

ACTION MEMORANDUM FOR THE ADMINISTRATOR

THRU: EXSEC

FROM: AA/PPC, Philip Birnbaum

Problem: The Government of Senegal has requested that A.I.D. increase its assistance to the two medium term projects: (Senegal Cereals Production and Senegal Range and Livestock Development) by providing supplemental funds to permit the addition of human resource development elements. To advance the implementation planning and actions requires your early approval of a total of \$900,000. Because Special Sahel Funds are being used, we plan to obligate the entire amount immediately for the respective projects.

Discussion: There have grown up in Senegal over the past 15 years a series of programs designed to compensate in various ways for the shortcomings of Senegal's school and agriculture extension systems. The lengthy, expensive task of reforming the state school system to more adequately address the needs of the rural areas got underway only in 1971. Many years must pass before schools in Senegal become a more effective means addressing the rural needs. Similarly, the extension services remain oriented in the formal tradition towards the delivery of special knowledge and techniques. Senegal's extension services are not yet staffed with personnel possessed of solid technical background, and teaching and organizational skills. To compensate for these deficiencies, various programs have emerged in Senegal, each independent of one another in conception and in source of financial support. Given their common set of objectives and their independent origins, these programs have overlapped somewhat. In an effort to coordinate rural training programs, the government of Senegal brought the various activities together within the same bureau, entitled Promotion Humaine.

A major recommendation of the Development Assistance Plan (DAP) for AFR/CWR is to encourage ways in which A.I.D. could assist with the development of human resources in the rural areas in order to compensate for the deficiencies of the present education and extension systems. The DAP specifically recommended that A.I.D. fund the addition of a Promotion Humaine component to each of the medium-term production projects, both to improve the projects and to give Promotion Humaine the opportunity, at the same time, to demonstrate its effectiveness.

The purpose of the Senegal Cereals Production project is to increase the production of millet and groundnuts in the heavily populated farming area of Central Senegal. A.I.D. will help achieve this objective by enabling the Agency for Agriculture Development and Extension (SODEVA) to carry out a graduated program of crops intensification by use of better seed varieties, fertilizers, animal traction, and specially adapted farm implements, and in

more rational and timely planting methods. The purpose of the Promotion Humaine addition, in the amount of \$500,000, is to insure the wider impact of the SODEVA extension program. This add-on provides modest support for several types of production-linked activity: off-farm rural employment, local village-level organization, and literacy and home-care training. More specifically, the add-on is designed to assist three groups: rural artisans, village representatives, and women and youth.

The purpose of the Range and Livestock Development Project is to assist the Government of Senegal in realizing more fully the potential for food production of Senegal's northern and eastern rangeland areas. This is to be accomplished through the introduction of modern range and livestock practices to populations inhabiting a well defined project zone within that larger area. Because the project seeks to introduce practices and attitudes which are often at variance with traditional views, the project's educational aspects are of fundamental importance. The original Project Paper (PROP) included an education component which was left open to further definition and refinement. The purpose of the add-on to the Livestock project (\$400,000) is to fulfill the PROP requirement for an educational component which consists of the following:

(a) a sociological function, to provide a detailed baseline survey of attitudes and practices; (b) an orientation function, to prepare the population and project staff to participate in the project activities; (c) an organization function, to assist the people to form cooperatives, groups, and associations; (d) a complementary extension function, to prepare groups to receive and make use of technical instruction; and (e) an instructional function, to import additional knowledge and techniques which, together with the new technical practices, prepare the way for better living conditions.

Procurement: Strict compliance with normal A.I.D. procurement policies (i.e., restriction of procurement to U.S. sources) would, in the circumstances of this add-on as it relates to the drought medium term project, constitute a serious restriction against providing timely and beneficial assistance. Section 639 A(b) of the Foreign Assistance Act of 1961, as amended, expressly provides that assistance to the drought-stricken nations of Africa may be provided "notwithstanding any...restrictions contained in this or any other act."

Senegal, like other Sahel states, faces a situation in which commodity imports emanate almost entirely from France and other EEC countries. U.S. equipment and commodities cannot be serviced or repaired in the event of breakdown. Spare parts are not available, and Africans are not trained in the maintenance of U.S. equipment. In the past, audits and inspections of A.I.D. projects in the area have been sharply critical of the difficulties of host governments in maintaining U.S. equipment after project phase-out. An additional factor to be considered if procurement were to be restricted to the U.S. is the lengthy lead-time for the delivery of commodity orders from the U.S.

The following are the commodity requirements over the life of both add-ons: \$67,500 for vehicles; \$4,500 for motorbikes; \$131,000 for training, teaching and support equipment; \$306,803 for construction of training centers, workshops, offices, storehouses, housing; \$12,000 for local supplies for training centers.

These project add-ons have been reviewed and cleared by all the concerned A.I.D. offices and have the approval of the Project Review Committee. Section 113 of the Foreign Assistance and Related Programs Appropriations Act of 1975 does not require Congressional notification prior to Agency authorization of the use of FAA Section 639 A(b) funds.

Recommendation: It is recommended that you approve the attached Project Paper Amendments.

Attachment: Project Paper Amendments

Approved: _____

Disapproved: _____

Date: _____

DBaker
AFR/CWR:DBaker:lws:9/29/75

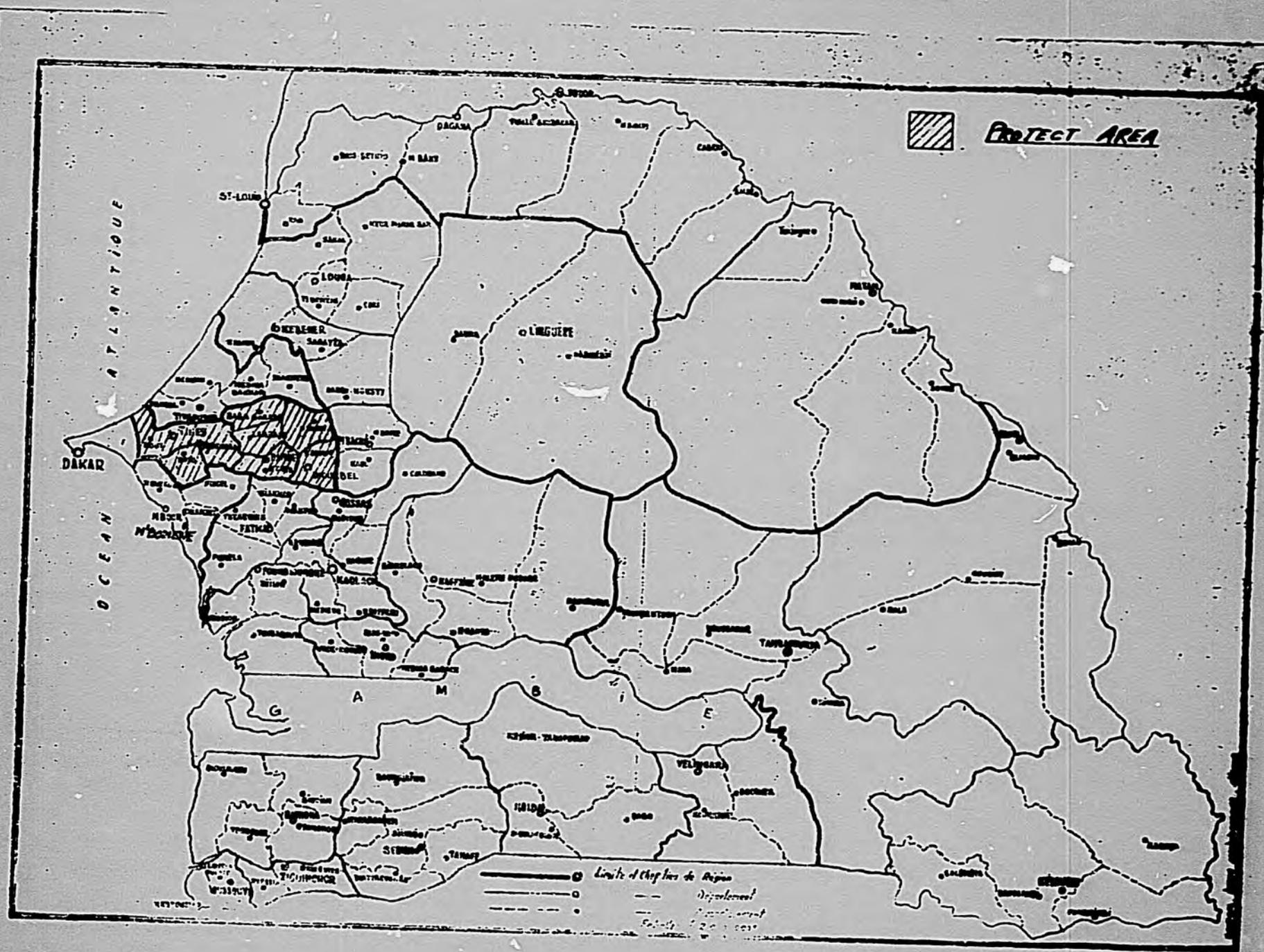
Clearances:

D/DAA/AFR:RHuesmann _____
AFR/CWR:DShear *DShear* _____
AFR/CWR:SRea(draft) _____
AFR/CWR:JPatterson (draft) _____
AFR/DS:PLYman _____
GC:CLGladson *CLGladson* _____
GC/AFR/EDragon *EDragon* _____
PPC/DPRE:RBobel *RBobel* _____
AA/AFR: SCAdams, Jr. _____

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 **PROTECT AREA**

OCEAN ATLANTIQUE

DAKAR

ST-LOUIS

DAGABA

LINGUIERE

DIASSANE

DIASSANE

FATMA

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———— (thick line) ———— *Limite d'Etat*
 ———— (thin line) ———— *Limite de Chef-lieu de Région*
 - - - - - (dashed line) - - - - - *Departement*
 (dotted line) *Commune*
 (circle) (with dot) *Capitale*

PART I.

SUMMARY AND RECOMMENDATIONS

1. Grantee

The Grantee will be the Government of Senegal. The implementing institution will be the national Senegalese agricultural extension agency, "Societe de Developpement et de Vulgarisation Agricole", commonly known as SODEVA.

2. Guaranty

There is no guaranty required for this grant project.

3. Summary of Grant

a) Total Program Cost: \$4 million (Does not include Grantee contribution.)

b) Duration of Project: AID financing will cover a period of approximately 3½ years from October 1, 1974 to March 31, 1978. Final date of disbursement will be December 31, 1978, unless otherwise extended.

Foreign Exchange: \$1.0 million (including Code 935 costs)

Local Cost Component: \$3.0 million

Grantee Contribution: \$2.0 million

Other Donor Contribution: ___ *See Footnote Below

c) Funding requirements for first three years are estimated at 80% of total project cost, or \$3.2 million.

Foreign Exchange: \$800,000

Local Cost Component: \$2.4 million

Grantee Contribution: \$1.6 million (CFA equivalent)

*While other donor assistance is not directly budgeted into the program, it will benefit directly and indirectly from several activities financed from other sources. For example, IDA funds are available for farmer credit and training facilities and equipment. The Iranian-financed audio-visual program directly affects the area, and the new CETAD, SODEVA's training center, is being financed from these sources. The National Research Center at Bambey, operated under contract by IRAT has large-scale French financing, while certain experiments for a new millet variety are financed by the European Development Fund, FED.

4. Summary Description of Program

This program will permit the Senegalese agricultural extension agency (SODEVA) to carry out and expand a farmer intensification program in three of the five Departements of the Thies-Diourbel region, which forms an important part of the so-called Groundnut Basin in Senegal, and is the principal area for the production of millet and groundnuts. For the past several years, as a result of reasearch carried out by the National Agricultural Research Center at Bambey (CNRA) and the perfection of extension methods adapted to the needs of the Senegalese farmer by SODEVA, both the necessary techniques and methods exist to assist farmers to use improved agricultural practices and thus obtain greater crop productivity for millet and groundnuts. The program includes the use of better seed varieties, fertilizers, animal traction, specially adapted farm implements, together with the introduction of more rational and timely planting methods through a graduated program of intensification. SODEVA has the planning and technical competence to expand its current extension activities in the area. The additional inputs will be made available through the proposed AID-financed program outlined in this document. These inputs include funding for additional personnel required at the field level, certain operational expenses, a limited construction program in the field, primarily to meet the needs for training and farmer demonstration facilities, and equipment principally for training and demonstration purposes. The program also includes the setting up of an applied research unit to assure a direct research input from CNRA to the extension work of SODEVA in the area. The Senegalese government will continue to allocate an annual amount at least equal to its contribution to the SODEVA budget for the Thies-Diourbel region in 1973.

5. Program Justification

Senegal is primarily an agricultural country which has been adversely affected by Sahelian drought conditions. It is largely dependent upon groundnuts for its foreign exchange, and in recent years has been deficitary in its production of cereals for internal consumption. If the Senegalese economy is to be developed and the standard of living of the mass of the people improved, priority must be directed towards assisting agriculture. The principal objective of this AID assisted project is to increase the production of cereals, principally millet, in one of the most densely populated farming areas of the country. Since nearly all of the tillable land is presently used in the region, increased production can only come about through the use of new methods applied by the

individual farmers. The necessary technical procedures exist and the method of bringing these techniques to the farmer has been developed and perfected by SODEVA. Considerable progress has already been made in convincing farmers in the "Groundnut Basin" that the intensification program is worthwhile, and it is believed that with the proper resources, encouraging results can be obtained over the life of this project 1974-1977. The economic analysis found in the body of this paper clearly indicates the economic viability of the program both for the individual farmer and the national economy. Unless a program of this type goes forward, a further degeneration of the soils is inevitable with the consequent worsening of the environment where thousands of small farmers and their families must make their living. It is believed that with the assistance provided by this project, SODEVA can carry out a successful program, and that quite substantial results can be achieved.

6. Issues

No major issues appear to stand in the way of the implementation of the project as outlined in this report. This assumes that the Senegalese government continues to support the program, and that other governmental agencies which must coordinate their efforts with SODEVA, particularly the organization responsible for agricultural credit and marketing (ONCAD), operate in an effective manner.

7. Recommendations

It is recommended that a Grant not to exceed \$4 million be accorded to the Government of Senegal for use by SODEVA to implement the type of agricultural extension program in the Thies-Diourbel region as outlined in this document which was planned with the direct participation of SODEVA.

It is further recommended that the Grant authorization include a waiver to permit SODEVA to contract for the required European technicians as outlined in the program, and to obtain such equipment from Code 935 countries as may be needed when it can not feasibly be imported from the United States.

The Grant should also make provision for the appropriate modification of the shelf item rule which will permit SODEVA to utilize an amount up to \$300,000 to purchase shelf items imported from Code 935 countries. The limit on individual transaction amounts for shelf items should also be modified as required.

A minimum of special conditions and covenants should be attached to this Grant. It is recommended, however, that the Government of Senegal contribute to the program in the Thies and Diourbel regions in an amount at least equal to that allocated to the SODEVA budget in 1973, annually, for the life of the project. Likewise, the annual program of expenditures should be submitted to AID for review and concurrence.

