identification of resistant varieties * Chemical control : efficiency of Carbofuran (1 kg a.i/ha possible use in seed treatment OTHER COUNTRIES : No Streak
	INSECTS	BURKINA : *.Leafhopper population dynamics * Identification and importance of stem borers GAMBIA : * Inventory of harmful insects with the importance of Busseola fusca in the "Western Region" * Effect of intercropping on the population of maize insects MALI : * Inventory of harmful species * Effect of sowing date on borer damages SENEGAL : * Inventory of harmful entomofauna * Importance of borers (Eldana and Sesamia) * Conjugate effects of various depredators = considerable losses (up to 400 kg/ha)

CROPS	PESTS	RESEARCHES CONDUCTED - RESULTS ACHIEVED
	WEEDS	BURKINA : * Identification of Striga aspera GAMBIA : * Identification of resistant varieties * Chemical control compared with manual weeding MALI * Weed inventory * Agronomic control (intercropping) * Higher yield with chemical weeding (Atrazine only with alachlor)
COWPEA AND VARIOUS LEGUMINOUS PLANTS	INSECTS AND DISEASES	CAPE VERDE * Knowledge importance of cowpea, beans and pigeon pea insects * Recording of natural enemies * Biological control GAMBIA : * Implications of Maruca testularis on cowpea * Continuous surveillance of cowpea diseases = importance of viral diseases (CYMV and CSMV) * Chemical control MALI : * Inventory and evaluation of losses caused by insects and diseases (cowpea, bambara groundnut, groundnut) * Identification of virus on bambara groundnut (7 tolerant ecotypes) * Screening for resistance to diseases (bacteria blight and leaf smut) * Importance of cercospora leaf spot on groundnut and chemical control
	STRIGA AND WEEDS	BURKINA : * Importance of Striga gesneroids on cowpea MALI : * Knowledge Striga damages to cowpea * Weed control (periods of manual weeding, efficiency of chemicals) NIGER : * Knowledge of Striga distribution and importance * Knowledge of other host plants * Biological control * Identification of tolerant varieties and possibilities of existence of Striga "races" * Reduction of Striga population with herbicide AC 252-214

* Pilot projects (commencements of attempts to apply technological packages among farmers) for millet in the following countries : Burkina Faso, Gambia, Mali, Mauritania, Niger, Senegal.

TABLE 3 : HUMAN RESOURCES (RESEARCH CROP PROTECTION)

	E	P	W	A	E	P	W	A	E	P	W	A	E	P	W	A
BURKINA	4	2	1	2	2	1	1	1	6	3	2	2	3	6	0	
CAPE VERDE	1			1					1			1				
GAMBIA	2				1	1	1	1**	3	2	1					
MALI	3	1	1		2	3	2		5	4	3					
MAURITANIA	2	1			3	3	1		5	4	1			1		
NIGER ***	2	1		1	1		1		3	2	1	1		2		
SENEGAL	4	1	1			1	1		4	2	2		2	2		
CHAD	1	1				1			2	2				1		
TOTALS									28	19	10	4				

* A socio-economist being trained with financing of the Regional Component

** Financing as a supplement to the RFCP

*** Other Nigeriens being trained with CIDA financing

E = Entomologist
P = Phytopathologist
W = Weed Scientist
A = Others, namely :
1 Agrometeorologist and
1 Burkina Agronomist
1Agronomist in Cape Verde

1 Breeder in Niger

CROPS	PESTS TO BE CONSIDERED	RESEARCH THEMES
GROUNDNUT	Millepedes, cercospora leaf rusts, Macrophomina phaseolina, viruses	1. Seed treatment and millepede trapping 2. Variety resistance (cercospora leaf spot, viruses, rusts) 3. Cultural practices (Macrophomina phaseolina 4. Epidemiology of viruses and relationship with vectors.
TRUCK CROPS - Curcubitaceae - Malvaceae - Solanaceae	The data on pests of truck crops in the Sahel are sparse and the key pests for each crop are yet to be specified	1. Inventory and economic importance of pests 2. Population dynamics of major pests 3. Control methods
PRESERVATION OF HARVEST	They are different insects of stored grains in the sub-region	1. Systematic inventory of storage insects 2. Profile of losses 3. Improvement of storage conditions 4. Chemical control 5. Resistance to stored grain insects
MAJOR PEST OUTBREAKS	Grasshoppers Birds Rodents	1. Bio-ecology 2. Surveillance and forecasting methods

