Organization of African Unity
Organisation de l' Unite Africaine

COORDINATION OFFICE
OAU/STRC J P 31 SAFGRAD
B.P. 1783
OUAGADOUGOU,
Telephone : 333-58
332,27

BUREAU DE COORDINATION
CSTR/OUA PC 31 SAFGRAD
B P 1783
OUAGADOUGOU
Télephone . 333-58
332-27

BURKINA FASO

A REGIONAL APPROACH TO STRENGTHEN AGRICULTURAL RESOURCE MANAGEMENT RESEARCH IN THE SEMI-ARID REGIONS OF SUB-SAHARAN AFRICA

OAU/STRC SAFGRAD

THE COORDINATION OFFICE

RP/01/1986

FEBRUARY 1986

TABLE OF CONTENTS

3883

5B

A B B R E V I A T I O N S

ACPO	-	Accelerated Crop Production Officer
CC	-	Consultative Committee
CILSS	-	Comité Permanent Inter-Etats de Lutte contre la Sécheresse dans le Sahel
CIRAD	-	Centre de Coopération Internationale en Recherche Agronomique pour le Développement
FAC	-	Fonds d'Aide et de Coopération
IARC	-	International Agricultural Research Centre
ICRAF	-	International Council for Research in Agro-forestry
ICRISAT	-	International Crops Research Institute for the Semi-Arid Tropics.
IFAD	-	International Fund for Agricultural Development
IITA	-	International Institute of Tropical Agriculture
ILCA	-	International Livestock Centre for Africa
INSAH	-	Institut du Sahel
OAU	-	Organization of African Unity
SACCAR	-	Southern African Centre for Cooperation in Agricultural Research
SAFGRAD	-	Semi-Arid Food Grain Research and Development
STRC	-	Scientific, Technical and Research Commission
TAC	-	Technical Advisory Committee (of SAFGRAD)
USAID	-	United States Agency for International Development

-:-:-:-:-:-

PROJECT TITLE : AGRICULTURAL RESOURCE MANAGEMENT RESEARCH

EXECUTIVE SUMMARY

Past trends in agricultural research and development must be changed and alternative paths to increase food production will have to be taken. A serious long-term commitment to agricultural resource management research is crucial. Studies in soil-water plant relationships, soil fertility, agro-climatology, agro-forestry, agricultural engineering, crop and livestock production systems and socio-economics would form the core activities of an integrated resource management research system. The core team would establish a vital link to national agricultural research systems and provide technical assistance services to SAFGRAD regional networks in agri-resource management. In addition to workshops, seminars to facilitate the exchange of technical information, training (both short and long-term) would be carried out. Scientists of participating countries would also gain practical field experience by working at main and satellite research stations of resource management based at selected national research stations.

INTRODUCTION

With increasing world population, our knowledge of the limits of our finite resources becomes ever clearer. According to United Nations projections, world population could reach a stable level of 10.5 billion by 2110, compared with 4.4 billion now (1985) and 6.2 billion projected for the year 2000. The bulk of this population increase is to take place by the middle of the 21st century with world population reaching 9.25 billion. Therefore, world demand for agricultural production will increase by 50% in the next 20 years and double again during the 21st century. As most of the population increase will occur in developing countries the outcome of this dilemma of too many people and not enough food, by conservative estimates, will not only be unsatisfactory but alarming. Increased agricultural production is expected to come from the development of arable land (26%), increase in cropping intensity (14%), and higher yields (60%). Therefore, past trends in agricultural development must be changed and alternative paths to increase food production will have to be selected.

A serious long-term commitment to agricultural resource management research is crucial. Studies in soil-water plant relationships, soil fertility, agro-forestry, agricultural engineering, crop and livestock production systems and socio-economics would form the core activities of an integrated resource management research system.

The decline in fertility of semi-arid soils due to the removal and destruction of vegetative cover and high demographic pressure, erosion, lack of water and adverse weather conditions, have become major constraints to increasing food production. The situation is worsening from year to year due to increased desertification.

PROGRAMME PURPOSE

The various facets of agricultural resource management research have been carried out in the semi-arid regions of tropical Africa by a multitude of research institutions during the last thirty years. Most of the programmes were supported through bilateral aid and by some international agencies. Technical information is yet to be collected, assembled and documented from scattered programmes of past and on-going research activities in soil fertility, water and soil conservation management, agro-climatology, agro-forestry, etc. Once a broad data base on agricultural resource management is realised, the major thrust of the project activity would be to synthesize the available data and set in motion zonal agricultural resource management networks in cooperation with IARCs and national research programmes. Thus, the programme would concentrate to enhance the dissemination of technical information to scientists and institutions of member countries through field demonstrations, seminars, workshops, literature services and technical publications. In order to improve the indigenous research capabilities of national institutions, direct technical research support would be made to six selected national research programmes that would serve as satellite stations.

During the first year the programme would be further elaborated based on data that would be available from each participating national research institution. The thrust of the project activity would be to intensify research on soil fertility, soil and water management, by integrating available research data in agro-climatology, agro-forestry, forage resources, animal and crop production systems. Furthermore, an attempt would be made to demonstrate that re-cycling of resources within an integrated production system is the long-term solution to sustained food production.

The proposed project in no way duplicates on-going research efforts; it rather utilizes them to promote regional cooperation in resource management research.

SCOPE OF ACTIVITIES

Technological changes in agriculture is partially impeded due to lack of communication among research workers and research institutions. Effective research networking among researchers is one way of overcoming the constraints to carrying out and delivering effective research which is derived from the presently limited number of highly qualified soil and water management researchers in the region.