8. Project Identification Team

Frank Moore, AFR/DP
John Patterson, AFR/CWR

9. Project Design Team

Norman Schoonover, Team Coordinator
Thomas Daves, Economist
Ralph Edwards, Agronomist
James Ito, Financial Analyst
Robert McDill, Agricultural Extension and Training
John Saccherl, Engineer

OBJECTIVES OF SODEVA PROGRAM FOR DEPARTMENTS
OF THIES - BAMBEY AND DIOURBEL

1974 - 1977

	YEAR	THIES	BAMBEY	DIOURBEL	TOTAL
N° of Intensified Farms	1974	93	150	80	323
	1975	190	250	140	580
	1976	400	500	280	1,180
	1977	850	720	400	1,970
N° of Farms Using Oxen Traction	1974	290	350	140	780
	1975	500	600	240	1,340
	1976	960	850	380	2,190
	1977	1,630	950	500	3,080
N° of Semi-Intensified Farms	1974	1,795	1,970	860	4,625
	1975	2,015	2,120	1,040	5,175
	1976	2,395	2,200	1,100	5,695
	1977	2,520	2,300	1,200	6,020
(GROUNDNUTS) Total Area Intensified in Hectares	1974	156	300	160	616
	1975	256	400	220	876
	1976	466	650	360	1,476
	1977	966	970	540	2,476
(MILLET) Total Area Intensified in Hectares	1974	78	150	80	308
	1975	282	250	140	672
	1976	592	750	420	1,762
	1977	1,152	970	540	2,662
(COWPEAS) Total Area Intensified in Hectares	1974	-	5	3	8
	1975	26	20	10	56
	1976	26	70	50	146
	1977	76	80	60	216
N° of Pairs of Oxen	1974	390	500	220	1,110
	1975	690	850	380	1,920
	1976	1,360	1,350	660	3,370
	1977	2,480	1,670	900	5,050

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PART II.

Section I.

NATURE OF THE PROJECT

Project Description and Objectives

The program to be undertaken with AID financing will be carried out in the region of Thies and Diourbel, one of the most heavily populated farming areas of Senegal. With the Sine Saloum region to the south of Diourbel, it forms the "Groundnut Basin", where the bulk of Senegal's groundnut and cereals crops, with the exception of rice, are produced. The program is based on work which has been going forward since 1964 under the country's "Programme Agricole" which has as its principal objective the increase in productivity of cereals and groundnut production.

During this period, a series of techniques, which can be applied directly at the farmer level, have been perfected by the combined efforts of the National Agricultural Research Center (CNRA) located at Bambey, and SODEVA, the Senegalese agricultural extension agency. Thus, in the research area, the CNRA has developed a new strain of millet which has a shorter growing season, has carried out extensive experiments with various combinations of fertilizers, and has worked out a series of measures which can assist the farmer to gradually change his unimproved traditional farming methods through various stages of semi-intensification to intensified farming using the full range of improved methods. These technical practices are brought directly to the farmer by SODEVA, and their experience has shown over the past few years that farmers are receptive to the improved methods when the resulting benefits are explained and demonstrated, and when the extension service provides the necessary supervision and follow-up.

A farm intensification program of this type financed by the French organization, the Caisse Centrale de Cooperation Economique (CCCE), was begun in Sine Saloum in 1972, using these technical and extension methods with encouraging results, and preliminary work has been carried out by SODEVA in the Thies-Diourbel region with financing provided from the Senegalese budget.

The principal objectives of the AID-financed program are as follows:

1. Encourage the production of cereals in rotation with existing cash crops (groundnuts) to provide farmers with their basic food requirements.
2. Gradually increase farmer income by the introduction of more rational production methods which will improve productivity and lead to the commercialization of the increased millet crop.
3. Assist in the expansion and strengthening of the Senegalese Agricultural Extension Service (SODEVA).
4. Expand the current program of applied research to village farm cooperatives and intensified farms to serve as models for more generalized agricultural development throughout the "Groundnut Basin".
5. Develop the necessary rural infrastructure to assure the continued overall agricultural development of the area.

The Thies-Diourbel region consists principally of light, sandy soils with an average rainfall of 650 mm per year, although the latter is subject to wide variations and has fallen considerably below this figure in several of the past years, especially in the serious drought of 1972. This region does not lend itself to the same degree of agricultural diversification which is possible in Sine Saloum, and intensification efforts are therefore to be applied principally to millet and groundnut production.

As explained in detail in the Technical Analysis section of this paper, research results and the application of these methods by SODEVA at the farm level have indicated that substantial increases in production of millet and groundnuts can be achieved in the area. It is particularly interesting to note that comparatively greater increases in yield can be obtained with millet.

There are other favorable factors which place increased emphasis on cereals production. First, the development of the millet variety "souna" with a 75-80 day growing period permits the farmer to normally obtain a reasonable crop even when rainfall goes below average. This has encouraged the farmer to give more attention to millet production, since barring drought conditions, he can obtain some return

even if his groundnut production fails to a certain extent. Secondly, in many conditions, it has been demonstrated in the Thies-Diourbel region that the application of fertilizer has a greater effect on millet than on groundnut production. Thirdly, because of the general shortage of cereals over the past few years, the farmer wishes to assure the requirements of his extended family group. For these reasons and with the present price of 28 CFA francs per kilo for millet set by the Government for the 1974 season, it is believed that a favorable base now exists for increased emphasis on cereals production.

The program outlined in this document has been prepared in close collaboration with SODEVA, and therefore represents the actual planning and objectives of that organization. Concrete objectives are projected as to the actual number of farmers to be covered in the various stages of intensification from the first step of introducing animal traction with horses or donkeys, the use of light equipment and basic simple improvements, to the next step which includes oxen drawn equipment and the application of light fertilizers, to the fully intensified system of farming. These various stages are described in more detail in the Technical Analysis and Economic Analysis sections.

A complete breakdown of the number of farms and the area in hectares planted in both millet and groundnuts to be affected in the four stages of intensification during the life of the project, 1974-1977, is included in the table attached. It can thus be seen that several thousand farms will be affected as a direct result of the program. Statistics indicating the projected income benefits to the participating farmers are likewise included in the Economic Analysis section and further delineated in attached annexes.

Agreement has been reached with SODEVA as to that part of the Thies-Diourbel region in which the AID-financed program will be concentrated. We have been guided by the desire to find the right formula which can provide sufficient impact and at the same time reasonable concentration of efforts. Thus, AID will particularly concentrate on three of the five "Departements" or administrative regions, covering eight of the fourteen "arrondissements" or political subdivisions of the region. The Departements are those of Diourbel, Bambey, and Thies, and appear to be the areas where the intensification program can best be accelerated.

Also built into the project, is the possibility of extending the program to the Departments of M'Bour (Thies Sud) and M'Backe in 1976/1977 if an evaluation of project results indicate the feasibility of expanding the activity. Such a decision would be subject to mutual agreement between the Government of Senegal, SODEVA, and AID.

An intergral part of the program will be an applied research unit to provide a direct research input and feedback into the extension program in the region. In addition, an experimental unit which would be set up by the CNRA can be financed subject to certain pre-conditions. Such a unit would combine experimental work in an area which contains both the lighter soils of the Thies-Diourbel region and the heavier, clay-like, "deck" soils found in M'Bour. Within this same context to carry out demonstrations on the clay soils, AID financing will also cover a demonstration center at M'Bodiene, south of M'Bour, to be operated by SODEVA. Details of the research activities are found in the section, "Applied Research and Liaison between Research and Extension".

The principal financial elements include providing the required additional personnel to SODEVA, a minimum light construction program to provide necessary basic facilities at the field level, demonstration and training equipment, operating expenses of the expanded program, and funding for the training program which will be an essential ingredient to project success. Complete details on the proposed financial package are found in the Financial and Budget Analysis section and the appropriate Annexes which are attached.

In the planning of the substantive implementation of the program, consideration has been given to the technical and economic elements which are required whether or not directly financed within the framework of SODEVA. Thus, the availability of agricultural credit, expanded storage requirements, continued research activities, pricing and marketing policy for cereals, and the Government's fertilizer subsidy program were examined. Further information on these aspects are included in subsequent sections of this paper.

In summary, the AID-financed program should permit the implementation of a well-conceived agricultural extension program in the Departements of Diourbel, Bambey, and Thies, which currently have an estimated 21,400 farm operations, with some 380,000 hectares devoted to millet and groundnut production.

The overall cost of AID participation for the period from October 1, 1974 to March 31, 1978, including research activities and the possibility of expanding into two additional Departments in 1976/1977 is \$4 million.

Section II.

PROJECT ANALYSIS

A. IMPLEMENTING AGENCY

The Senegalese implementing agency for this project will be the "Societe de Developpement et de Vulgarisation" (SODEVA). The organization was created in 1968 and was designed to replace the extension services provided from 1964 by France through the French firm, SATEC (Societe d'Aide Technique et de Cooperation). The principal objective of SODEVA is to provide the technical assistance necessary to increase Senegalese agricultural productivity and to disseminate better agricultural development techniques at the farmer level through extension programs. SATEC staff members were transferred to SODEVA, and expatriate technicians were retained to provide managerial and technical assistance during the early years. The organization has a planned Senegalization schedule, and expatriates replaced as Senegalese technicians and managers have been trained. The expatriate staff presently number 13 compared to the original 43.

SODEVA is a semi-autonomous "mixed economy" institution set up with an initial capital of 10 million CFA. The Senegalese Government is the principal stockholder, but others include the Senegalese marketing organization, (ONCAD), the Senegalese development bank (BNDS), SATEC, and agricultural cooperatives created by ONCAD for credit and marketing purposes. Its budgetary resources are provided by the government and by donor and international financing organizations which agree to finance specific program activities carried out by SODEVA.

Between 1968 and 1971, the work of SODEVA was largely financed by the French Caisse Centrale (CCCE) and IBRD. Since that date, the government has contributed substantially to its financing. There is also very significant support from CCCE, FAC, FED and IDA at the present time, for specific projects and activities. More recently, a long term loan was made by Iran to provide SODEVA with audio-visual facilities and buildings as well as mobile units. SODEVA has a board of directors presently consisting of 11 members representing the various stockholder interests.

In view of the importance and expansion of SODEVA's agricultural extension program, it has been agreed to increase its capital in the near future to 100 million CFA. The

present stockholders will participate on a pro rata basis in this capital increase which is expected to be finalized by the early fall of 1974. This will considerably strengthen the financial situation and permit SODEVA to better meet its responsibilities. A more detailed summary of SODEVA's financial position is found in an Annex.

SODEVA has its headquarters in Dakar and has three principal field operations offices known as "Delegations" in Kaolack (Sine Saloum), Thies and Diourbel. The latter two Delegations are thus located in the heart of the region where the AID-financed program is to take place. The Dakar office is subdivided into a "Direction Generale" or general management division with a professional staff of four Senegalese and one expatriate, and a "Direction Technique" or technical division with a staff of eight Senegalese and two expatriates. The latter includes the head of the Studies and Methods unit, while the second technician is the technical advisor on training programs for SODEVA field employees and for demonstration training for farmers. The recent second agricultural credit program accorded to Senegal by IDA includes a provision for the strengthening of the headquarters staff with four additional agronomists for a period of two years. While the main office has a heavy planning and programming workload, it is believed that this somewhat streamlined office undoubtedly is an advantage, while particular efforts are being made to assure the improvement and upgrading of the field operations staff.

The vast majority of SODEVA personnel is directly attached to the three field offices. For example, in Sine Saloum, where an important extension program was begun in 1972 with financing provided by the CCCE, some 458 employees are attached to the office. More than 300 of these employees are included in the basic level of extension agents who are in direct contact with the farmers, and under the direction of more experienced technicians are responsible for instructing the farmers. The field offices in Thies and Diourbel currently have 169 and 141 employees respectively. The Sine Saloum project includes eight expatriate specialists, while there is one expatriate in Thies.

Operational programs in each region vary, but they generally promote one or both of two types of emphasis, diversification when appropriate, and intensification. Diversification of agriculture is promoted by introducing or expanding the production of such crops as corn, millet, sorghum, tobacco, and rice, in conjunction with the traditional groundnut crop. Intensification of the existing

agriculture is promoted by initiating certain new cultivation techniques which have been proven by research to have significant socio-economic value.

Individual farmers are brought into the program at various levels of intensification, and are led through progressive stages of application, and assisted to advance from one level to the next over a period of years, toward full adoption and application of all the techniques. For example, the three principal stages planned for this project are termed (1) Exploitation Theme Leger (semi-intensive), (2) Exploitation Traction Bovine (oxen traction) and (3) Exploitation Intensif (Intensive Exploitation). This type of program offers a level of participation for nearly any farmer regardless of his means, and at the same time presents a challenge to each farmer to progress from one level of achievement to the next higher level.

SODEVA coordinates its efforts closely with other governmental and quasi-governmental organizations and agencies which have responsibilities in the agricultural sector. For example, there are working relationships with ONCAD, which is responsible for credit, cooperatives, and commercialization of agricultural products, with the Direction des Services Agricoles, which is that part of the Ministry of Rural Development responsible for overall crop production, and with CNRA, the national agricultural research center.

SODEVA created its own training center, CETAD, in 1968 to satisfy its need for trained staff to carry out operations. Courses taught at CETAD vary in length from up to 120 days for the training of technical assistants to 15 days for warehouse clerks. Training courses in seed production and processing, in animal husbandry, and a variety of other subjects, are also given.

The SODEVA organization has consistently improved its performance and has developed the means to plan, prepare, and execute programs. The channels through which implementation orders and techniques flow seem to be well established. The supervision/in-service training activities flow by a system called "cascade" from the direction and supervisory levels to field operation levels. In this way, those working directly with the farmers receive the knowledge, skills, and materials necessary at the time they are required, in order to bring about desired change on the farms.

SODEVA currently has a good reputation with other donors for its ability to prepare, plan and implement agricultural extension programs, and as a result, substantial amounts of financing are being made available by these organizations for the expansion of SODEVA's activities. Within this context, the Caisse Centrale (CCCE) is financing a farm intensification program in the Sine Salcum region for the period 1972-75, and the IBRD is currently making exhaustive studies with the assistance of SATEC for the financing of a still larger program in that area beginning in 1975. Studies and reviews of SODEVA's operations contained in recent Caisse Central and IBRD surveys indicate their confidence in SODEVA's ability to carry out well conceived agricultural extension programs. It is therefore believed that with appropriate additional support, the proposed AID-financed program can be implemented with reasonable chances of success.

B. ELEMENTS FOR PROGRAM IMPLEMENTATION

1. General

The proposed program in the Thies-Diourbel region requires several specific elements and inputs to permit successful implementation. All of these elements and planning projections have been carefully worked out with SODEVA, and therefore represent a clearly defined decision between SODEVA and AID as to what is needed and how it is to be provided.