TABLE 4 :

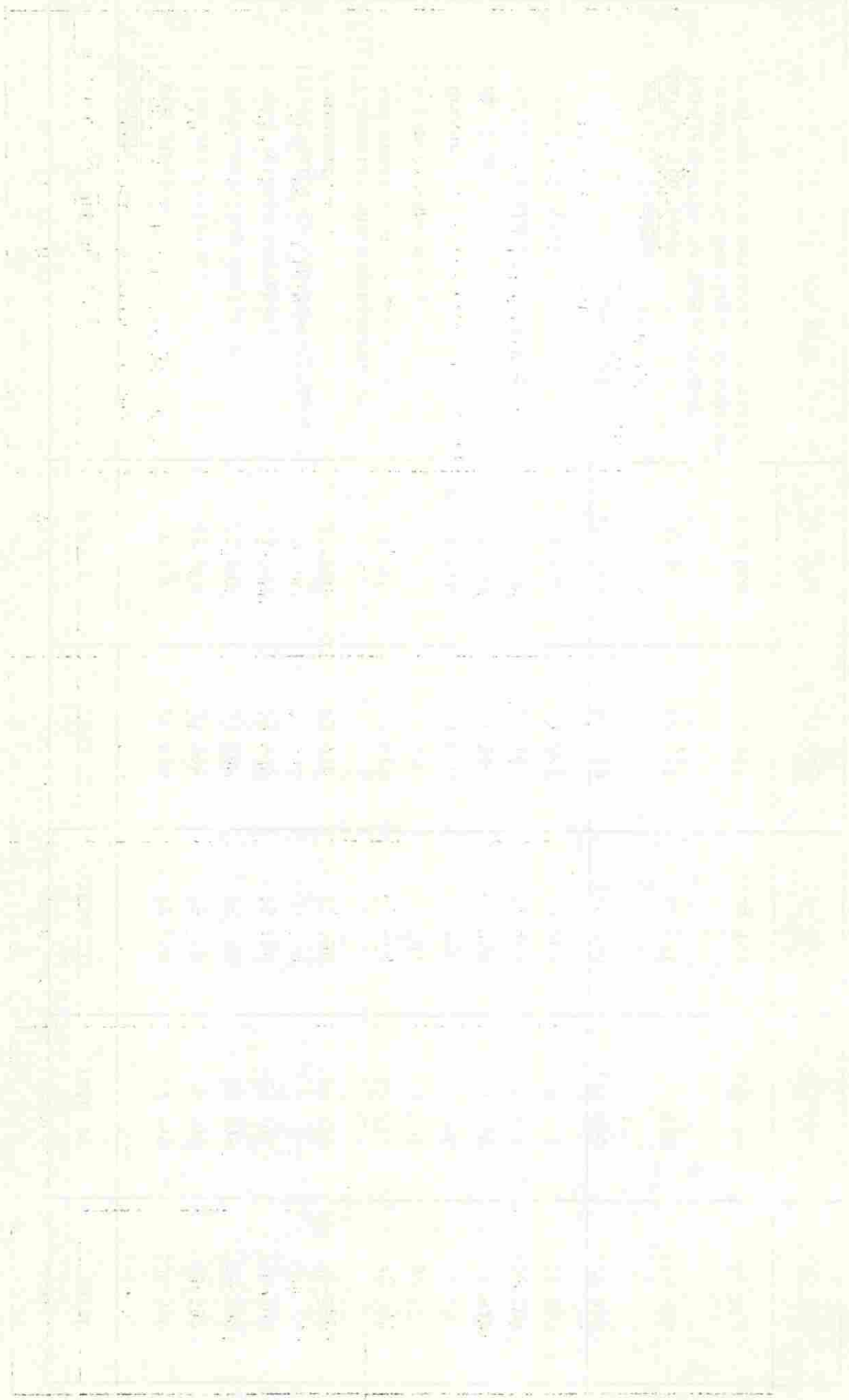
IPM "STATION" RESEARCH THEMES

1988-1991

CROPS	PESTS TO BE CONSIDERED	RESEARCH THEMES
MILLET	Raghuva, flower beetles, stem borers, mildews, smut Striga and other weeds	1. Seed protection 2. Variety resistance (Raghuva, borers, mildew, smut, Striga) 3. Farming practices (weeds) 4. Biological control (Raghuva) 5. Traditional control (flower beetles) 6. Control by trapping (flower beetles) 7. Development of simple surveillance and prevention methods 8. Bio-ecology of flower beetles
SORGHUM	Panicle insects, smuts, grain molds, Striga, and other weeds, stem rots (Macrophomina phaseolina and Colletotrichum graminicola)	1. Variety resistance (panicle insects, smuts, stem rot, grain molds, striga) 2. Farming practices 3. Biological Control (Striga, midge) 4. Seed Protection
RICE	Leaf blast, midge, stem borers, viral and bacterial diseases, weeds and birds.	1. Study on the importance of viral and bacterial diseases 2. Variety resistance to leaf blast, midge, viral and bacterial diseases, stem borers. 3. Interaction of chemical control and cultural techniques (Leaf blast and weeds) 4. Biological control of stem borers and midge 5. Chemical control of insects
COWPEA	Insects (Thrips and storage weevils) viruses, striga, Macrophomina Phaseolina	1. Variety resistance 2. Biological control 3. Chemical control 4. Traditional control 5. Cultural techniques 6. Storage and preservation methods
MAIZE	STREAK, STEM BORERS, WEEDS	1. Variety resistance to Streak 2. Epidemiology of Streak 3. Dynamics of Streak vector populations 4. Study on the inoculum (weeds) 5. Stem borer control 6. Weed control

TABLE 5 : REGIONAL TECHNICAL COORDINATION UNIT-BUDGET

I T E M	YEAR I	YEAR II	YEAR III	YEAR IV	TOTAL
1. PERSONNEL					
1 Coordinator	26 436	26 436	27 759	27 759	108 390