Networking would help to optimize human and natural resource utilization by more closely linking national, regional and international agricultural research and training institutions. Intellectual interchange among resource management researchers in their respective fields stimulates new ideas and creative solutions to difficult and complex problems and avoids pitfalls already encountered. Networking also can enhance professional development by facilitating contacts among junior and senior professionals. Networking can ensure a continuous flow of technical information and enhance the dissemination and adoption of research results.

The management of soil and water in relation to food grain production would be the thrust of network activities. Some of the programme components of the agricultural resource management networks are :

(a) To facilitate the restoration of the fertility of the soil, i.e. soil amelioration, conservation, etc., studies;

(b) Other agronomic practices, especially tillage;

/.....

(c) To promote the application of techniques to prevent run-off;

(d) To demonstrate integrated production systems in order to establish resource recycling and long-term improvement of the farming environment;

(e) Research on supplemental irrigation.

The objective of the network would be to enhance the efficient use of soil and water resources including fertilizers to increase food grain production.

The core research team would establish a vital link to national agricultural research systems and provide technical services in soil-water management research networks. Scientists of participating countries would be able to gain practical field experience by conducting research at the main and satellite research stations in resource management.

The network would consider both high and low potential agro-ecological zones. Six satellite stations would be established at selected national research programmes. To inventory on-going research activities in resource management, the team would conduct thorough surveys to systematically synthesize and document relevant research works to establish a data base for the network. Initial regional workshops would be organized involving several institutions and scientists associated with research on soil fertility,

fertilizer use, and soil-water relations. From such meetings collaborators for the networks would be identified.

One of the major activities of the programme is to coordinate research activities in order to strengthen on-going research programmes and to utilize existing information resources through collaborative research with national research institutions, International Agricultural Research Centres (ICRISAT, IITA, ILCA, ICRAF, etc.) and with other bilateral and regional organizations (INSAH, SACCAR, CIRAD, etc.). The major activities of SAFGRAD's core interdisciplinary team for resource management research could be as follows ;

- Collate, assemble and document available data from scattered research activities of past and current programmes in soil fertility, water and soil conservation management and related fields and thus maintain a documentation service for participating countries;

- Initiate zonal agricultural resource management networks related to soil-water management, agroforestry and crop livestock interactions and facilitate collaborative research activities with on-going research programmes;

- Establish main and satellite research stations to strengthen resource management research networks;

- Disseminate technological information on agricultural resource management to scientists of member countries through field demonstrations, seminars, workshops, technical publications and literature services;

- Conduct short-term training and also prepare promising scientists for long-term training;
- Improve and strengthen research facilities of selected national research stations through direct research support.

Research Information

From its data base, the agricultural resource management team would publish newsletters, practical technical bulletins and would also organize annual monitoring tours in order to enhance better understanding and exchange of experience among scientists. The findings of each network workshop would be published and disseminated to all parties concerned.

Training

In the areas of agricultural resource management, very limited training both of short and long-term were carried out. During the first phase of the SAFGRAD project, major emphasis on training has been on the improvement of varieties and agronomic practices. The core team would develop both formal and informal type of training. In cooperation with national, international and regional organizations, the agricultural resource management team would have the following regular training activities :

- short-term production oriented courses for researchers currently working on soil fertility conservation and soil-water management;
- specialized training in water harvesting and irrigation under small farm conditions;

- occasional agro-forestry courses in collaboration with ICRAF to enhance agro-forestry interactions;
- regional field activities through field trials and demonstrations in cooperation with national programmes;
- long-term training in soil-water management for promising scientists.

CONSTRAINTS

a) Inappropriate soil management system

The African continent, although endowed with immense natural resources, has faced serious food crises since the last two decades. The continuous decline in per capita food production has been attributed variously to the drought, rapid population growth and degradation of the resource base for productive agriculture. Although these factors may have exacerbated the food crisis, deep at the root of the problem lies the neglect of the environment in general and improvement of the soil fertility, conservation and water management in particular. Soil degradation has consequently become a major constraint to food production in the semi-arid tropics. Technology and methodology for improved soil fertility, conservation and water management are therefore urgently needed. In addition, development of an integrated production system which recycles resources and consequently conserves and optimizes available soil resources, is required.

/.....

b) Drought

The drought that destabilized food grain production in many countries of Africa is not unique to the region. Although the droughts of the 1960s and 1970s of the Sahel received world-wide attention, it was reported that more than 20 droughts did occur since the 16th century in the same region. Previous patterns of climate seem to suggest that droughts occur in one or more regions of Africa every year. Two or more droughts affect large areas of the continent every decade while extremely protracted and widespread droughts occur about three times in a century, although the precise geographical area of incidence is not predictable. In general the erratic pattern of rainfall distribution, as well as poor soil management techniques to conserve moisture, have also contributed to poor food grain production.

c) Lack of sufficiently trained agricultural research workers, particularly in soil science and water management.

d) Inadequate research and extension infrastructures. Only half to 8% of government financial resources of most African states are allocated to agriculture, whereas 90% of the workforce depends for its main stay primarily on agriculture in most sub-Saharan African countries.

/.....

The problems of erosion, desertification and deforestation have further exacerbated the dwindling of food production in many sub-Saharan African countries. Increased food production to cope with the rapid population growth could not be attained without effective and self-sustaining agricultural production systems.

THE PROBLEM

Soil and water are often seen as natural resources to agriculture which are uncontrollable whereas they should, in fact, be considered finite resources which can be modified, conserved and managed. In most sub-saharan regions, average annual rainfall can vary from 400 mm to 1200 mm. However, the estimates of surface runoff could be up to 40 - 80 per cent. Effectively, farmers are losing more than half of the rainfall that reaches their plot of earth. As much as 8 tons of soil could be lost from a cultivated hectare and 20 tons/ha from bare soil, attributable to the forces of erosion. The potential for implementation of agricultural resource management technology is challenging. Through the use of conservation techniques the soil can replenish its storage reservoir for better plant growth, reducing the damaging effects of erosion.