As a basic tenet, the projections have been made with the premise that the Senegalese government will continue to make budgetary support available to SODEVA at the same level as in 1973 for field office operations in the Thies and Diourbel delegations. According to SODEVA, this is a reasonable assumption. Thus, AID financing to permit the expanded farm intensification program in the Departements of Thies, Bambey, and Diourbel, will be in addition to current operations and will not represent a substitution of AID financing for that previously available from the government. As an example, personnel requirements at the field level for extension work and the relevant cost projections are based on the fact that current personnel will continue to be paid from the SODEVA budget while additional personnel required for the period October 1, 1974 to March 31, 1978 will be financed by the AID project. Further information on this subject is contained in the Financial and Budget Analysis section.

2. Personnel

The expanded program will require additional personnel at both the field extension level and to some degree at the Delegation field offices in Thies and Diourbel. These personnel will be added gradually over the life of the project, and are directly tied into the specific objectives as to the number of farms to be intensified, the degree of intensification, and the acreage to be covered. These specific objectives are set forth in an Annex.

Field level personnel are classified in a hierarchical structure in which each level is directly responsible for the activities of the next lower level, under the overall supervision of the chief officer in the area. At the Department level, the principal SODEVA officer is the CO, or chief of operations. In descending order, the other positions are the AO, assistant chief of operations, the AT, technical assistant, the EB or field extension agent, and the VG, the basic extension agent. Details of the exact numbers presently on duty and additional personnel required by category is found in the appropriate Annex.

At the Delegation field office level, similar projections have been made. Additions at this level are relatively modest and principally concern the assigning of a small number of highly skilled agronomists and training specialists, and their assistants. In addition, certain other categories of personnel will be increased including warehousemen, field research samplers, and office help. These additional requirements have been held to a very reasonable level.

The officer in charge of the program in the Departements attached to their respective Delegations will be the SODEVA "delegate" or chief officer in Thies and in Diourbel.

In view of the present structure, and plans by the IBRD to provide several agronomists for the headquarters staff in Dakar, only one additional technical person is considered necessary there in connection with the AID-assisted program. It is proposed to provide SODEVA with an additional Senegalese agronomist, so that the organization will be better able to provide close headquarters liaison with the Thies-Diourbel field operations. Two positions in the financial management area are also tentatively projected at the intermediate level as may be necessary.

All additional personnel required for the extension program will be Senegalese with the exception of two expatriate specialists who are expected to assist in the field operations. One of these technicians will be an experienced

agronomist who can work closely with the Senegalese agronomists assigned to the project, and who can also assist in the training of young Senegalese agricultural engineers who have recently completed their studies. The second expatriate technician would be responsible for the organization at the field level of the required training program for field personnel as well as for the demonstration training program for farmers in the three Departements.

It is recommended that the two expatriate technicians be provided by the French firm, SATEC. As previously indicated, the farm extension program was started in Senegal in 1964 by SATEC, and since the establishment of SODEVA in 1968, expatriate technical assistance has been provided by them. Twelve of the 13 expatriates presently working with SODEVA are from SATEC including those connected with the Sine Saloum project. The whole system is therefore tied in with methods and training techniques perfected by SATEC. Fluent French is also an absolute requirement for effective work.

The above personnel outline does not include the needs of the applied research program which is outlined in a following section. Two additional expatriates are needed for this activity.

3. Training and Farmer Demonstration Program

Training is an essential element for the success of the project, and SODEVA is giving considerable emphasis to this sector. There is already a program underway which provides initial training for newly recruited personnel as well as periodic refresher courses in crop production and extension techniques on a continuing basis to present employees.

SODEVA operates a national extension training center (CETAD), which is located near the city of Thies. The center offers training programs of differing lengths and subject matter according to the level and specialty of the trainees. It is particularly responsible for the initial training given to the important category of supervisory extension agents known as AT's or technical assistants. Recruits for this category have at least three years of secondary school plus two years of training at one of the Senegalese agricultural institutes. At CETAD, they follow a program of 17 weeks in which study courses in extension methods including the use of animal traction and farm implements are combined with practical work near the center or on demonstration farms.

In view of increasing needs for trained personnel, an enlarged CETAD will be constructed in another part of Thies Departement with funds recently made available for this purpose by IDA in connection with its agricultural credit program. This will permit the center to have adequate facilities together with farm demonstration and pedagogical equipment equal to the task. An audio-visual center and complementary equipment for CETAD is likewise being financed from a credit accorded SODEVA by Iran. The center will be properly staffed, and should be able to adequately fulfill its role in the training of middle level extension technicians.

A second level of training has also been started by SODEVA and is part of the so-called "cascade" system whereby each level of agent is responsible for the continuing training of the level under their direct supervision. This training is carried out periodically over the year in sessions which range from a few days to three weeks. Thus, the chief of operations organizes sessions for the technical assistants, while the latter are responsible for appropriate courses given to the more basic extension agents. These programs are normally held at a type of secondary training center at the Departement level. These centers known by their initials as ZER's (Zone d'Entraînement et de Reference) are to be established in each Departement where a donor-financed program is underway. One of the centers has been set up in Sine Saloum, and three are planned under the AID-financed program. They provide for simple structures and dormitory facilities which are inexpensive to build and easy to maintain. No permanent staffs are stationed at ZER's but they are used as required for the continuing training sessions. One of the three ZER's will use the facilities of the present CETAD. Each of these centers will be provided with a reasonable amount of furnishings and equipment needed for the courses, including some audio-visual equipment for projection purposes. The amount of equipment requested is modest, and it has been agreed with SODEVA that projection equipment would only be purchased on a gradual basis when sufficient film strips and training films become available so that the equipment can be used adequately and be properly maintained. More details on the construction element for training is found in a following section.

For the implementation of the expanded program in Thies-Diourbel, the training requirements, types of training programs, number and length of sessions, subject material, and annual projections have been directly meshed in with the

numbers of each category of personnel needed in accordance with the personnel schedule found attached as an Annex, and in accordance with the specific farm intensification objectives through 1977. It is planned that whenever possible, present field personnel will be upgraded to fill the additional positions at the next higher level. However, since more personnel overall will be required, new recruitment must also take place, and be trained either at the CETAD or in one of the ZER's. The largest expansion of personnel will take place at the lower level where the basic extension agent, normally a young farmer with little formal education, is in direct contact with the farmers participating in the program under the close supervision of the technical assistants. Following the pattern begun in the Sine Saloum project, an upgraded basic extension agent, "encadreur de base" will be introduced into the system between the technical assistant and the lowest level extension agent or "vulgarisateur". The number of the upgraded agents will rise sharply over the life of the project, while the number of the lowest level agents will gradually decrease. Particular attention will therefore be given in the secondary centers to these training requirements.

The number of technical assistants will also increase as it is planned that each TA will be in charge of five of the more basic agents to assure appropriate supervision as the intensification program is expanded, as compared with eight to twelve at the present time. The introduction of a new category, CA, or agricultural consultant will also be programmed, and these latter technicians will supervise the AT's under the direction of the chief of operations or his assistant. The proposed training schedule takes into account all of these factors.

In addition to the construction, equipment, and personnel costs connected with the training program, certain operational expenses will also be covered by AID financing. This consists principally of per diem expenses for the training participants. The cost has been projected on the number of days of training scheduled, with a fixed rate which varies with the level of the trainee. These rates seem modest and in keeping with good financial management.

The SODEVA headquarters has a training section with a Senegalese specialist and an experienced expatriate training advisor provided through SATEC. There is one training specialist attached to the Thies field office. It is proposed to build up this field staff in the area by adding an

assistant to the Thies office and by providing a training specialist and assistant to the Diourbel office. In addition, as mentioned above, an expatriate training director would be recruited for overall coordination at the field level. Training materials and aids are currently available for use in the program, while a new dimension using audio-visual materials will be possible within the framework of the Iranian-financed project.

Farmer demonstrations by groups are also an integral part of the programmed training activities. These sessions are held several times a year, normally for two days, for groups of farmers who are ready to participate in various stages of the intensification program. The training and demonstrations are directed by SODEVA personnel at the appropriate level. The AID-financed program provides for basic facilities, equipment, and operating expenses to permit SODEVA to carry out this program. Certain light structures are included in the construction program, and demonstration tools and equipment will be purchased. Operating expenses will cover miscellaneous costs of the sessions. Additional demonstration equipment including material for mobile oxen training centers, and for storage, cereals treatment, and threshing demonstrations and experiments will be financed. These requirements have been thoroughly reviewed with SODEVA and are considered to be necessary for the successful carrying out of this phase of the overall program.

4. Construction and Infrastructure Program

(a) Background and General Description

SODEVA's activities have greatly increased in the past three years, and the number of employees has nearly doubled during this period. In addition to the substantial assistance accorded by donors for specific field operations programs, the bulk of SODEVA's budget provided by the Senegalese government has been allocated to personnel needs for the expansion of extension programs at the farmer level. This type of budgetary allocation has permitted SODEVA to move forward rapidly with field level action programs, and thus to gain the necessary experience from the practical point of view to undertake further expansion of its work. At this point, however, consideration must be given to the installation of a more permanent type of infrastructure particularly at the field level to provide the staff with adequate working conditions, and to provide the necessary facilities for the continuing program of training and farm demonstrations which are basic to the success of the extension activities. A minimum standard of supporting infrastructure is certainly a necessity in the three Departements of the Thies-Diourbel region included in the AID-financed project. This area covers about 4,400 sq. kilometers, and has a population of some 270,000 people, corresponding to an average density of 61 inhabitants per sq. km., one of the highest rates in Senegal.

Within the above context, careful consideration has been given in the design of the project to basic infrastructure requirements which are needed for this program, and which will equip SODEVA with the means to continue activities beyond the duration of this specific project in the Thies-Diourbel region. An inspection of the project area was made, SODEVA's current organizational structure and facilities were reviewed, and needs for the expanded program ascertained.

The construction program is planned to provide SODEVA with both the minimum infrastructure it needs to carry out its extension work at the farm level, and the office and warehouse space it requires for the staff, equipment and supplies which support the field operations. For the office space and simple warehouse facilities incorporated into the project, the relative merits for continuing SODEVA's current rental practices were weighed against the desirability of providing a more permanent type infrastructure. Alternative site locations, types of building

construction, and local construction practices were examined. Consideration was also given to the ways in which district level office and warehousing requirements and training and field demonstration facilities could be coordinated and provided at the same locality to reduce cost to a minimum.

SODEVA currently rents office space to house its Delegation and Departement-level staff in Thies and Diourbel. The space is in old, partially renovated quarters, and was found to be completely non-functional. It was likewise ascertained that additional rental facilities were not readily available.

The new office facilities proposed by this project will help integrate operations of the Delegation and Departement level in the region and provide adequate working space for the additional staff under the expanded project.

For the total extension operations of the Thies and Diourbel regions, SODEVA has only about 100 m² of warehouse space. Since supply operations are such an important part of SODEVA's daily contact with the farmer, a series of small warehouse stores were designed into the project. The warehouse/store will include a meeting room and small office which can service these needs in the demonstration and training program. The cost of construction is limited to slightly over 10% of the total project cost, and this level of funding is considered very reasonable.

(b) Description of Principal Construction Items

The office facilities, warehouses and stores proposed for this project will consist of the following elements:

Masonry walls will be constructed of locally fabricated concrete blocks or bricks plastered with stucco on both sides of wall. A system of piers and beams which make up the structural framing of the building will be built of reinforced concrete. Roofings will be of corrugated asbestos cement fabricated locally and will be supported by light-weight metal roof beams. These beams will be anchored to the piers. Floors will consist of a poured concrete slab over a sand base. Accessories such as doors and windows will be built from lumber. The reinforcing steel, light-weight roof framing members and metal hardware will be the only importations for these simple structures. It is estimated that the cost of these importations will amount

to less than 10 percent of the total cost of the constructions. Portland cement is fabricated locally and is in abundant supply in Senegal. Sand and gravel are readily available locally. Types of construction similar to these were inspected and found adequate, functional and of good standard.

The type of farm level storage included in the demonstration centers, the silo Carrera, has been developed by the CNRA and is especially designed to protect the stored cereal grain against rain, excessive humidity, excessive heat, rodents and fire.

The silo is a cylindrical structure in which the interior diameter is 1.50 meters. It is 2.15 meters high and its capacity measures 3.7m^3 . This corresponds to a capacity of about 3 metric tons of cereal grain. The circular wall of the structure is constructed from specially fabricated concrete blocks which are shaped in the form of an arc. Each block measures about 20 cms high, 12 cms long, and is 12 cms wide. The interior cell of each block is without ribs. In constructing the silo, the blocks can be laid adjacent to each other and one above the other. No mortar is required to bond the adjacent blocks. Once completed, the circular block wall becomes a form for the reinforcing bars placed in the cells and the concrete which is to be poured inside the cells. It is the reinforced concrete in the cells which gives the wall its structural strength. The floor of the silo is a reinforced concrete slab, 10 cms. thick. No foundations are required. The roof cover is a reinforced concrete shell which includes a trap door. To form this roof shell, the concrete is poured over a steel pan form which is supported by an umbrella type steel mast.

Training facilities for both the Departemental centers (ZERS) and at the Arrondissement level (Centres de Formation Agricole) will be basically simple structures of the type being used in the Sine Saloum program. The principal type of structure used for classes is an open type shed or hut with a thatch-type roof. Dormitory facilities are likewise simple in design and consist of either durable construction for the use of SODEVA employees during their training period, or thatch-type structures for farmers participating in demonstration programs. Costs are therefore minimal, but at the same time the structures are functional and simple to maintain.

(c) Technical Soundness of Construction Proposal

The technical data provided to the study team by SODEVA management, the evaluation of the analysis made of such data and the appraisal of the organization's current operational structure provides a sound technical basis for concluding that the construction program is designed to support SODEVA's objective to increase as well as intensify and diversify agricultural productivity in the groundnut basin of Senegal. The demonstration and training centers have been carefully planned and will be strategically located within the eight districts of the project area for SODEVA to effectively carry out its work in this sector. The construction of office buildings, warehouses and stores will improve the efficiency of SODEVA's operations and will help solidify its stature as a permanent organization in the rural environment.

Refinement of design details including a review of certain project design alternatives will be undertaken when project plans are finalized. Provision has been made for the satisfactory operation of the facilities, as well as for the continuing maintenance of the building structures and the estimated construction costs are reasonably firm. A satisfactory plan for the execution of the overall activity has been prepared. Therefore, it is concluded that the facilities can be constructed and operated in a sound manner, that costs should not exceed those estimated, and that there is a reasonable basis for deciding that they will be effectively utilized.

A summary of construction and equipment costs is attached in the following table.