1 Zoology Assistant	23 998	23 998	25 198	25 198	98 392
1 Phytopathology Assistant	23 998	23 998	25 198	25 198	98 392
1 Weed Science Assistant	23 998	23 998	25 198	25 198	98 392
1Bioclimatology and Surveillance Assistant	23 998	23 998	25 198	25 198	98 392
1 Financial and Administrative Assistant	24 070	24 070	25 272	25 272	98 684
1 Bilingual Secretary	7 420	7 420	7 791	7 791	30 422
1 Driver	4 816	4 816	5 156	5 056	19 744
1 Watchman	1 200	1 200	1 259	1 259	4 918
Social expenses 18.5 %	25 148	25 148	26 404	26 404	103 104
Medical expenses	4 667	4 667	4 667	4 667	18 668
Sub-total	189 749	189 749	199 000	199 000	777 498
11. OFFICIAL TRAVELS Within the Sahel	56 670	62 337	68 571	75 428	263 006
Participation in Regional and International Meetings (Coordination unit and National Officials)	100 980	111 078	122 185	148 240	482 483
SUB TOTAL	157 650	173 415	190 756	223 668	745 489



I T E M	YEAR I	YEAR II	YEAR III	YEAR IV	TOTAL
III. CONTRACTUEL SERVICES					
Consultants (5 months/annum)	34 200	37 050	39 900	43 300	154 450
IV. GENERAL OPERATING EXPENDITURES					
Rent	10 000	11 000	12 100	13 310	46 410
Water, Electricity	4 000	4 400	4 840	5 324	18 564
Motor-fuel	15 000	16 600	18 150	19 965	69 615
Telephone and telex	16 000	17 000	19 360	21 296	74 256
Miscellaneous	2 500	2 750	3 025	3 318	11 603
Sub total	47 500	52 250	57 475	63 223	220 448
V. TRANSLATIONS					
Translations (Literacy-Drive Services)	23 140	25 454	27 999	30 798	107 391
Manuals intented for farmers	115 700	127 270	139 997	153 996	536 963
Technical Sheets	5 000	5 500	6 050	6 655	23 205
Scientific documents	7 000	7 700	8 470	9 317	32 487
Technical reports (5)(Synthesis of research results, annual phytosanitary situation, report on the 3 seminars forSenior Staff	42 860	47 146	51 860	57 046	198 912
Office supplies, camera films video cassette, etc...	50 000	55 000	60 500	66 550	232 050