Nutrient requirements must be determined for all soils, particularly those of West Africa, before recommendations can be made on the type of fertility management required. Soil testing and laboratory analyses are needed, with on-site yield trials of the various crops and soil types within the ecological environment of the vegetative zones. All elements essential for the growth of plants are involved in the fertility management of soils. The maintenance of soil fertility at a satisfactory level, while at the same time attempting to increase production, is a complex problem. There are also important interactions between soil nutrients and soil water.

The maintenance of optimal amounts of nutrients can only be realized by keeping a favourable balance between nutrient gains and losses. Continual crop removal depletes the soil of

/.....

nutrients, but replenishment by organic additions such as farm manures and green manures, crop rotation and intercropping and the addition of inorganic fertilizer, are some of the methods employed to maintain a balance. In West Africa phosphorus is the major limiting element. However, yields cannot be substantially increased without the addition of nitrogen and a supply of water for root development and eventual nutrient uptake. Nitrogen deficit, generally caused by leaching, volatalization, crop removal and soil erosion can be met by incorporating farm and organic matter and by the addition of commercial fertilizers.

Woodlot farming, with controlled cutting and harvesting of trees, needs to be started to ensure a continuous supply of trees for fuel, soil erosion control, and for the protection of the landscape. The removal of trees for fuel has been occurring at an accelerated rate throughout Africa. Traditional cooking is done over an open wood fire. With expanding population, the cutting of trees near population centres has increased and land clearing has progressed steadily. Land clearing leaves the soil bare and unprotected from the ravages of water and wind erosion which occur at an alarming rate. Often, production losses are only reflections of soil losses and few controls or corrective measures are implemented throughout the region.

OBJECTIVES

Although soil and water management research was a component of SAFGRAD Phase I, no expanded network of research activities was launched on a regional basis except as a component of agronomic trials. The objectives are : /.....

- To develop and improve techniques of water use efficiency, water harvesting technology' appropriate cropping systems and soil conservation practices;

- To implement and evaluate supplemental irrigation, to restrict surface water losses (zero-runoff concept) and prevent soil erosion;

- To delineate tillage problems employing animal-drawn implements for the most effective use of draft animals in preparing field designs, including seedbed preparation, seed and fertilizer application, construction of water harvesting facilities and weeding, as well as harvesting and earth-moving equipment to improve production agronomy;

- To assess the capacity of soils in semi-arid tropical Africa to supply higher plants with essential elements which are fundamental to crop production. To determine and identify nutrient deficient areas within the programmes of international networks where the concentration of available nutrients could be adjusted by applying fertilizer required for increased crop production. To select methods and management alternatives so that farmers can provide an adequate quantity of each nutrient to increase and maintain a high level of agronomic output;

- To include agricultural forestry techniques which can reduce runoff and erosion on depleted soils. To facilitate the establishment of agro-forestry at the village level supportive of woodlot management as an

/ ...

integral part of the farming systems programme ;

To identify and test various trees and brush systems for use as windbreaks to reduce wind erosion and crop damage in the sand-blowing areas ;

. To demonstrate the restoration of soil fertility through integrated production systems.

Areas of Research Emphasis

Field studies emphasizing soil, water and nutrient conservation practices for rainfed agriculture would be the major thrust of research in the project.

Tillage studies

Energy efficient and conservation effective tillage systems which improve soil structure, reduce weed growth, labour and fertilizer inputs would be studied at the village level with appropriately designed on-farm trials. Concurrently, similar trials would also be run at the research station level. The role of crop residues in improving the productivity of such tillage systems would be scrutinized in the above trials.

Water conservation studies

Water is the most important constraint to crop production in the semi-arid zones of Africa. Conservation and efficient use of water are consequently critical to the development of a rational agricultural resource management system. Management systems which minimize runoff and erosion, and maximize water infiltration into the soil profile would, therefore, be given a high priority. Possible techniques for study would

....

include 'digettes', tied ridging, ring terraces and water spreading. Other related topics of study would include interaction of nutrients and various soil and water conservation systems in the Savanna soils of Africa, efficiency in terms of water storage of terraces, tied ridges and contour ridges constructed by animal traction. Appropriate socio-economic studies of the above soil-water conservation systems would also be undertaken at the village level. Design and construction of rainwater collection systems for domestic and farm use in collaboration with the animal-traction and agro-forestry programmes is also envisaged. Demonstration projects would be implemented at the village level in areas representative of given agro-ecological zones.

Greater emphasis would be placed on drought tolerance of various crops and trees and their capacity to adjust to different forms of soil-water and fertility management practices such as various timing and type of mulch applications, seedbed shapes, planting patterns, cultivation methods, cropping systems and supplemental irrigation. These studies would involve measurement of soil-water in situ (i.e. soil water content, hydraulic conductivity and water potential), soil fertility, soil and plant microclimate (i.e. temperature, relative humidity, wind speed, net radiation, etc.), plant water status (i.e. leaf water, potential, leaf diffusive resistance), plant growth characteristics (i.e. photosynthesis rates, leaf area index), crop water and nutrient use studies (with lysimeters and under open field conditions). Under no conditions should lack of equipment be permitted to constrain urgently needed studies of soil-water and fertility management.

/.....