SUMMARY OF COSTS
PROGRAM OF CONSTRUCTIONS, EQUIPMENT - MISCELLANEOUS SUPPLIES
FOR PROJECT ACTIVITIES

PRINCIPAL ITEM	THIES DELEGATION											DIOUNBELL DELEGATION					FUNDING INPUTS BY YEAR				
	THIES DEPARTMENT											DEPARTMENT					DIOUNBELL				
	District POST	District NOTO	District THEPRABA	DEPT - Delegation THIES	District BARA GARAGE	District MOOTE	District Lambaya	Dept. Bombay	District N'Daundy	District N'Doule	DEPART. - Delegation DIOUNBELL	1974	1975	1976	1977	TOTALS					
																	DEPARTMENT				
1 Warehouse (Dept. Level)				\$ 27,400 (1975)																	
2 Warehouse/Store (District Level)		\$18,900 (1975)			\$20,300 (1976)	\$18,900 (1975)	\$20,300 (1976)		\$20,300 (1976)		\$27,400 (1974)	\$24,800			\$ 98,800						
3 Office Buildings																					
4 Office Equipment				\$ 47,500 (1975)							\$51,000 (1976)	\$ 47,500	\$60,900		\$ 117,600						
5 Flatbed Truck				\$ 2,500 (1974)											\$ 2,500						
6 Audio/Visual Relay Center and Office Building				\$ 20,000 (1974)							\$ 20,000 (1974)	\$ 5,000			\$ 25,000						
7 Veterinary Supply Kits	\$2,000 (1975)	\$2,000 (1975)	\$2,000 (1975)					\$ 21,400 (1974)							\$ 25,400						
8 Small Topo Equipment	\$ 200 (1975)	\$ 200 (1975)	\$ 200 (1975)		\$ 200 (1976)	\$ 200 (1975)	\$ 200 (1975)		\$ 200 (1976)	\$ 200 (1976)		\$10,000	\$ 6,000		\$ 16,000						
9 Small Weighing Equipment	\$ 200 (1975)	\$ 200 (1975)	\$ 200 (1975)		\$ 200 (1976)	\$ 200 (1975)	\$ 200 (1975)		\$ 200 (1976)	\$ 200 (1976)		\$ 1,000	\$ 600		\$ 1,600						
10 Analy. Harvesting Centers (ZER PROGRAM)	\$ 400 (1975)	\$ 400 (1975)	\$ 400 (1975)		\$ 400 (1976)	\$ 400 (1975)	\$ 400 (1975)		\$ 400 (1976)	\$ 400 (1976)		\$ 1,000	\$ 600		\$ 1,600						
11 Demonstration Stables and Storage Shed (ZER PROGRAM)	\$ 800 (1975)	\$ 800 (1975)	\$ 800 (1975)		\$ 800 (1976)	\$ 800 (1975)	\$ 800 (1975)		\$ 800 (1976)	\$ 800 (1976)		\$ 2,000	\$ 1,200		\$ 3,200						
12 Training and Storage demonstration Center (ZER PROGRAM)	\$10,000 (1975)				\$ 800 (1976)	\$ 800 (1975)	\$ 800 (1975)		\$ 800 (1976)	\$ 800 (1976)		\$ 4,000	\$ 2,400		\$ 6,400						
13 Sodiane Demonstration Center							\$30,000 (1975)			\$36,500 (1976)		\$60,000	\$36,600		\$ 96,600						
14 Liaison - Research Operations (CMRA)				\$ 47,000 (1974)								\$ 47,000			\$ 47,000						
15 Agric. and Personnel Training Centers (CPA Program)	\$4,000 (1975)	\$4,000 (1975)	\$4,000 (1975)		\$1,700 (1976)		\$2,000 (1975)					\$ 21,700	\$2,000		\$ 23,700						
16 Farm level storage	\$6,000 (1975)	\$6,000 (1975)	\$6,000 (1975)		\$3,000 (1976)	\$3,000 (1975)	\$1,000 (1975)		\$ 4,000 (1976)	\$ 4,000 (1976)		\$20,000	\$2,000		\$ 22,000						
												\$4,000	\$6,000		\$ 10,000						
TOTALS											\$ 156,500	\$39,600	\$18,700		\$214,800						

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5. Storage Revolving Fund

In order to permit farmers who reach the intensified stage in the project to increase their on-farm storage capacities, a revolving credit fund will be established to be administered by SODEVA. The funds would operate in a manner similar to the special fund used in the Sine Saloum to enable farmers to purchase draft oxen. The funds would be advanced to any farmer who reaches the intensified stage of production and who makes a formal application. Exact modalities must be worked out later but it is expected that repayment would be over a period of 4-5 years, with interest free or at a low rate.

According to individual desires, credit would be made available for construction of either the improved type of local granary or for the construction of the "Carrera" type silo developed by CNRA and fabricated from cement. Except for very large exploitations it is assumed that the normal request would be for the construction of no more than two improved granaries of either type or perhaps one of each type. In exceptional cases construction of additional units could be considered.

According to estimates prepared by SODEVA it is calculated that a fund of 15 million CFA will be sufficient to satisfy the demands of farmers for this credit. It is intended that the 15 million CFA for the establishment of this fund will be provided from the Grain Stabilization Sorghum Counterpart account under a letter of agreement between the Government of Senegal and AID. These funds were generated from the sale of PL-480 grain and are to be used for programs in support of cereal production, marketing and storage. In the event that agreement cannot be reached between AID and the Government of Senegal it is planned to use part of the contingency funds built into the project budget.

6. Agricultural Credit and Provision of Equipment, Fertilizers and Seed

The extension of agricultural credit, and the subsequent delivery of animal-drawn equipment, seeds, and fertilizers to farmers in Senegal is the responsibility of the National Office for Cooperatives and Development Assistance (ONCAD), which is also the national marketing agency for the groundnut crop. Thus, in the implementation of the SODEVA agricultural extension program, close coordination must be maintained with ONCAD both at the regional and national levels, and the success of the program is to a considerable degree dependent upon the efficient operations of ONCAD in providing agricultural credit and in making available the equipment and supplies ordered by the farmers. In the past, certain difficulties have been encountered in this area, and even at the present time, the system is not absolutely fool-proof. Nevertheless, the importance of the problem has been recognized by the Senegalese authorities and improvements made over the past three year period. Regional committees have been set up and serious efforts made to coordinate orders from cooperatives to assure that deliveries of equipment, supplies, and fertilizers are made to the farmer cooperatives in a timely manner prior to the beginning of the planting season.

The IBRD through the first and second IDA agricultural credit programs has been instrumental in bringing these problems to the fore and in providing assistance to ONCAD in meeting its responsibilities. Under the first \$6 million credit arrangement made in 1968, an Italian consulting firm was hired to make a complete study of ONCAD's organization and operations, and a significant technical assistance input was made to carry out certain reforms. As part of the second agricultural credit program approved in 1973, IDA is providing additional technical assistance to ONCAD. At the same time, as part of the overall agreement for the credit, IDA received assurances from the government inter alia that technical assistance to ONCAD would be continued under terms and conditions satisfactory to IDA; and that within 12 months after signing the credit agreement, ONCAD would take all action necessary to ensure that the suppliers of fertilizers and implements undertake their delivery to farmer cooperatives in a timely fashion.

Briefly, the agricultural credit system works in the following manner. ONCAD assists in the formation of farmer cooperatives set up for the purpose of channeling requests for credits for the purchase of equipment, supplies, and draft animals from their members. The cooperatives do not

function as producer or marketing cooperatives. Individual farmers must pass through the cooperative to obtain governmental credit. Certain indebtedness limitations are fixed by ONCAD for each cooperative, and this is based on a percentage of the value of the cereals and cash crops marketed by the cooperative in the previous three years. Orders are grouped and given to ONCAD which is responsible for placing the orders with suppliers and in seeing that deliveries are made. As indicated above, this system has not always worked to perfection, but improvements are expected, so that late deliveries or non-delivery of certain items will hopefully be reduced to a minimum. ONCAD is also responsible for the purchase and distribution of seed, and regional units known as "seccos" to store the seed have been set up. This operation is working in a relatively satisfactory manner. A Senegalese plant, SISCOMA, manufactures most of the farm implements used in the SODEVIA extension program, and these implements have been adapted over the years to the specific needs of farmers in the Groundnut Basin through the combined efforts of SODEVIA and the national research center (CNRA).

The requirements for agricultural credit have been discussed in detail with SODEVIA in the preparation of this project, and it is believed that sufficient resources are available through the Senegalese development bank (BNDS) to meet the needs of the area covered by the AID-financed project, in addition to requirements in other parts of the country. One of the principal sources of the funds is the second IDA agricultural credit made in late 1973. As a result of this \$8.2 million loan, a total of \$6.3 million is made available to the BNDS for loans to farmer cooperatives for the period 1974-1977. As part of this agreement, the BNDS is to make available an additional \$2.1 million for implement loans and \$900,000 for draft animals for an overall total of \$9 million.

The IDA credit is made available to the BNDS at the Central Bank's discount rate which is currently 5.5% for a term of 20 years. Credit is accorded through ONCAD to the farmers at a margin of 2% over the discount rate. Repayments from the farmers are made to ONCAD and then to the BNDS through the farmer cooperatives. Farmers pay off their loan with a percentage of the crops which they market each year. The farmer loans usually run for a period of four to five years.

In view of certain past difficulties which have been encountered, SODEVIA has started in the past two years a

supplementary credit program which is considered a temporary measure. The principal objective is to assure that credits are made available to certain farmers taking part in the intensification program in those cases where a cooperative has not been set up, has been in default, or where because of past difficulties, the cooperative withdraws from the credit program for a time. These special credits are obtained from the BNDS by SODEVA and the latter organization is responsible for the repayments. SODEVA has emphasized that it will only carry out such credit operations as may be absolutely required to meet their objectives.

Within this context, it is proposed that the principle be accepted that an amount of up to 50 million CFA (about \$200,000) could be made available to set up a revolving credit fund from the contingency portion of the overall AID budget for the project. This fund would only be established in the case that the regular agricultural credit program does not meet all the requirements of the Thies-Diourbel program, or if sufficient special credits are not available for this purpose to SODEVA from the BNDS. The modalities for the revolving fund would be worked out by mutual agreement between AID and the appropriate Senegalese organizations.

7. Marketing and Pricing Factors for Cereals and Groundnuts

Up to the present time the marketing of the cereals crops of millet and sorghum in Senegal has been relatively limited and these food crops do not enter into the regular commercial channels to anywhere near the extent of cash crops, such as groundnuts. Perhaps 85% of the crop in Senegal is used on the farm by the producers themselves. With the negative effect of recent drought periods, particularly in 1972, the tendency is for the farmer to stock at least one year's supply of cereals for the use of his own extended family. It is only after these needs are fully met, that the farmer is interested in selling a portion of his crop. If the SODEVA farm intensification program is at least moderately successful and rainfall conditions over the next few years are somewhat more normal, it can be expected that cereals crops will increase to the extent that a gradually larger amount of the crop will be commercialized in the producer areas to provide supplies for the deficitary regions of the country. It is also expected that ONCAD which markets the entire groundnut crop will also be responsible for the marketing of cereals. Although conditions have been such that a national marketing policy for cereals has not existed, planning is going forward to meet future needs. As a result,

in 1973, although rainfall was not particularly plentiful in the Thies-Diourbel region, and in many areas was only about half of the average over the past 15 years, the millet crop was reasonably good because of the use of the shorter growing season souna variety. ONCAD therefore did purchase several thousand tons of cereals from the farmers at a fixed price to supply other parts of the country. This system will have to be concretized and expanded in the future if cereals production does increase.

Within this context, attention has been directed towards the availability of sufficient storage facilities for grain at the national and regional level. It is generally believed that at the present time, a large-scale storage program for cereals is not necessary, although a review of the needs must be made annually, and at some future time, additional facilities will undoubtedly be required. As outlined in sections on storage and construction in this paper, attention will be given in the Thies-Diourbel program to the improvement of grain storage facilities at the farmer level and eventually at the cooperative or village level involving several farmers. The need for improved farm storage is also treated as part of the farm demonstration program which is included in the overall training activities of SODEVA.

The price for groundnuts, other cash crops, and cereals are officially set by the government in advance of each planting season. In the Economic Analysis section of this paper, projections at both the micro and macro economic levels use the price which has been set for groundnuts and millet in Senegal for 1974. With world groundnut prices at a high level, the price at the farm has been set at 35 francs per kilo as compared with 29 francs in 1973. In the case of millet, the price has been set at 28 francs per kilo. These prices do offer a considerable incentive to the farmer to increase his production through intensification and in the case of groundnuts to intensify production to the extent possible. Should world prices of groundnuts decrease, the farm price will also fall. However, in this case, it is not believed that the farmer will lose the incentive to continue production at maximum levels.

The millet price is also set at a relatively high level for 1974. Again, it is difficult to project the future course of price fluctuations, but in view of the increased overall needs of Senegal for cereals and high world market prices and short supplies, it is believed that there is a

reasonable chance that the 1974 price level will be maintained over the intermediate future. Even if the price is reduced somewhat, intensification will still be profitable for the individual farmer and for the national economy, as the amounts available for commercialization over the next several years are not expected to be such as to create surplus supplies and thus result in a precipitous fall in internal prices for cereals.

8. Applied Research and Liaison between Research and Extension

It is clear, as described elsewhere in this document, that the techniques required to improve production levels on the sandy "Dior" soils are already well established. These recommended intensification systems have been thoroughly researched and the methods for their use and the probable results are well understood by research and extension personnel alike. In addition, these systems have already been applied with success by SODEVA for the last three years in their production improvement program in Sine Saloum.

However, it is also clear that a close liaison between research and extension will be extremely useful in order to both assure that the extension programs properly follow established recommendations and to provide necessary "feedback" to the research program to allow re-orientation and re-direction of the research program according to actual field results. It is therefore believed that a liaison unit should be created which would be responsible for the preparation of documents and brochures in a form consistent with research results and usable by the extension service. The liaison unit would also be charged with the conduct of applied research trials throughout the project area, and for socio-economic surveys in selected areas to measure the effects realized by the project at the farm level.

Because of the dense population levels encountered in the project area, there is virtually no unused land available. Therefore, in order to increase total production, it will be necessary to intensify production per unit area. Although the agricultural techniques necessary to achieve increased production are well established, the acceptance of these techniques is dependent on the decisions of the individual farmers. The farmers are looking for production systems which are capable of optimizing their own exploitation in a manner consistent with their particular situation and the surrounding environment.

Thus, additional research is required on the production system itself, research which cannot be done on a research station, since it is the direct result of the interaction between agronomic techniques and the socio-economic environment of the farm. The need for this type of research has long been realized and the formula adopted in Senegal is that put into practice on the two "Experimental Units" established in the Sine Saloum region. Within these units, research staff work directly with the member farmers of a rural cooperative and are thus able to conduct research on the socio-economic aspects involved in the choice and use of a production system or systems. The Experimental Unit in addition to serving as a research unit is also, in effect, a controlled demonstration unit which can be put to good use by the extension service both for training of staff members and for demonstrations to groups of interested farmers. In view of the probable socio-economic strains that will be imposed within the project area by the density of population, it is evident that research of a socio-economic nature is essential. The major thrust of the research should be directed toward the development and/or improvement of production systems compatible both with the environment and climate of the area and with the socio-economic realities imposed by the human element. It therefore appears important for an Experimental Unit to be established within the project area to conduct research on production systems adopted to the sandy "Dior" soils and to the human ecological system of the area.

In addition, there is the question of needed research for the heavier "Deck" soils which are present in an area extending from Bambey south to Popenguine and Joal. These soils which are relatively high in clay content, cover some 30-50,000 hectares in the area. Partially because of their heavy nature, but largely because of a lack of potable water, these areas are rather thinly populated. Nevertheless research results obtained both at Bambey and N'Diamane some 20 km to the south, indicate a high production potential for these soils, particularly for cereals. Because of the lack of potable water in the surface levels (up to 30 meters in depth) it is not possible to undertake an extension program for this area at this time. Nevertheless, the availability of under-populated areas immediately adjacent to the heavily populated areas on the sandy Dior soils to the north and east is of obvious interest to the government. Therefore, it is proposed to undertake a research program for these heavier soils in order to develop the basis for production improvement programs which could be undertaken if the problem of the availability of potable water can be resolved.

In view of the obvious relationships between the neighboring sandy "Dior" soils and the heavier "Deck" soils, the government has proposed that a single Experimental Unit be established in an area near N'Diamane where research can be conducted on both types of soils. It has been further agreed that because of the close relationships between the applied research to be conducted on the Experimental Unit and the liaison work proposed for the special research-extension liaison unit, that these two programs be merged, at least for the first 3 years of the project. The liaison groups would thus be based within the Experimental Unit and would also be responsible for the conduct of research on the Unit under the guidance of the CNRA staff located at Bambey. However, before the Experimental Unit can be located on the Deck soils it will be necessary to locate a source of potable water. It is thought that potable water can be obtained through a deep bore well into the Maestrichtien layer located at some 400 meters depth. Therefore, it has been proposed that AID provide the financing of the Experimental Unit in the N'Diamane area on both the "Dior" and "Deck" soils with the proviso that the government is able to locate a source of potable water. During the first year of project operation, only the liaison group will be funded, with funds for the Experimental Unit itself reserved for the 1975-76 and 1976-77 crop seasons. If the government is able to locate funds from sources other than this project to provide a deep well, the Experimental Unit will then become an integral operation of this project. If funds are not located for such a well, then the Experimental Unit will be eliminated from the project and the funds reserved for this use will be available for other project uses.

For the operation of the N'Diamane Experimental Unit, including the research-extension liaison function, a budget of CFA 125,000,000 will be required. This will be used according to the budget shown in an attached annex.

Personnel required for the project include two expatriate technicians which should be provided by IRAT which already supplies most of the research technicians for the CNRA at Bambey. Both the Chief of the Experimental Unit and the Chief of the liaison group should be expatriate agronomists with extensive socio-economic training and experience. They will require a staff of two Senegalese agronomists at the engineer level plus 5-6 technical assistants as well as a secretary and other necessary administrative staff. During the first year of operations, the liaison unit will

be based at the CNRA station at Bambey. Thereafter, assuming the successful establishment of a source of water, they will be officed on the Experimental Unit in a building to be constructed and equipped with project funds according to the budget found in the appropriate Annex.

C. TECHNICAL ANALYSIS AND FEASIBILITY

Agriculture in Senegal is dominated by the production of millet (including sorghum) representing the staple cereal, and of groundnuts which is the principal cash and export crop, each of which is grown on about one million hectares annually. With the exception of irrigated areas where other crops are usually more profitable, these two crops are grown in combination throughout Senegal. Both crops can be grown under low rainfall conditions making the combination particularly well suited to the densely populated "Groundnut Basin" where rainfall is low and erratic. Although both millet and groundnuts are reasonably drought resistant, nevertheless poor rainfall conditions often result in full or partial crop failure in many areas. As a result average yields in most of Senegal are low, on the order of 500 kg/ha for millet and 750 kg/ha for groundnuts.

But even this low average includes considerable variations depending on the area of the country. Thus in northern Senegal with a rainfall range of 400 to 600 mm, the groundnut crop averages over 500 kg/ha in only one year out of two. In the central areas with rainfall from 600-800 mm the crop will yield more than 750 kg/ha in two out of three years. With average rainfall over 800 mm, the southern and southeastern areas usually obtain a normal crop of 850-950 kg/ha every year. These latter areas offer some scope for diversification and considerable progress has been made with the production of cotton, rice, tobacco and maize. However, in the central and northern areas the low and erratic rainfall permits little opportunity to vary the present groundnut/millet rotation which remains best suited to the environment.

Programs to improve crop production can draw on a solid research base established in Senegal by the program conducted by the National Agronomic Research Center at Bambey (CNRA) for many years. The Center is under the control of the Ministry of Rural Development but the work is largely conducted by the French research organization, IRAT, (Institut de Recherches Agronomiques Tropicales et de Cultures Vivrières) under a contractual arrangement. In addition to the national center, research is conducted at 5 regional sub-centers and two "Experimental Units". The latter involve working directly with existing farm operations in a complete village with research directed largely toward socio-economic problems. The final link in the research chain involves some 21 applied research centers (called PAFEM) where research recommendations are carried out under conditions closely approximating actual on-farm operations.

Although in many parts of Senegal increased production can be achieved by increasing the area under cultivation, this is not applicable to the more heavily populated areas in west-central Senegal, particularly the northern half of the so-called "Groundnut Basin" where this project is to be located. In this area therefore research has been concentrated on methods of intensification of production levels.

Despite their dominant sandy character the soils of Senegal usually display poor physical characteristics which are particularly unfavorable for satisfactory root development. Since the traditional cultural system depends exclusively on hand cultivation the result is very superficial tillage and little, if any, improvement of the soil structure. The introduction and use of animal-drawn equipment, principally the plow, permits deeper and more thorough tillage resulting in improvements in the physical condition of the soil, particularly in its structure and porosity.

The improved soil structure leads to better root development which in turn permits a more effective and efficient use of the usually limited soil reserves of water and minerals. A secondary benefit of improved tillage is the result of better control of weeds.

Nearly twenty years of trial results conducted with two different systems of tillage on predominantly sandy soils are currently available. These results indicate gains ranging from 7 to 103% for a variety of crops for tillage with and without incorporation of crop residues. In the latter case tillage is compared to traditional hand cultivation methods. In the case where crop residues are incorporated during tillage the check was either a fallow crop which was burned off or a cereal crop with all crop residues removed prior to plowing.

Nearly 300 replicated comparisons of tillage methods are summarized in Table I which indicate a favorable effect for all types of crops. Although results obtained vary among soil types, years and the crops concerned, gains are substantial. As will be noted, tillage without residue incorporation was nearly always positive for all crops. In the case of tillage with incorporation of residues, results were largely favorable as well, except with groundnuts, where gains were registered in only three-quarters of the comparisons.

In addition to the direct effects of tillage as described above, residue effects on subsequent crops can also be important. However, as with the direct effects, gains are usually greater with the cereals crop than with groundnuts. This is particularly true for the two year rotation of millet-groundnuts, which is quite common in the project area, where the millet production averaged a 40 percent gain from the use of tillage practices contrasted to 11% for groundnuts.

Largely as a result of their predominantly sandy texture, the upper soil horizons in Senegal are uniformly characterized by their general poverty. Exchange capacities are low, organic matter content is poor to non-existent and pH ranges from slightly to strongly acidic.

Phosphorus is normally found to be the first limiting nutrient throughout Senegal. Soil contents of P₂O₅ rarely exceed 250 mg/kg of soil and contents below 150 are often encountered. Nitrogen is the second limiting factor, at least for cereal production, which is not surprising since the low organic matter content of 1-3% provides levels of total N of only 0.3 to 1.5%. Potassium can also be quite limiting. Although exchangeable potassium levels ranging from 0.005 to 0.20 m.e./100 g are often sufficient for initial plant growth, low soil reserves and slow renewal of available potash usually leads to deficiencies later in the season.

The frequent occurrence of heavy rainfalls in a short period of time combined with sandy textured soils results in significant leaching losses throughout the country. Losses from leaching depend on percolation rates which vary according to the year and the surface vegetation. Over a seven year period at Bambey, annual water losses through percolation have averaged 140 mm or 21% of precipitation. Lysimeter studies at Bambey during the same period indicate the following range of losses through leaching:

N	5	-	30	kg/ha
P ₂ O ₅	0.1	-	0.5	kg/ha
CaO	40	-	150	kg/ha
K ₂ O	10	-	20	kg/ha

Of particular interest is the heavy loss of calcium through leaching, where losses are greater than the amounts removed through cropping.

The amounts of nutrients removed through cropping are relatively high, particularly for the cereals crops which have a very low grain/straw ratio. The high removal rates are due to the normal practices of removing virtually all plant materials from the fields for domestic uses. The little crop residues that are allowed to remain are nearly always burned, with a complete loss of nitrogen and sulfur, and at least partial losses of other nutrients. Even in the case where fallow is grown in the rotation, the vegetation is normally burned rather than plowed under, thus nullifying most of the intended benefits.

Based on the results from numerous tests conducted under near-farm conditions, it is estimated that an average groundnut crop will remove 105 kg/ha of N, 18 kg of P_2O_5 , 33 kg of K_2O and 22 kg of CaO. Although it is assumed that the N was provided through fixation, the amounts of the other elements represent net soil losses since all crop residues are normally used. In the case of millet, the amounts of nutrients removed average 66 kg/ha of N, 18 kg of P_2O_5 , 21 kg of K_2O and 11 kg of CaO. If the millet stalks are burned on the field, approximately 3 kg each of P_2O_5 and K_2O and 6 kg of CaO of the above amounts will be returned to the soil.

Thus it is not surprising that positive responses to fertilization are obtained throughout the project area. As previously indicated, phosphorus is usually found to be the first limiting nutrient. Although numerous results could be cited, those summarized in Table 2 are representative. The results presented represent a variety of trials conducted on predominantly sandy soils of the types found throughout the project area.

As evidenced by the above results and supported by numerous additional trials for the above crops, an application of 100 kg/ha of P_2O_5 is generally sufficient to attain the expected levels of production. For a number of years the recommended practice in the project area was to apply 500 kg/ha of tricalcium phosphate supplying approximately 200 kg/ha of P_2O_5 every four years with annual maintenance doses in the other three years from the application of mixed fertilizers. As shown in Table 3, results obtained from a crop rotation trial in Sine Saloum Region indicate no apparent gain to be realized from the application of increased amounts of tricalcium phosphate above 400 kg/ha.

The recommended practice now in effect for the entire project area is to apply 400 kg of tricalcium phosphate for the correction of the basic phosphate deficiency. It is then recommended to apply mixed fertilizers annually at a rate sufficient to supply from 25 to 35 kg P₂O₅ in order to replace the phosphate removed by the crops.

For potassium, positive responses are obtained less often than for phosphate, particularly on recently cleared fields or after relatively long periods of fallow. However, on fields which have been in continuous cropping and particularly where phosphate is not limiting, considerable response can be obtained. As shown in Table 4, on sandy soils in the project area, applications of up to 500-100 kg of K₂O per hectare give economical returns. Responses above that level are not consistent and are uneconomical.

The present recommendation for potash is for the annual application of K₂O through the use of a mixed fertilizer at a level sufficient to replace that removed by the cropping system. The quantities and fertilizers recommended at this time provide 31 kg K₂O/ha for millet and 44 kg/ha for groundnut which correspond closely to the average level of potash removed by each of these crops.

In the case of nitrogen the primary concern is with the cereal crop. In general, symbiotic fixation is sufficient to provide all necessary nitrogen for groundnut production. However, a small quantity of nitrogen applied at planting time may get the crop off to a better start, consequently N is normally applied to groundnuts as part of a mixed fertilizer at the rate of 10 kg N per hectare.

For cereals, the build-up of nitrate in the soil during the dry season puts increased pressure on planting at or slightly before the first rain. Crops planted early are able to take advantage of the readily available nitrogen while late planted fields are unable to do so since nitrate is quickly leached from the rooting zone. The maximum demand by cereal crops for nitrogen is normally during the jointing and flowering stages at a time while soil levels of nitrogen are at their lowest levels. Consequently, top dressed nitrogen is usually required in addition to that furnished by the mixed fertilizer applied at planting time. The normal recommendation for millet in the project area is to apply 50 kg/ha of urea as top dressing about 20 days after emergence with an additional 50 kg/ha of urea applied some 25 days later.

The introduction and subsequent use of animal drawn equipment now permit the farmers to overcome the two principal bottlenecks of the crop season: planting and weeding. Two general types of equipment have been developed and adapted to Senegalese farm conditions. A set of light equipment which can be drawn by donkeys or horses has been available for some time and has been rather widely distributed. Although various equipment is available for a wide range of operations, a single row seeder and a hoe for weeding between the rows have been most in demand.

As mentioned above, crops planted with the onset of the first rains are able to take advantage both of soil moisture and available soil nitrates which may not be available to later plantings. The use of the seeder reduces the manhours required per hectare for seeding from some 90 to 14-16. Furthermore, the planting of the crop with the advent of the first rain allows no opportunity for a preliminary destruction of weeds. Consequently the weeds germinate with the crop and must be removed fairly quickly before they can compete too heavily for the limited moisture and nutrients. Here again the animal-drawn hoe provides for a significant reduction in labor demand, reducing requirements from 200 manhours per hectare to 64.

Even further reductions can be effected with the use of heavier equipment, which is also available, which provides more effective basic plowing and soil tillage. Although this equipment permits better efficiency it requires the purchase of a team of oxen and is also quite expensive in itself. Consequently, substantial credit is required, which makes the system better suited to the larger farms. In view of the heavy population density in the project area, which limits farm size, the heavy ox-drawn equipment, the so-called Ariana chain, may be accepted relatively slowly. However, it is also possible to join two or three of the light seeders or cultivators together and use them with a team of oxen, resulting in an efficiency of operation intermediate between the basic light equipment with donkey or horse traction and the heavier Ariana equipment.

Finally, the development of mechanized cultivation systems coupled with the available fertilization programs have put increased pressure on the varietal development programs. For groundnuts, there are two varieties available which are well adapted to the project area. The earliest variety, 55-437 has a growing period of 90 days and is recommended for the northern part of the project area and as an early variety a little further south. The second variety, 55-422 has a 105 day growing period and is recommended for the northern half of the project area.

farmers are strongly advised to divide their groundnut acreage between the two varieties in order to protect against the vagaries of the climate, particularly possible variations in the length of the rainy season.

For millet, CNRA has developed an early variety called MOUNA 3 which has a 75-80 day growing season. During the last two years the rainy seasons have been very short and this early variety has largely replaced the longer-season millets which require up to 105-110 days. A strong program is also now underway at CNRA to develop a type of millet with a greatly reduced height and a consequent improvement in the grain to straw ratio. Some progress has been made in developing a breeding population containing the desired characteristics and some useful varieties are showing promise in field trials. They should be available for farmer use within 2-3 years.