(c) Agro-forestry component

Establishment of nursery stock and selection of suitable trees and shrubs for woodlots and alley-cropping systems with emphasis being on leguminous species such as Acacia, Casuarina and Prosopis spp. The implication of introducing trees and shrubs into the farming systems of a given area would be studied in terms of soil-plant relationships (i.e. water use, nutrient cycles competitive relationships with annual crops,etc.) and socio-economics.

(d) Soil fertility

The process of diagnosing plant nutritional problems is based upon on-going fertility evaluation programmes which can be grouped according to the principal techniques used. The main ones are soil testing, plant analysis, missing element techniques, and simple fertilizer trials. These emphasize the central concept that fertility evaluation is a site-and crop-specified undertaking. The purpose of a soil fertility evaluation project is that it must be correlated with growth response under field conditions. There is a need to identify soil fertility problem areas within the vegetative zones, develop field plot studies at the village level and, when possible, offer remedial solutions for fertility management.

Soil Fertility Interventions

a) Phosphorus studies

Characterization of soil P status, crop P responses, P removal and balance in different cropping systems, residual P effects,efficient use and effectiveness of different P sources (with particular emphasis

'....

on local phosphatic rocks), role of mycorrhyzas genotype x P level interactions, drought stress x P level interactions.

b) Nitrogen studies

Characterization of soil N status, crop N responses, N removal and balance in different cropping systems, residual N effects, efficient use and effectiveness of different N sources, role of leaching and volatilization losses on the N balance, genotype x N level interactions, drought stress x N level and timing of application interactions.

c) Biological N fixation systems

Contribution of locally grown legumes in the N balance under traditional and improved cropping systems, role of non-traditional legumes (e.g. soybeans) for improving the soil N balance, evaluation of Rhizobium strains for efficiency of N fixation, development of agroforestry systems and, in particular, alley-cropping systems involving legumes, legume genotype x N fixation studies.

d) Soil organic matter studies

Characterization of soil organic matter under different soils and traditional cropping/farming systems; maintenance and improvement of soil organic matter studies; effect on soil organic

/....

matter of traditional and improved management systems, involving burning, residue management, use of animal manure, fertilizer use; agro-forestry systems, improved soil-water management techniques.

e) Studies on secondary and minor elements and other deficiencies or toxicities. Sulphur status and management, deficiencies of Zn, Boron, etc and correction, Aluminium toxicity and management, etc.

Severe soil erosion cuts and gullies can be seen throughout the landscape in Africa which represents a large percentage of land not in production. These areas have been denuded of grasses and trees for fuel. To stabilize the scars of human destruction, trees can be planted and with minimum maintenance regain the loss, stabilize the area, improve the soil and in time create an area supportive of agro-forestry.

Usually the first method suggested for the control of wind erosion is establishment of a permanent windbreak by planting trees and shrubs. Windbreaks are intended to reduce wind erosion and crop damage. Semi-porus windbreaks are more effective than impervious types because of diffusion and eddy effects on the downwind side. The usual design has several rows of trees in combination with shrubs and bushes to reduce wind speed at the soil surface.

The declining crop yields accompanied with the increased requirements for cereal production in the heavily cropped areas is demanding for more land to be cultivated at the expense of

/....

grazing. As a result, the capability of the farmers to maintain cattle, despite the many benefits they are gaining from the integration, has continued to be jeopardized.
In order to achieve an increase in the production of food under the objective conditions of the semi-arid regions, the possible maximum use of the locally available resources is an inavoidable necessity. A research policy that is deliberately biaised in favour of utilization of such resources needs to be adopted as a conceptual framework.

In many parts of the world the integration of livestock has always served as a strong back-up for the increased production of food crops. It has allowed the expansion of cultivated land while permitting intensification of crop production through draught power, recycling of nutrients and reinvestments of livestock generated income. This, not only is sound conceptually, but the chances of it being adopted by the farmers could also be high.

The practice of recycling and utilization of the locally available resources through the system of integration is already existing although not to a great enough extent. The system could be within their economic reach, thus fitting into the objective conditions of the farms.

Therefore, in order to increase the efficiency of recycling and utilization of natural resources through the integration of crops and livestock, a thorough study that will allow the injection of scientific knowledge is an immediate requirement. The following aspects could be considered for study :

Research on animal draught power

Use of animal draught power is a technological improvement that could eliminate the drudgery of labour, increase the efficiency of use of available labour and gradual intensification of the production system. Draught power is required for the various activities of soil and water conservation, drawing of water for consumption by humans and animals, etc.

Most of the soil and water conservation activities are expected to occur before the rains, i.e. during the dry season when the animals are usually in poor condition for draught work. The available basic feed resources to the animals for the major part of the year are mainly the crop residues and the dry-mature natural pastures. These materials, although rich in cellulosic energy, are poorly consumed due mainly to their low nitrogen content. It is recognized that the physiological demand of nutrients by the animal for body maintenance, work, growth, calf and milk production can only be satisfied when the nutritional factors limiting intake are removed and adequate levels of nutrients are supplied.

Therefore investigation on the nutrition of draught animals to establish a feeding system suited to the requirements of draught work using the locally available feed resources will be necessary.

For the further improvement in the efficiency of utilization of animal energy, improvements in ploughs and implements will be expected to develop too. Such improvements in addition to improved tillage operations will also encourage the use of cows for draught purposes.

/.....

Cows could serve as multi-purpose animals contributing to the draught power requirement of the farm while producing milk and calves as sources of income to help reinvest in the cropping system for further intensification. To exploit such possibilities, investigations on the added effects of draught power, fertility and lactation performance of cows vis-a-vis the draught power of oxen need to be conducted under the specific conditions of the farms.