From the research results described above, two production systems have been developed for use by farmers interested in intensification of production levels. The first system is a semi-intensive system (known as Theses legers in French) and represents the first step up from the traditional system of hand cultivation. The change to the semi-intensive system requires basic changes by the farmer in both his tillage methods and his fertilization practices. Under the semi-intensive system the farmer moves to superficial tillage through the use of light equipment drawn by donkeys or horses. This normally involves the purchase of one or more single-row seeders and one or more small cultivators or hoes for inter-row weeding. At the same time the farmer is recommended to apply fertilizer to both groundnuts and 150 kg/ha of 14-7-7 for millet.

The intensive production system (called theme lourds in French) requires the purchase of a team of oxen and the heavier equipment adapted to their use. This system requires the inclusion of fallow in the rotation and the incorporation of plant residues by deep plowing at least once during a four-year rotation. The intensive system also requires the application of 400 kg of tricalcium phosphate (phosphatage de fond) and the use of heavier levels of mixed fertilizer. The types and rates recommended are 150 kg/ha of 7-21-29 at planting for groundnuts while for millet 150 kg of 10-21-21 is recommended at planting plus 100 kg of urea divided between two equal applications of 50 kg each at approximately 20 and 45 days after emergence.

The probable gains expected from these recommended systems can be predicted from the results obtained on a number of private farms under the control of the Research Service. On these farms, selected as representative of the area, the recommended farming systems are followed closely. On each of the some 15 farms (called Points d'Appui de Pre-vulgarisation et d'Experimentation Multi-locale or PAPEM), scattered throughout the farming areas, the recommended crops for the area are grown with three different levels of fertilization and under three different tillage systems. These correspond to (1) the traditional system of no fertilizer $[F_0]$ and manual cultivation $[T_0]$, (2) the semi-intensive system with light application of fertilizer $[F_1]$ and use of horse-drawn light equipment $[T_1]$, and (3) the intensive system with heavier rates of fertilizer $[F_2]$ and use of heavy ox-drawn equipment $[T_2]$.

The results from these trials from 1965-1971 are summarized in Table 5. The yields from groundnuts and cereals in the Groundnut Basin are shown for the Sine Saloum area where the project sponsored by CCE is underway and for the northern and central areas which encompass the area involved in this project. The data from these trials, obtained under the direct supervision of research personnel, are assumed to be achievable at the farm level with comparable supervision and training of the farmers by SODEVA extension personnel.

The data in Table 5 permit the drawing of a number of conclusions:

- (a) cereals give a better response to improved cultivation than do groundnuts;
- (b) positive responses to improved cultivation methods are obtainable in the project area, although less than those to be obtained in the Sine-Saloum;
- (c) with fertilization, good yields of groundnuts can be obtained even with hand cultivation, but this requires excessive amounts of labor;
- (d) with good rainfall, fertilization is as important as good cultivation and finally,
- (e) maximum production levels are attainable only with the combination of fertilizers and equipment.

Additional support to possible yields attainable under farm conditions is provided by Table 6. This table provides data obtained from a survey of farmers who had worked closely with research personnel on their farms, although with a lesser

degree of control than represented for the trials reported in Table 5. As will be noted, columns 2, 3, and 5 correspond to the F₀T₀, F₁T₁ and F₂T₂ systems, respectively, shown in Table 5. Column 1 presupposes traditional methods at the lowest level without even the use of recommended varieties and planting dates. Column 5 corresponds to an intermediate step in the intensification program wherein a farmer has taken the step from light equipment to ox-drawn equipment but has not yet increased fertilizer level. These data, although representative rather than precise averages of results obtained, are nevertheless further indications of what may be expected from the application of the recommended systems.

Finally, the maximum yields which might be expected on the farm under ideal management are shown in Table 7. Data in this table represent the results obtained from 1967 to 1973 from a model farm located on the CNRA station at Bambey but operated under the recommended intensive system with equipment which is available to any interested farmer. Although the yields vary depending on the year it will be noted that the average yields obtained over the seven year period equal or exceed the yields shown in Table 6 for the intensive production system.

Thus it can be concluded that workable realizable production systems are already available for the project area which can lead to greatly increased levels of production by Senegalese farmers. These systems are proven by numerous trial results both under research station and actual farm conditions. It is reasonable to assume that with the organization of a solid extension program with well-trained personnel and the provision of necessary credit for the purchase of required inputs, the objective of increased production of food and cash crops can be attained in the project area.

D. ECONOMIC ANALYSIS AND FEASIBILITY

Of key importance to success of the project is the response of individual farmers to the expanded SODEVA extension program. The farmers' response in turn depends on the net returns -- in terms of increased cash and/or non-cash net incomes -- accruing to them as a result of their participation.

1. Farm Enterprise Budgets

To estimate the probable effects of the project on net incomes of farmer participants, simple hectare unit budgets of farm enterprises were constructed under various assumptions about farm size, the amount of land intensified, and the level of intensification achieved. Technical and economic coefficients used in constructing the budgets were obtained from numerous reports of research or farm survey documents provided by the National Agronomic Research Center (CNRA) and by SODEVA. In all cases estimates judged to be consistent with results that most practicing farmers could hope to achieve were used. The basic input, output and price data used are given in appendix Tables E.1 and E.2.

The budgets -- presented in Table E.3 -- give estimates of the increased values of output, costs, and net returns which farmers might expect as a result of adopting one of the three basic sets of organization and input use changes currently being encouraged by the SODEVA. These improved organizational-agronomic packages are:

T₁F₁ - Themes legers (semi-intensive system) which entails the introduction of animal traction (horse or donkey), simple one-row implements, light fertilizer applications, the use of improved seeds, observation of proper planting dates, planting in rows and some superficial plowing. Yield increases of 320 kg of millet or 280 kg of groundnuts per hectare are expected as a result of introducing T₁F₁ practices to replace traditional ones.

T₂1F₁ Traction bovine (oxen traction) which presumes that the T₁F₁ practices are followed but introduces an oxen pair to replace the horse or donkey furnishing power. Heavier

equipment is also introduced. More rapid and deeper working of the soil can be accomplished. Some return of organic matter (stalks) to the soil is possible.

Yields gains resulting from introduction of oxen traction and associated equipment are 620 kg per hectare for millet, 380 kg for groundnuts. Gains over the T_1F_1 level are 200 kg/ha and 100 kg/ha for millet and groundnuts, respectively.

$T_{21}F_2$ - Theme lourde (intensive system) which presumes all T_1F_1 practices are followed and introduces a heavier rate of mixed fertilizers on both groundnuts and millet plus up to 150 kg/ha urea on cereal grains. Also in this package is a one-time application of 400 kg/ha of tricalcium phosphate to correct a calcium deficiency in the soil. T_{22} is distinguished from T_{21} by the introduction of somewhat more advanced (and expensive) equipment necessary to cover larger areas. This equipment (T_{22}) is recommended only for larger farms. Expected yield increases over traditional methods are 1020 kg/ha for millet and 430 kg/ha for groundnuts.^{1/}

In each of the improved packages is a change from the traditional rotation fallow-groundnuts-millet-groundnuts to a biennial millet-groundnuts rotation. Use of fertilizers and return of organic matter to the soil will allow the more intensive land use while at the same time improving soil fertility and water holding capacity.

2. The Budget Results

Estimates of the increased per hectare value of output resulting from adoption of each of the possible packages of practices were made by applying current farm level prices to the expected yield increases over average

^{1/} At subsidized fertilizer prices (12 CFA/kg) and current farm level groundnut prices (35 CFA/kg) it pays the farmers to use fertilizer up to the F_2 level (150 kg/ha). However, at world market prices 41 CFA/kg for fertilizer and 45 CFA/kg for groundnuts, heavy fertilization of groundnuts is not justified.

yields obtained using traditional methods. Also the value of draft oxen when sold for slaughter at the end of their usefulness for work was estimated as part of farm income. The sums of these two income elements indicate a potential increase in value of output per hectare intensified ranging from 13,000 CFA (\$53) for farms adopting the themes legers, to more than 25,000 CFA (\$102) for farms adopting the themes lourds.

Additional costs of introduction of the new practices include the investment costs -- amortization and interest -- of the animal-drawn equipment and of the draft animals, maintenance for the equipment and animals, and fertilizer. Current prices paid by farmers were used for estimating these costs. Estimated total additional costs range from about 24,500 CFA (\$100) for a one hectare T_1F_1 plot to 4,500 CFA (\$18) per hectare for an 8 hectare T_1F_1 plot. Similar differences occur for the more intensified units, with the $T_{21}F_1$ range being from 38,300 CFA (\$156) for a one hectare plot to 6,700 CFA (\$27) per hectare for a 10 hectare plot.

The estimated increased net returns per hectare from each level of intensification are negative for one hectare plots but are positive for all plot sizes of two hectares and above. For the largest plot sizes which can be cultivated using one set of draft animals and equipment -- i.e., 8 hectares for T_1F_1 (horse drawn equipment), 10 hectares for $T_{21}F_1$ and $T_{21}F_2$, and 15 hectares for $T_{22}F_2$ -- increased net returns per hectare are respectively 8,900 CFA (\$36), 12,900 CFA (\$73) and 17,900 CFA (\$73) and 18,700 CFA (\$76).

For an average sized farm in the project area, 15 hectares, introducing the themes legers, T_1F_1 on six hectares would result in increasing total farm net income by 47,500 CFA (\$194), from 191,200 CFA (\$776) to 238,700 CFA (\$970). Introducing the themes lourds $T_{21}F_2$, to 6 hectares of a 15 hectare farm would increase total farm net income by 94,600 CFA (\$386) to 285,800 CFA (\$1162). For the average 13 persons per farm in the project area (see Table E.1) adoption of the themes lourds on six hectares would increase per capita farm income from 14,700 CFA (\$60) to 22,000 CFA (\$89), a 31 percent increase.

Even more striking is the potential for increasing farm incomes on smaller farms such as the average 8 hectare farm in Thienaba arrondissement of Thies Department. Farms in this area support an average of 11 persons and could achieve an increase in net per capita incomes of 46 percent by adopting the themes lourds on one-half of their holdings. Per capita net farm income would increase from 9,300 CFA (\$39) to 14,000 CFA (\$57).^{2/}

Even assuming that an 11-member family on an 8 hectare farm would not follow a traditional rotation of one-half groundnuts, one-fourth millet and one-fourth fallow, but would be using a biennial groundnut-millet rotation the production of millet using traditional methods falls short of home consumption needs. Estimated total cereals output is 4 ha X 360 kg/ha = 1440 kg. Total home consumption needs to achieve minimum FAO standards (450g/day/person) are 1460 kg. Introduction of T_2F_2 production methods would increase total cereals output to 2,880 kg, yielding a marketable surplus of 1,240 kg worth 34,720 CFA (\$142). Output of groundnuts would increase from 2,960 kg -- with a market value of 103,600 CFA (\$423), to 3,820 -- valued at 133,700 CFA (\$546). Thus, the total net cash income to the farm (after subtracting debt service costs of 47,900 CFA) would increase to 120,500 CFA (\$492). Net returns after payment of investment debt (over 5 years) would increase by an even greater amount.

The conclusion which can be drawn from this analysis is that under existing price and technological conditions farmers have a strong economic incentive to adopt the investments and improved cropping practices that are being encouraged by the SODEVA extension efforts.

^{2/} These estimates of increased per capita incomes can be considered conservative because the introduction of animal traction reduces labor requirements in the improved plot thereby releasing some of the farm's labor resources for more timely and more intensive work on the unimproved part of the farm. Of particular importance is the release of labor during the critical planting period (See the final part of Appendix Table E.1). Furthermore the draft animals and equipment may also be used on the nominally unimproved plots.

Even assuming a fairly high risk of adverse weather ^{3/} and a strong preference for risk aversion on the part of farmers, it appears that most farmers, and certainly those with larger holdings and financial resources, can be induced to improve their incomes and family welfare through intensification of their farming operations.

3. The Effect of Fertilizer Price Increases

An important agricultural policy decision which is expected to occur during the next few years is an increase in the price which farmers must pay for fertilizers. Currently the government-set fixed price for all mixed fertilizers is 12 CFA/kf (tricalcium phosphate is provided to farmers in the SODEVA program at the T_2F_2 level at zero price). For common fertilizer mixed the 12 CFA/kg price represents a 29.2 CFA/kg subsidy when compared to the cost to the Government. For urea the subsidy is 63.8 CFA/kg, and for tricalcium phosphate the subsidy is 12.0 CFA/kg. The current levels of subsidy appear likely to decrease because the world price of fertilizers has increased rapidly (by about 200% in the past year) and promises to continue to increase as a result of the forecasted long run shortages of petroleum.^{4/}

^{3/} The adverse weather risk is partially compensated for by the conservatism used in making yield estimates. Furthermore, important elements in the improved practices being encouraged are the reduction of time necessary to do weather-sensitive operations (such as planting), to plant at the proper time, and to use early maturing varieties which are more likely to make a crop even in poor rainfall years. Each of these factors will reduce the variability and increase the average level of incomes to participants.

^{4/} Arguments that world and hence domestic prices of groundnuts might fall because of increases in world edible oils supplies were not considered because of the existence of a 10 CFA/kg buffer between current farmer and world prices (i.e., groundnuts delivered at processing plant in Senegal or FOB Dakar).

Assuming that fertilizer prices were allowed to rise to the world market prices the total annual costs per hectare necessary to reach the T₁F₁ level of intensification would increase by 2,190 CFA/ha to 10,395 CFA/ha for a four hectare intensified plot. Total costs for four hectares of intensification would rise to 12,670 CFA/ha respectively. Thus for four hectares of intensification, increased net returns per hectare due to intensification would fall to 2,905 CFA/ha for T₁F₁, 5,810 CFA/ha for T₂F₁ and 5,505 CFA/ha for T₂F₂ plots. Intensification to each of these levels would still be profitable for farmers intensifying four hectares. However, the profitability would be substantially reduced from that obtained with subsidized fertilizers, 64% in the T₂F₂ case. Other results to be expected from an increase in fertilizer prices would be a greater relative profitability of intensifying larger plots per farm or per set of draft animals and equipment (economies of size become more important), lessened incentive to move from light to heavy fertilization rates, and a shift of land from groundnut to millet production and/or a termination of fertilizers use on groundnuts.

Nevertheless economic incentives to farmers to follow other practices in the intensification packages would remain.