Research on feed resources

Crop residues and dry/mature natural pasture on the fallow and wasteland constitute the basic diet of the animals during the dry season (7-9 months). These are low quality roughages. An attempt to increase the utilization of such materials demands the availability of nitrogenous sources. Of special interest under the existing objective conditions is the need to exploit the potentials of tropical leguminous forages and browses, The incorporation of forage legumes and browses could serve as a vital link between the crop and livestock production systems. The supply of nitrogen to the animals could allow the maximization of digestion of cellulosic materials by the microbes in the rumen. Leguminous forages are known to contribute to the fertility and structure improvement of soil through nitrogen fixation and organic matter supply. The legume forages and browses could be incorporated in various ways:-

- Using fallow and wasteland

  In quite a number of places fallowing (after a number of years of cereal production) appears to be the only means of restoring soil fertility. Fallow fields are also used for grazing. These abandoned fields can be used for :

- the introduction of annual and drought resistant perennial forage legumes directly cultivated or oversown in the fallow pasture for conservation for dry season feeding. If the legumes are annuals the regrowth after the harvest for conservation could be ploughed under to increase the nitrogen, mineral and organic matter contents of the soil.

- planting leguminous browses as alley crops for a cut-and-carry feeding system as a source of nitrogen and energy to supplement the crop residue feeding in the dry season. This system also allows the use of the branches of the browse to mulch the soil. The pasture between the alleys could be harvested for conservation and the regrowth grazed by sheep. After the termination of the fallow period the legume trees could continue to serve as alley crops.

Using contour ridges

Contour ridges on the arable land could be planted with browse species for conservation of soil and mulching while providing feed as a cut-and-carry system to supplement the crop residues. Conserved forage and the cut-and-carry system will encourage the feeding of animals in enclosures where feeding could be controlled and manure output and management improved.

Allocation of arable land

Establishment of a permanent perennial legume and grass forage production on part of the arable land in the absence of

/...

fallow might have a substantial contribution to the feed budget of the farm.

Intercropping of legumes with cereals

This could also serve as a source of nitrogen and energy when conserved for the dry season feeding.

The above points might indicate the possibility of increasing the resources of feed to combat the problems of nutrition for the integration of livestock with the crop system.

SOCIO-ECONOMIC INTERVENTIONS

(a) Conducting baseline studies of current production systems in representative benchmark sites:
Accent in the baseline surveys would be placed on :

- farmers' current resource management practices (soil fertility management, erosion control, livestock management, tree management, etc.);
- socio-cultural factors related to resource management (land tenure, herder/farmer relations, common properties such as woodlots, etc.);
- nature and rates of environmental degradation by zone;
- farmers' management responses to the environmental decline.

(b) Conduct ex ante assessment of costs and benefits of alternative technical interventions to improve resource management.

/....

(c) Test the most promising technical interventions in operational scale researcher-managed and farmer-managed tests. The study could provide an economic assessment of the costs and benefits in both the short and long-run, and assess the compatibility of the new techniques with socio-cultural factors.

(d) Monitor the adoption and subsequent modification of new techniques tested by farmers.

CORE RESEARCH TEAM

The Agricultural Resource Management team will not be expected to initiate and undertake research in most related fields. It will, however, utilise on-going research and other institutional resources. The team would first inventory most research results on soil fertility, water conservation, water-management, cropping systems, agro-climatology, agro-forestry, farming systems practice, etc., and establish broad data base in resource management. The collected data will be used to initiate research networking. The team will also identify research gaps and conduct collaborative research in deficient areas at the main and at satellite stations that would be based at selected national research centres.

The core research team will consist of :

1. SOIL FERTILITY EXPERT - with several years of experience on tropical soils management. In collaboration with other scientists, the expert will provide leadership to assemble past and on-going research results in this field; play a catalytic role in strengthening research both at main and satellite stations to initiate regional resource management network and training.

2. AGRICULTURAL ECONOMIST - several years of experience of agricultural production systems: carry out baseline studies of current production systems as outlined earlier. The expert in collaboration with other team members would provide economic assessment of promising technical interventions and determine cost and benefits of the integrated systems of production, monitor adoption of techniques, etc.

3. SOIL CONSERVATION SPECIALIST - with several years of experience in soil conservation techniques, water-harvesting, etc. The expert would facilitate the introduction of cost effective technology, training and monitor network

/.....

activities in this field. In collaboration with other members of the team, inventory research results from past and on-going research programmes conducted by different institutions in order to establish strong data base for research, training and networking activities. He will also conduct research in identified research gaps.

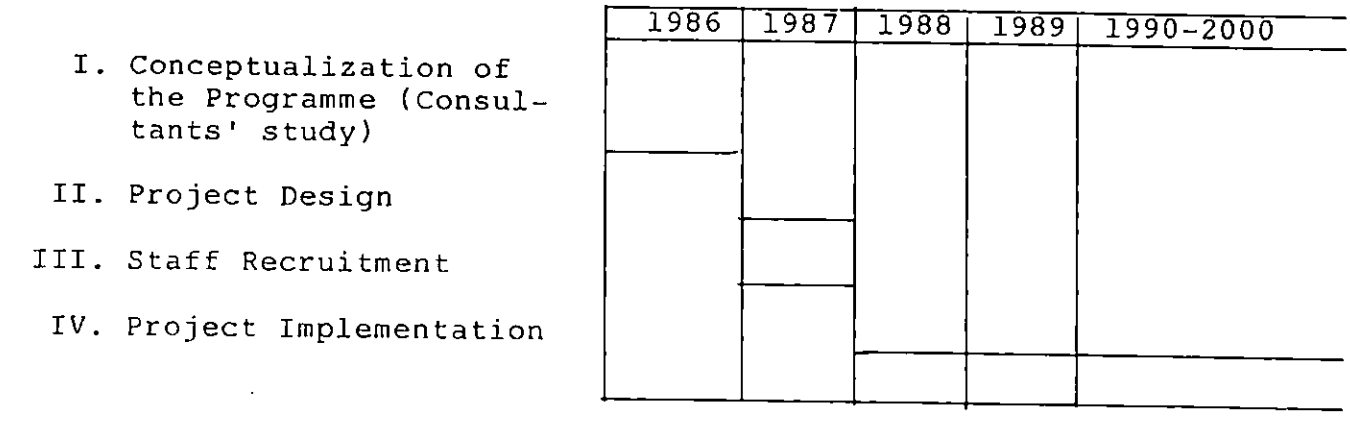
4. AGRICULTURALIST - with broad experience in both animal and crop-production systems (several years of experience), the expert would first survey available technical information on forage resources and intercropping systems with reference to improving fertility of the soil; integrate animal traction, and production in order to establish economic compatibility between and among production systems (agro-forestry, cropping and animal production, etc.)

5. TECHNICAL STAFF - 3 to 5 experienced scientists with B.Sc. or M.Sc degree levels would be locally recruited. They should possess specialized training in agro-forestry, agro-meterology, agronomy, socio-economics, soil science, land use management, agricultural engineering, documentation, etc, and assist core scientists in the collection, assembling data as well as conducting research.

PROGRAMME DEVELOPMENT

Provided that initial response from the donor is received, the schedule for project initiation and implementation could be as outlined below:

Schedule of programme development:



BUDGET

This budget summary is based on SAFGRAD Project activities during the last eight years. A considerable portion of the fund is allocated to support national research programmes, training, and for zonal research networking. Project service cost refers to overhead costs by OAU/STRC SAFGRAD affiliated regional services. Operating costs refer to local expenses including fuel, utilities and overall administrative costs. A detailed itemised budget including local inputs would be submitted as soon as this project is considered for funding.

BUDGET SUMMARY

(US $ 000)

	YEARS					
	1	2	3	4	5	TOTAL
1.0 PERSONNEL						
1.1 International staff[4]	300	300	300	240	240	1380
1.2 Technical staff (6)	65	80	80	90	100	415
1.3 Other Service staff	20	25	25	30	30	130
Sub-Total						1925
2.0 RESEARCH NETWORKS						
2.1 Workshops & Seminars	40	50	60	50	50	260
2.2 National Programmes Research Support	300	300	500	400	300	1800
Sub-Total						2060
3.0 TRAINING						
3.1 Long-Term	-	200	100	150	-	350
3.2 Short-Term	40	50	60	60	40	250
Sub-Total						600
4.0 TRAVEL						
4.1 Scientific Staff	60	60	40	20	20	200
4.2 Other Staff	10	10	10	10	10	50
Sub-Total						250
5.0 EQUIPMENT & SUPPLIES						
5.1 Lab and field equip.	100	90	70	-	-	260
5.2 Vehicles	70	-	30			100
5.3 Office Supplies	10	10	20	20	20	80
5.4 Publications	10	10	15	15	10	60
Sub-Total						500
6.0 OPERATING COSTS	70	100	150	150	150	620
TOTAL						5955
CONTIGENCY (5%)						297.75
PROJECT SERVICING COST 10%						595.5
GRAND TOTAL						6848.25

INSTITUTIONAL ARRANGEMENT

Following the OAU/Ministerial decision in 1976, SAFGRAD was created in 1977 as a regional research coordination and technology promotion project.

The headquarters of SAFGRAD Agency is located in Ouagadougou, Burkina Faso. SAFGRAD is under the administrative umbrella of the Scientific, Technical and Research Commission of the Organization of African Unity (OAU/STRC) which provides the legal basis for the SAFGRAD Coordination Office as an operating entity.

Management and Policy Body of SAFGRAD

As an implementing agency, the SAFGRAD Coordination Office is responsible and accountable to OAU/STRC although SAFGRAD is autonomous in implementing its programme once approved by the Consultative Committee (CC). The CC provides policy and operational guidance to facilitate project implementation through sound administrative management. This highest decision making body of SAFGRAD Agency consists of experienced senior policy makers, executives and scientists selected as follows:

- Executive Secretary, OAU/STRC - Chairman
- Four African scientists or Directors of research representing different regions of Africa.
- IITA - Senior scientist or Administrator
- ICRISAT - Senior scientist or Administrator
- CILSS
- Donor representatives
- SAFGRAD International Coordinator is the secretary of the CC.

The CC is assisted by a Technical Advisory Committee (TAC) which reviews the technical feasibility and relevance of all research and technology improvement programmes.

TAC Composition is similar to

/.....

that of the CC except that regional agencies such as INSAH are also members. SAFGRAD programme leaders also participate as observers. The Director of Research of SAFGRAD is the secretary of TAC.

Donors

SAFGRAD has been conceived as a multi-donor programme. During SAFGRAD Phase I, the major funding was by the United States Agency for International Development (USAID) with a total of about US $21 million (as of 1 March 1986). Since 1984, the International Fund for Agricultural Development (IFAD) has maintained about one million US dollars a year to support FSR in three countries including coordination of SAFGRAD research activities, while the French Government through its Aid and Cooperation Fund (FAC) has continued to support on-farm testing activities in the Republic of Togo. Member countries hosting some SAFGRAD programmes, for example, Burkina Faso, Nigeria, Mali, Cameroon, Senegal, Kenya, etc., have provided local logistic support, personnel and funds to facilitate the implementation of such programmes in their respective countries.

As a non-political and non-profit making regional research coordination and technology promotion agency of the OAU/STRC, SAFGRAD's role is to promote the continuous flow of technology and information to and among national research programmes (networking), to improve the indigenous research management capability of member countries, and to enhance the diffusion of agricultural innovations through its on-farm testing programme.