4. Economic Effects in the Project Area

The effects of the project on total agricultural output and incomes in the project area were estimated by applying the expected increases in output (Tables E.1, E.2, and E.3) to the numbers of farms (exploitations) in each intensity category as projected by the SODEVA for the 1974 and 1977 crop seasons. The base data used for projecting crop yields were the 1960-1973 average yields as reported

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as official government statistics for the regions of Thies and Diourbel (appendix Table E.8). 5/

Table E.4 of the appendix lists the projected 1974-1977 changes in numbers of farms and in areas of millet and groundnuts within each of the various intensity categories (i.e. T₁ T₁ ...). For the total project area 11,070 farms (52%) are expected to have adopted some level

5/ The official yield estimates for millet are considerably below estimates made by the SODEVA for the project area--which encompasses only 5 of the 9 departments in the Thies and Diourbel regions. For example, in the Thies department the SODEVA's 1973 millet yield estimate was 660 kg/ha. The official statistics for Thies region indicate an average millet yield of 410 kg/ha in 1973. Because both of these estimates are admittedly rough--there is no systematic statistical estimation of either total millet output (most of which is consumed on the farm) or total harvested area--no technical justification exists for choosing either estimate as a base for projections. The official estimate was used in hopes that errors might cancel out in a long-term average, and also because of a need to normalize out rainfall level and distribution effects.

In any case, the base yield estimates used do not affect conclusions with respect to the economic feasibility of the project. Expected yield increases due to intensification were estimated as absolute yield changes with respect to base yields. Therefore, projected changes in output and gross and net incomes are not affected by the base chosen. However, because the lower base was used the absolute 1974 and 1977 gross output projections for the project area should be taken as being conservative. Also, percentage changes in farmers' net incomes might be somewhat overstated.

of intensification by 1977. Total intensification of part of the farm is expected for 1970 farm units. Intensified millet area is projected to increase by 14,000 hectares during the period. Intensification will also affect 14,000 hectares of groundnuts. The total area under cultivation is expected to increase by 5,000 hectares as a result of reduction of fallowed area.

As a result of the expected changes in total harvested area and in the areas to which improved practices are applied, annual output of millet in the total project area is expected to increase by 10,500 metric tons between 1974 and 1977 (Table E.5). Increased groundnut production is estimated to be 5,000 metric tons. The value of this additional production at current farm level prices would be 468.9 million CFA (\$1.91 million). If groundnuts are valued at the export price (45 CFA/kg) the value of increased groundnut output rises from 174.5 million CFA (\$0.71 million) to 224.3 million CFA (\$0.92 million)^{6/} Total world market value of the increased agricultural output in the project area would be 518.7 million CFA (\$2.12 million).

Projections of the 1974-1977 increase in returns to farmers net of increased production costs due to intensification are given in Table E.6. Assuming current market prices, farmers in the project area would receive increased net income of 326.2 million CFA (\$1.33 million) as a result of project activities. At world market prices for both groundnuts and fertilizers, the expected increase in net returns is 291.4 million CFA (\$1.19 million).

5. Total Project Costs and Returns

Estimation of the total direct benefits and costs of the project was done using three different assumptions about post-project responses to SODEVA activities, which were assumed to continue at the expanded level attained at the end of the initial period of project funding (1977).

^{6/} This increased value of groundnut output can be considered as an estimate of the increase in annual foreign exchange earnings generated by the project. Not included are the gross value of output and foreign exchange earnings accruing outside the project area as a result of project activities, e.g., value added by groundnut processing.

- (1) Annual benefits in the project area would stabilize at the level achieved during the 1977 season.
- (2) Annual benefits in the project area would increase after 1977 at a rate that is one-half the rate achieved during the initial U.S. input.
- (3) Annual benefits in the project area would increase after 1977 at a rate equal to that achieved in the initial period.

Annual project benefits (the value of increased net returns to farmers at constant 1974 world price levels) were estimated to attain a level of \$1.19 million by 1977 under each of the three assumptions. Under assumption (1) the annual benefits would after 1977, remain at \$1.19 million throughout the period of evaluation (to 1984). With assumption (2) benefits were projected to increase to an annual rate of \$2.58 million by 1984. And, with assumption (3) annual net benefits would be \$3.96 million by 1974.

For purposes of this analysis project costs--SODEVA (or direct U.S.) expenditures in the project area and for project purposes which are in excess of the normal SODEVA budget in the area--were assumed to be \$4 million during the first four years, apportioned 15 percent, 25 percent, 30 percent and 30 percent from 1974 through 1977. Beginning in the fifth year 1978 project costs would stabilize at \$640,000 annually and would be borne by the National budget or by foreign donor financing.

Annual net benefits to project activities (total benefits minus total costs) would be negative during each of the project years, 1974-1977. However, beginning with the fifth year net benefits would become positive under each of the benefit assumptions made. By 1984 annual net benefits would increase to \$0.5 million with assumption (1), \$1.9 million with assumption (2), and \$3.3 million with assumption (3).

6. Project Feasibility Indicators

The calculation of present values of net benefits, internal rates of return and benefit-cost ratios is presented in appendix Table E.7. Results of these calculations are given in Table 1 below.

TABLE 1 Economic evaluation of the total project: present values of net benefits, benefit cost ratios and internal rates of return with alternative annual benefit assumptions.

Annual Total Benefits Assumptions			
Present values of Accruals to 1984	(1)	(2)	(3)
	Thousand US Dollars		
@ 4%			
Benefits	8,508.2	12,574.3	16,641.1
Costs	7,043.2	7,043.2	7,043.2
Net Benefits	1,465.0	5,531.1	9,597.9
@ 6%			
Benefits	7,644.5	11,140.9	14,638.8
Costs	6,611.2	6,611.2	6,611.2
Net Benefits	1,033.3	4,529.7	8,027.6
<u>Benefit-Cost Ratios</u>			
@ 4%	1.21	1.78	2.36
@ 6%	1.16	1.68	2.21
<u>Internal Rate of Return</u>			
	11.	14.	17.

The results presented in Table 1 indicate that three measures of project feasibility give positive indications for each of the alternative benefit assumptions considered. Even the most modest assumption with respect to continuation of project benefits after 1977 yields a benefit-cost ratio of 1.2, when calculated using a 6 percent rate of discount. The estimated present value of total net benefits accruing over ten years is \$1.0 million, and the internal rate of return is 11 percent.

It should be noted that this assumption is quite modest. It means that SODEVA's efforts would have to remain at a high level in years after termination of the initial

grant period just to maintain the status-quo. This is unlikely. Once farmers have made the transition to modern more productive methods they would not be expected to turn back. Also, the cut-off of project net benefits at the end of 10 years (for computation purposes) is arbitrary. Any lengthening of residual positive net effects from project activities would increase each of the estimated measures of project feasibility for this as well as for the other assumptions.

Furthermore, indirect and non-monetary project benefits are not included in these estimates. As mentioned earlier, the increased supplies of groundnuts to Senegal's processing plants will add employment, and revenues not counted here. Other excluded benefits are increased transport and input and output marketing activities, stabilization of incomes in the project area, increased probabilities that adequate diets will be available to the farm families affected, increased social and economic inter-change between traditional and modern sectors, and reduction of the drudgery of daily life.

7. Income Distribution and Employment Effects

Equally as important as the output and income increases which can be expected to occur as outputs of project activities are the effects on the distribution of incomes among individuals or groups of individuals and, to a lesser extent, among regions.

Some information about the potential income distribution effects can be obtained by referring to the projections for the average project area farm of 15 hectares and for a small (8 hectares) farm representing the average farm in Thienaba Arrondissement. The estimated current per capita incomes for both of these synthesized but representative farms, \$60 and \$39 respectively, must be characterized as low when judged on either an absolute or relative scale. The comparable estimate of per capita income for the total Senegalese agricultural sector is \$108.^{7/}

^{7/} This estimate was made by the World Bank in 1973 and includes the value of rural non-farm activities such as fishing, cottage industry and trading. Unfortunately these activities are not feasible alternatives for most rural families.

Thus project activities would be directed primarily toward helping farm families with considerably less than average per capita incomes and also with fewer than average physical assets (land). The project area is the most populous rural area in Senegal. It has an average rural population density of 61 persons per square kilometer. Density in Bambey Department is 75 persons per square kilometer. Density in Bambey Department is 75 persons per square kilometer. Furthermore it should be noted that the Thies-Diourbel region is the only region in Senegal without an important outside funded agricultural project currently active.

As illustrated by the last section of Table E.1 the employment effects of the project are expected to be negative insofar as agricultural labor is concerned. Each of the improved packages of farming practices would reduce annual labor requirements per hectare and per farm. There would, however, be a beneficial shift in the timing of relative labor requirements from the rush planting season when labor is often the limiting productive factor to the less time specific harvesting, thrashing and transporting activities. Season labor shortages would be reduced and total labor requirements would be spread more evenly throughout the year.

Off farm labor requirements for transport, processing and marketing would increase as a result of increased output of both cereals and groundnuts.

E. FINANCIAL AND BUDGET ANALYSIS

1. Cost Estimates for AID Project

The cost estimates for AID participation in the Thies-Diourbel region are based on an intensive review with SODEVA of each category of expenditure required for successful project implementation in the three Departements to be covered by the project. Estimates are based on requirements to reach specific objectives, and the number of personnel, costs of construction, equipment, training, and operating overhead expenses are projected within this context.

One of the basic assumptions in this financial planning with SODEVA is that the Senegalese Government will continue to allocate resources to the Delegations in Thies and Diourbel in an annual amount equal to that provided to the SODEVA budget in 1973. At the same time, certain personnel attached to the field office operations are in the category of permanent civil servants, whose salaries are paid directly by the government outside of the SODEVA budget. It is expected that this practice will continue during the life of the project.

The projections for financing of personnel by AID, therefore, cover additional personnel needed over and above present staffing levels in order to implement the expanded programs.

Likewise, a thorough review was made with SODEVA of actual operating expenses for the Thies and Diourbel Delegations, currently covered by financing made available by the national budget, and careful projections made of increased expenses which will directly result from the expanded program. Since continued governmental support is expected for this category of expenditures, it was tentatively agreed with SODEVA finance management that AID would cover 65% of the operating expenses of the Thies and Diourbel Delegations, and that the remainder would continue to be supported by national budget allocations.

As outlined in other sections of this paper, similar reviews were made of construction and equipment requirements. For construction, comparisons were made between the costs of the rental of additional facilities needed for the expanded program, and the advisability of providing SODEVA with a more permanent type of field infrastructure. It was found after such an examination that the construction program outlined within the context of the project is considered financially advantageous to both AID and SODEVA, and will certainly contribute to the overall stature and efficiency of the organization in its field operations.

The light infrastructure needed for a permanent training and farmer demonstration program was also costed out and found to be modest in view of the organization's overall responsibilities.

An additional factor taken into consideration, both for construction and equipment, was the availability of funds for these purposes through another donor or international financial organizations. Thus, it was found that the IDA second agricultural credit accorded in 1973 provided for certain infrastructure and equipment in the area directly affected by the AID-financed project. The same review was made of a recent credit accorded to SODEVVA by Iran, which likewise covers audio-visual facilities in several parts of the country, including Thies and Diourbel. In this manner, any possibility of duplication is avoided.

As part of the financial package, SODEVVA has requested that AID financing cover part of the overhead expenses of the headquarters office in Dakar. In view of the organization's somewhat limited financial means apart from financing accorded by donors for specific program activities, SODEVVA believes it is necessary for donors to assist the operations by bearing a percentage of overhead costs in order to finance the additional management, technical, and financial responsibilities of the principle office for the implementation of each specific program.

Thus, it was found that as part of the Sine Saloum project, the Caisse Centrale contributes to the overhead expenses of the home office through a formula which is 10% of the total personnel and operating expenses borne by CCCE for their project. A similar arrangement has been worked out with the French seed implementation program currently being implemented in the Louga Department through financing from FAC, as well as with FED in various activities they are carrying out with SODEVVA.

The AID budget therefore includes an item for overhead expenses at SODEVVA headquarters utilizing the same formula as that agreed to by the Caisse Centrale.

It will also be noted that the AID budget contains a contingency fund equal to approximately 135 million CFA (about \$550,000). As mentioned in the project description, the possibility has been informally discussed with SODEVVA of extending the farm intensification program to additional Department of the Thies and Diourbel Delegations beginning in 1976 and 1977, if satisfactory progress is being made and the organization shows itself capable of expanding

the program to a wider area at that time. The fund will also be available to set up revolving funds for special credits to farmers and for farm and village-level grain storage facilities if required, and as outlined elsewhere in this paper.

It is also recommended that the same system be adopted for the approval of annual budgets as that worked out between the Caisse Centrale, the Senegalese Government and SODEVA, for the annual approval of budgetary expenditures as projected for the following implementation year.

AID funding for the program has been set forth so as to coincide with the fiscal year of SODEVA which begins on April 1. In these projections, it is estimated that the full impact of the expanded program made possible by AID financing will not come about until the 1975 planting season which begins in June of that year. Nevertheless, the remainder of SODEVA's fiscal year 1974 will require AID financing primarily to permit the recruitment and upgrading of personnel, and to begin as quickly as possible the infrastructure facilities and equipment procurement needed for the full-scale program.

It is estimated that AID funds will be available as of October 1, 1974 to permit SODEVA to move forward. The length of the project extends through March 31, 1978. Should for any reason the program, which is ambitious, move forward more slowly than actual planning, it is recommended that with mutual agreement between AID and Senegal, any financing not used by the terminal date mentioned above, be made available to carry out the program for an additional 12-month period.

Another important factor which has been examined as part of the financial analysis of this program is the ability of SODEVA to continue the program at approximately the same level or perhaps a slightly reduced level, once AID financing is no longer available. On the basis of this analysis, and in view of the expected economic results, it is believed that there are reasonable chances for Senegal to proceed with the program either with its own resources, or from possible financing from other donors or international financial organizations. Under these conditions, continuation of the program at a reasonable level would not put an undue burden on the national budget.

It will be noted that 75% of AID financing is expected to be in local currency. This is inherent in the nature

of the project since personnel costs, operating and overhead expenses, and construction costs are almost entirely local. A considerable percentage of equipment requirements will either be locally manufactured as in the case of farm implements fabricated by the local firm, SISCOMA, or small equipment normally available as shelf items, and therefore qualifying as local expenditures. Foreign exchange costs involving U.S. procurement will be limited to larger items of equipment, such as the heavy duty truck required for the warehouse and farm demonstration activities. It is believed that approximately \$150,000 may be needed for specialized equipment not normally available in Senegal, and which should be imported from Code 935 countries because of servicing and maintenance problems, and so that this equipment can be standardized with that normally used by SODEVA in its extension operations. Other foreign exchange costs are required for the expatriate technicians to be assigned to the project.

In those cases where revolving funds or lease-sale of farm implements are incorporated into the program, SODEVA has agreed that as part of its regular financial reporting, complete details of these operations and results will be made available to AID.

Below is a summary breakdown of AID project costs for the program.