/...

The geographic mandate of SAFGRAD covers the semi-arid regions of its current 26 member countries in West, Central East and Southern Africa, namely Benin, Botswana, Burkina Faso, Cameroon, Cape Verde, Central African Republic, Chad, Ethiopia, Gambia, Ghana, Guinea, Guinea Bissau, Ivory Coast, Kenya, Mali, Mauritania, Niger, Nigeria, Senegal, Sierra Leone, Somalia, Sudan, Tanzania, Togo, Zambia and Uganda.

Collaborative research for the development and improvement of maize, sorghum, millet and cowpea varieties as well as for the generation of related technologies for the national research systems, was established with the International Agricultural Research Centres particularly IITA, ICRISAT and with selected national research programmes of SAFGRAD member countries.

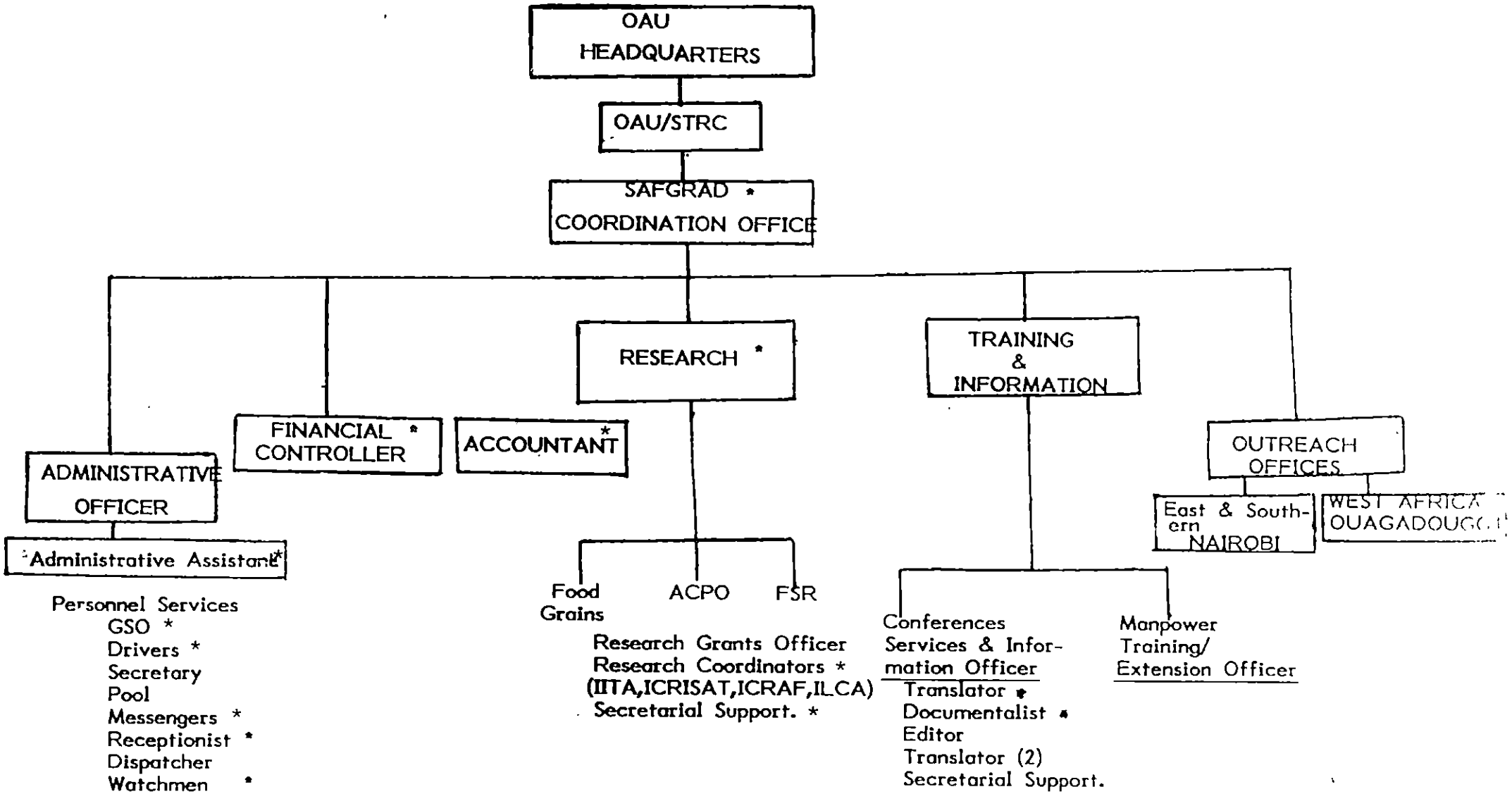
Recently, realizing the need to integrate agro-forestry interventions with its on-going FSR (in three countries), SAFGRAD and ICRAF have also developed a joint collaborative programme.

The major thrust of SAFGRAD is to improve the indigenous capacity of national research. This is achieved through training, workshops, seminars, direct technical research support in field trials, farming systems research and related outreach activities such as the Accelerated Crop Production Programme (ACPO).

Currently, SAFGRAD Phase I has been implemented through its country programmes and representative offices. (FSR in 3 countries, the ACPO Programme in 5 countries and 2 regional coordination offices in West and Eastern Africa). In collaboration with IITA the SAFGRAD maize and cowpea research network includes 18 countries while the Eastern Africa SAFGRAD/ICRISAT sorghum and millet improvement network involves 10 countries. The technology transfer network (focus on on-farm testing) has been started through SAFGRAD since 1984.

Project site

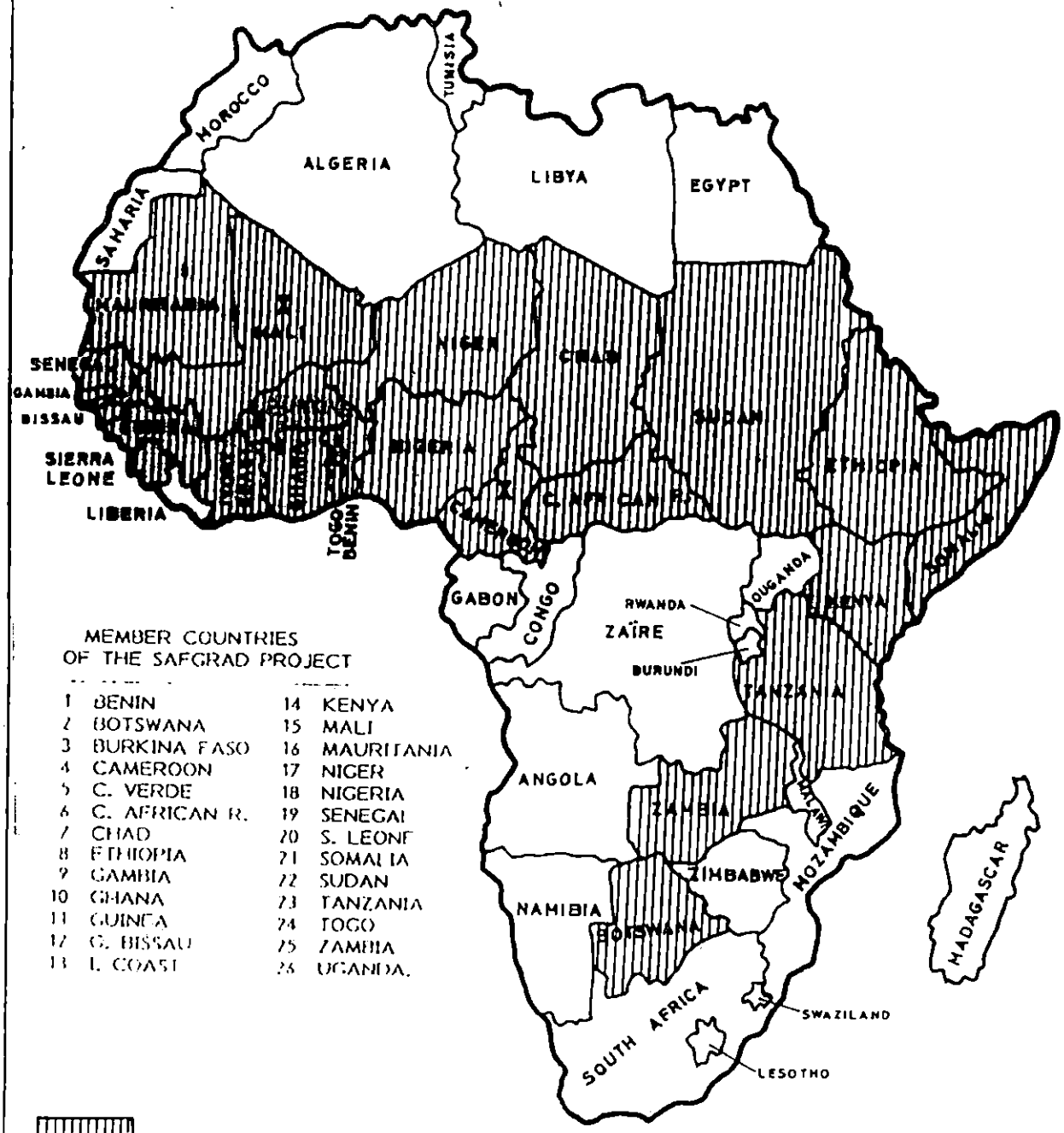
Through OAU/STRC, the SAFGRAD Agency is uniquely structured to base this project in any of its 26 member countries. The "core team" comprised of three or four international scientists could be based at SAFGRAD regional offices (Nairobi, Kenya for East Africa or Ouagadougou, Burkina Faso for West Africa) or in any other country to be selected in agreement with OAU/STRC and the donor. In addition to the main site, six national research programmes would be selected as satellite stations in realizing the agricultural resources management research network. All programme activities would be based at national research stations. Furthermore, elaboration of the proposed project would enable us determine which sub-components of the project would be based at the selected national research programmes.



Notes.

1. Asterisk (*) denotes existing staff positions.

MAP OF AFRICA



MEMBER COUNTRIES
OF THE SAFGRAD PROJECT

1	BENIN	14	KENYA
2	BOTSWANA	15	MALI
3	BURKINA FASO	16	MAURITANIA
4	CAMEROON	17	NIGER
5	C. VERDE	18	NIGERIA
6	C. AFRICAN R.	19	SENEGAL
7	CHAD	20	S. LEONE
8	ETHIOPIA	21	SOMALIA
9	GAMBIA	22	SUDAN
10	GHANA	23	TANZANIA
11	GUINEA	24	TOGO
12	G. BISSAU	25	ZAMBIA
13	I. COAST	26	UGANDA.

SAFGRAD COUNTRIES

X ACPO's

0 500 1000 1500 2000 KM

1986-02

A REGIONAL APPROACH TO STRENGTHEN AGRICULTURAL RESOURCE MANAGEMENT RESEARCH IN THE SEMI-ARID REGIONS OF SUB-SAHARAN AFRICA

OUA/CSTR-SAFGRAD

OUA/CSTR-SAFGRAD