PROJECT COST SUMMARY

<u>Thies-Diourbel Project</u>	<u>000 CFA</u>	<u>US Dollars</u>
Construction	102,552	\$ 427,300
Equipment	11,376	47,400
Supplies	13,350	55,625
Personnel	345,275	1,488,646
Operating Expenses	101,020	420,917
Training and Demonstration	48,747	203,112
 Special Projects:		
M'Bodine Project	41,611	173,379
Implement Lease/Sale Program	1,787	7,446
Farm Storage Program	15,000	62,500
Sub-Total	<u>680,718</u>	<u>\$ 2,836,325</u>
 Contingencies and/or Possible Expansion in Other Districts	135,030	562,625
Applied Research Activities	132,538	552,242
	<u>948,286</u>	<u>\$ 3,951,192</u>
 Other Contingencies		48,808
		<u>\$ 4,000,000</u>

2. Financial Review of SODEVA

In the past, SODEVA has experienced considerable financial problems in carrying out its operating programs, largely because of undercapitalization. The original amount of 10,000,000 CFA is clearly insufficient for the needs of the organization. Fortunately, however, the Board of Directors has recently voted to increase the institution's capital to a more substantial total of 100,000,000 CFA, and the additional 90,000,000 CFA will be paid in on a pro-rata basis by the present stockholders in accordance with their current shareholdings. Financial details of the transaction are now being completed, and it is believed that the operation will be finalized by the fall of 1974.

SODEVA has also had difficulty in meeting its current expenditures promptly because of the cumbersome system with which it must comply before reimbursements for expenditures are made from donors. The government requires that bills and invoices must be presented to both the Ministry of Rural Development and the Ministry of Finance for approval, before they are normally sent on to the donor organizations. By the time the reimbursements are made, delays of up to several months usually result. SODEVA is thus required to seek short-term financing through commercial banks, and must delay payments to various creditors. This has obviously not been a satisfactory situation, although the principal creditor has been the French firm, SATEC.

While the additional capital will certainly improve the situation, other steps should be taken so that the financial position of the organization will be as strong as its technical capacity. The Caisse Centrale in its Sine Saloum program has recently agreed with the Senegalese government to reimburse SODEVA directly upon the presentation of invoices rather than depositing the money to the Senegalese Treasury, and then have it relayed to SODEVA, usually with a delay of at least three months.

The suggested disbursement procedures outlined below for the AID-financed program have been developed with a view of not only meeting AID's financial management requirements, but also to assist in the strengthening of SODEVA's financial position.

Although not specifically a part of this AID financial package, it is recommended that consideration be given to the earmarking of up to 50,000,000 CFA (about \$210,000)

from the PL-480 Title II counterpart special account which has resulted from AID's relief program in Senegal. Should the Government of Senegal be in agreement with such a proposal, the amount could be released as a revolving fund to SODEVA to be used as working capital. This would infinitely strengthen the financial structure of the organization.

A thorough review has been made of the internal control, budgeting, accounting, and financial reporting procedures of SODEVA, and they are considered satisfactory. Financial reporting procedures are computerized utilizing the IBM Services Bureau in Dakar. Improvements are being made by SODEVA to utilize the financial data in a timely manner in order to improve overall operations both at headquarters and field office levels. The internal auditing procedures are being improved, and field office accounting staffs are being strengthened, as part of the AID program.

The conclusion of the review is that in spite of past difficulties, SODEVA's financial position will be strengthened by measures currently being developed, and that its financial management and accounting system is fully competent to meet AID requirements for the appropriate utilization and reporting of AID fund expenditures.

SODEVA's operations are financed by the national budget, donors, and financial agencies. Funds provided by various supporting organizations, together with expenditures and number of employees, are summarized below for the years 1971/72 through 1974/75.

SODEVA BUDGET FROM ALL SOURCES
(Operations and Specific Programs)
Stated in Thousands of CFA

	<u>1971/72</u>	<u>1972/73</u>	<u>1973/74</u>	<u>1974/75</u>
Nat'l Budget Allotment	264,000	186,075	250,000	260,000
Nat'l Budget Agreements	12,750	-	17,165	-
IBRD/IDA Special	22,762	-	-	66,900
CCCE	11,000	141,876	285,000	305,000
FED	-	21,766	45,500	45,500
FAC	25,216	27,328	69,436	61,600
Iran	-	-	-	83,500
Com'l Activities (gross receipts)	-	20,000	54,000	60,000
Proposed AID Proj	-	-	-	91,000
Total	<u>335,728</u>	<u>397,045</u>	<u>721,101</u>	<u>973,500</u>
Expenditures	<u>360,268</u>	<u>373,350</u>	<u>754,000</u>	<u>1,000,000</u>
No. of Employees	<u>636</u>	<u>811</u>	<u>1,023</u>	<u>1,230</u>

3. Disbursement Procedures

It is recommended that an advance of \$200,000 be made to SODEVA at the beginning of the AID-financed program to permit adequate working capital for the expanded program to be undertaken in the Thies-Diourbel region. This amount is less than the three months average expenditure from AID funds projected over the life of the project. Said advance will be deposited to a Special Account to be set up for the SODEVA project. Replenishments will be made on a monthly, bimonthly or quarterly basis, as later agreed with SODEVA. Reimbursements will be made to SODEVA directly based on two IBM runs made monthly, accompanied by a certification signed by the Director General of SODEVA to the effect that all expenditures were made during the period in accordance with the terms of the Grant Agreement. The invoices and other documentation, duly signed by the Ministry of Finance, will be retained in accordance with the normal practices of SODEVA, and will be available to AID for appropriate auditing purposes.

Section 3 - PROJECT IMPLEMENTATION

A. Project Execution and Implementation Schedule

Implementation of this project by SODEVA can begin in the fall of 1974, as soon as the Grant Agreement is signed, conditions precedent met, and financing made available. As set forth in the financial and other Annexes to this report, requirements for personnel, operating costs, equipment, and construction on an annual basis are carefully outlined in accordance with overall planning for the program, and in accordance with the specific objectives of the farm intensification program.

Below is a resume of the preliminary implementation schedule through June 30, 1975:

1. Submission of Program Document to AID/W May 27, 1974
2. AID Grant Authorized June 1974
3. Grant Agreement Signed July 1974
4. Conditions Precedent to Disbursement Met July thru Sept 1974
5. Disbursement Procedures Established Sept-Oct 1974
6. Recruitment Begins for Expatriate Technicians October 1974
7. Plans, specifications, and IFB documents for 1st tranche construction of office space, warehouse and training facilities completed by local architect/engineering firm. Reviewed with AID. November 1974
8. Plans agreed to with AID for procurement of equipment required for first year of operations Nov-Dec 1974
9. Expatriate Technicians Begin Work January 1975
10. Bid Documents for 1st Tranche Construction Issued January 1975
11. Recruitment of Additional Senegalese Personnel Begins in Accordance with Personnel Schedule January 1975

- | | |
|---|---------------|
| 12. Training Program for New Personnel and Upgrading Current Employees Begins | February 1975 |
| 13. Bid Opening | March 1975 |
| 14. Construction Contracts Signed | April 1975 |
| 15. Construction Begins | May 1975 |
| 16. SODEVA Personnel Begin Intensification Program for 1975 Planting Season in Accordance with Objectives | June 1975 |

B. Evaluation

SODEVA has already established a system of continuing evaluation of its efforts, and will follow the pattern currently being used in the Sine Saloum project. Field personnel are furnished with specially prepared forms devised for the program, and at each level, these questionnaires are regularly submitted to the principal field offices for compilation and analysis. SODEVA is thus able to follow the operations in each district in considerable detail, and can immediately take action or attempt to overcome difficulties where progress seems to be slow. Constant technical as well as socio-economic evaluation and feedback between the research station located in the area and the extension activities will be made possible by the establishment of the applied research unit to set up under the project.

As indicated in various sections of the paper, and as tabulated in the appropriate Annexes, specific, concrete objectives have been laid out by SODEVA, and progress and results can thus be measured against these data. SODEVA has indicated its willingness to cooperate with AID on a regular basis in the periodic evaluation of the different phases of the program, and a specific evaluation system will be mutually agreed to by SODEVA and AID.

C. Conditions and Covenants

A minimum of special conditions and covenants should be attached to this Grant. It is recommended, however, that the Government of Senegal contribute to the program in the Thies and Diourbel regions in an amount at least equal to that allocated to the SODEVA budget in 1973, annually, for the life of the project. Likewise, the annual program of expenditures should be submitted to AID for review and concurrence.

D. Issues and Special Recommendations

No major issues appear to stand in the way of the implementation of the project as outlined in this report. This assumes that the Senegalese government continues to support the program, and that other governmental agencies which must coordinate their efforts with SODEVA, particularly the organization responsible for agricultural credit and marketing (ONCAD), operate in an effective manner.

In view of the importance of upgrading personnel and the training of new employees, considerable emphasis is given to the overall training aspects of the program. The need for an expatriate training specialist at the field level is required. At the same time, an experienced expatriate agronomist is needed to help supervise field work. As described earlier, the applied research unit to be coordinated with the National Agronomic Research Center (CNRA) will require two expatriate socio-economic and agronomy specialists. Since the French firm, SATEC, has provided technicians to Senegal in the extension field for 10 years, and since the research station is operated by technicians from the French tropical agricultural organization, IRAT, it is recommended that the expatriate technicians for this project, a maximum of four, be obtained from the above mentioned groups and that the appropriate waiver be made a part of the authorization.

It is also recommended that while much of the material and equipment will be locally produced, or be available as shelf items, some equipment must be imported. In view of difficulties in servicing non-European equipment and the lack of spare parts, it is recommended that a waiver be granted for the importation of Code 935 equipment when this seems desirable. Every effort will be made, however, to assure the importation of U.S. equipment when feasible.

The Grant should also make provision for the appropriate modification of the shelf item rule which will permit SODEVA to utilize an amount up to \$300,000 to purchase shelf items imported from Code 935 countries. The limit on individual transaction amounts for shelf items should also be modified as required.

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Project Title: Senegal Cereals Production and Agricultural Extension Project (SODEVA)

Life of Project
From FY 75 to FY 79
Total U.S. Funding - \$4,000,000
Date Prepared: May 22, 1974

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
<p>Program Goal: (A-1)</p> <p>To contribute to the economic development of agricultural productivity, particularly in cereals, in an important area of the country's Groundnut Basin.</p>	<p>Measures of Achievement: (A-2)</p> <ol style="list-style-type: none"> Increase yields per hectare on participating farms through the introduction of farm intensification methods of from 25 to 50% over life of project. Increase number of farmers participating in various stages from semi-intensified farming to fullscale use of techniques in accordance with specific objectives set by SODEVA and outlined in appropriate annex. 	<p>(A-3)</p> <p>Evaluation of project through systematic field checks, annual reviews, and program of socio-economic and technical feedback between research and extension activities are integral part of program's planning and implementation.</p>	<p>Assumption for Achieving Goal Targets. (A-4)</p> <ol style="list-style-type: none"> Farmer receptivity to intensification program will continue to be satisfactory in view of reasonable success obtained thus far in applying proven technical and extension techniques. SODEVA will be able to recruit, train, and upgrade field personnel required for the expanded program. Senegalese Government will continue to give support to SODEVA activities. Average rainfall during the life of project will be somewhere near normal conditions.

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PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK (cont'd)

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
<p>Project Purpose: (B-1)</p> <p>To assist the Government of Senegal achieve a higher and self-sustaining level of productivity in the agricultural sector. In addition, support the efforts of the Senegalese Implementing Agency, SODEVVA, to diversify and intensify productivity in the West Central Region of Senegal's Groundnut Basin.</p>	<p>Conditions That Will Indicate Purpose Has Been Achieved: End-of Project Status. (B-2)</p> <ol style="list-style-type: none"> 1. Increased groundnut and cereals output per farm participating in the program and benefiting from SODEVVA's Agricultural Extension System. 2. Increased government revenues due to increase in groundnut output from application of improved cultivation techniques in zone of intensification. 3. Stabilization of cereals market prices as a result of increased cereals output in project area. 4. Reduced demand for rice in rural environment as a substitute for cereals. 5. Increase in farmers' incomes producing greater self-sufficiency and stability in rural environment. 	<p>(B-3)</p> <ol style="list-style-type: none"> 1. Data gathered by liaison research team investigating impacts of SODEVVA extension work at the village and farm level in the zone of intensification. 2. Statistics gathered by SODEVVA extension workers in their daily contacts with the farmer based on results of implementation of program elements. 3. CNRA's evaluation of data gathered and fed back to the research center by the liaison research team. 	<p>Assumptions for Achieving Purpose: (B-4)</p> <ol style="list-style-type: none"> 1. Farmer remains receptive to introduction of innovative cultivation techniques. 2. SODEVVA organization is able to meet goals of expanded program in terms of funds, increased staffing, training outputs, and others on schedule. 3. Government of Senegal will maintain or increase its level of support activities to SODEVVA's extension program.

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PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK (cont'd)

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
<p>Project Outputs: (C-1)</p> <ol style="list-style-type: none"> 1. Recruitment and up-grading of extension personnel by SODEVA in project area. 2. Establishment of required SODEVA infrastructure including training and farm demonstration facilities in project area. 3. Setting up of applied research unit to assure coordination between research and agricultural extension activities. 4. Increased number of farmers to be included each year in intensification program. 	<p>Magnitude of Outputs: (C-2)</p> <ol style="list-style-type: none"> 1. Number of personnel to be trained and upgraded in accordance with personnel schedule attached as Annex. 2. Number and types of building infrastructure in accordance with schedule attached as Annex. 3. Number of farmer participants in accordance with appropriate Annex outline, including area planted to millet and groundnuts. 	<p>(C-3)</p> <ol style="list-style-type: none"> 1. Records maintenance by SODEVA and research station, CNRA. 2. Direct observation. 3. Special project evaluations and audit. 	<p>Assumptions for Achieving Outputs: (C-4)</p> <ol style="list-style-type: none"> 1. Training facilities will be ready as planned for training programs. 2. Building program will go forward according to schedule.

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PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK (cont'd)

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
<p>Project Inputs: (D-1)</p> <ol style="list-style-type: none"> 1. Financial assistance for increased number of Senegalese extension personnel required for program. 2. Provide 2 expatriate technicians, a training specialist and an agronomist. 3. Construction and Equipment: <ol style="list-style-type: none"> (a) Training and farmer demonstration facilities. (b) Warehouse, farm stores, and office space. (c) Training infrastructure and extension equipment. 4. Support for Operating Expenses. 5. Funding for Applied Research Unit including possible experimental unit. 6. Continued GOS support of SODEVA at 1973 level in project area. 7. Continued programs of other donors which directly or indirectly affect SODEVA activities. 	<p>Implementation Target (Type and Quantity): D-2</p> <p>See appropriate sections of paper and Annexes.</p>	<p>D-3</p> <ol style="list-style-type: none"> 1. Grant agreement and other funding documents. 2. Commodity purchase by contracted firm. 3. Local construction contracts and periodic site visits. 4. Contracts with expatriate technicians. 5. SODEVA management, technical, personnel and financial records. 6. Agreement with CNRA on research aspects of program. 7. Periodic progress reports by SODEVA. 8. Inspections and audits. 	<p>Assumption for Providing Inputs: (D-4)</p> <ol style="list-style-type: none"> 1. Qualified Senegalese personnel can be recruited and trained for expanded program. 2. Local construction firms are fully qualified to undertake proposed construction on timely basis 3. U.S. funding will be available for the life of project. 4. SODEVA management is competent at both headquarters and field office levels to direct expanded programs.

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