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FINAL REPORT

**ON THE TECHNICAL ASSISTANCE TO
AND THE ACHIEVEMENTS OF THE
CEREALS PRODUCTION II PROJECT
NO. 685-0235
AGROFORESTRY PILOT PROGRAM**

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Abbreviations Used

- CA - Conseiller Agricole (SODEVA agricultural extension agent)
- CETAD - Centre d'Entrainement aux Techniques Agricoles de Developpement (a unit of SODEVA)
- DCSR - Direction de Conservation des Sols et du Reboisement
- DRPF - Direction des Recherches sur les Productions Forestieres, formerly called: CNRF - Centre National de la Recherche Forestiere
- ISTI - International Science and Technology Institute Inc.
- PAFOCSE - Projet de l'Agroforesterie et du Conservation des Sols et des Faux (SODEVA name for the project)
- PREVINOBA - Projet de Reboisement Villageois du Nord-Ouest du Bassin Arichidier
- RR - Responsable Regional de Reboisement (SODEVA regional reforestation coordinator)
- SODEVA - Societe de Developpement et de Vulgarisation Agricole
- USAID - United States Agency for International Development

SUMMARY

The following report describes the objectives, constraints and achievements of the Agroforestry Pilot Program. It does not cover the financial aspects of the project, except as these have a direct effect on the technical program, due to the limitations of the contractor's scope of work (see Annex 2).

This project was a continuation of the Cereals Production II Project No. 685-0235, financed by USAID and executed primarily by SODEVA. The extension was for 33 months with approximately US\$2 million available. The specific project objectives are outlined below:

- 1) To initiate a series of agroforestry activities in 60 villages in the Thies and Diourbel regions to:
 - o Reintroduce trees into the production system;
 - o Demonstrate the role and importance of tree planting in maintaining soil productivity, in satisfying the needs of villagers for fuelwood, construction materials, and livestock and human food, and in improving farm revenue; and
 - o Demonstrate the beneficial use of agricultural subproducts (i.e. compost, animal waste, livestock fodder) in connection with forestry.
- 2) Test and validate agroforestry techniques by conducting adaptive research of tree species, plantation techniques, use of animal wastes and crop residue.
- 3) Obtain adequate information on the degree of environmental degradation, the interest of villagers, and the economic feasibility of project interventions to permit the elaboration of a long-term, large-scale agroforestry project.

The project was designed to continue and expand a cooperative approach to research and extension that had started during the original Cereals II Project. The following agencies were participants in various phases of the project:

- o The DCSR, through the regional Inspection Forestieres, provided plants and technical assistance.
- o ISRA, through its forestry research branch DRPF, was to conduct applied research in agroforestry and soil conservation both in villages and on research stations. However, due to administrative disagreements, DRPF never carried out its research program. Its inputs were limited to some training activities for field personnel early in the project. Eventually three of the planned research activities were carried out by private Senegalese consulting firms.
- o The U.S. Peace Corps provided six volunteers to work in project villages over the life of the project.

Technical assistance was provided under a contract between USAID and the International Science and Technology Institute, Inc. ISTI provided the services of a long-term forestry advisor from September 1985 to the end of the project in December 1987. Money originally under ISTI's short-term consultancy budget was realigned to finance the project's research activities, extend the time of the long-term forestry advisor by four months and to provide a forester facilitator/translator during a training tour of Senegalese technicians to agroforestry and soil conservation research sites in the U.S.

SODEVA used its field level extension agents to work with participating villages to encourage and guide agroforestry activities. These agents were to work 1/3 time on agroforestry, with the rest of their time consecrated to SODEVA's other activities, such as improved millet and cowpea seed dissemination and duplication. A detailed discussion of the extension methods used is included.

In each village a 15 member management committee was established to help set objectives and oversee the village's agroforestry and soil conservation plantings. Among the activities typically undertaken in project villages were:

- o Community woodlots of 1 to 2 hectares, with a mix of local and exotic species to provide fuelwood, poles and fodder; usually with intercropping of cowpeas, peanuts or other low crops.
- o Community orchards of 1/2 or more hectares of mango, citron or guava, planted at wider spacings than the woodlots.
- o Community windbreaks consisting of a double row of prosopis or other hardy species 1 to 2 kilometers long.
- o Windrows around woodlots, fruit tree orchards or in villages.
- o Tree planting within village compounds.
- o Individual plantations of all types of trees (beginning in the second year of the project).
- o Planting of *Acacia albida* at wide spacings in fields, as well as systematic protection of natural *Acacia albida* regeneration in fields.

Detailed descriptions of each type of plantation, the species used, periodic survival rates and constraints to tree planting, are covered in the report. Specific project achievements are given in tables.

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Protection of the plantations was the responsibility of the villagers, who tried several methods of local fencing including:

- o woven thorns and branches,
- o euphorbia cuttings, and
- o mixtures of thorns and euphorbia.

No one type of local fencing proved entirely satisfactory. The project did also provide some rubber waste mats to help in protection, but not in sufficient quantities to meet all the demand.

Other allied activities promoted by the project were as follows.

- o The institution of village nurseries in villages that had enough water to enable them to produce their own plants and have a surplus for sale. The project did provide tools for this activity and for demonstration purposes for village plantations.
- o Training in the construction of improved woodstoves for many of the villages, a particularly popular and successful program with women.
- o The building of compost pits to process agricultural wastes and provide a source of organic matter for the degraded soils of the region. Although project support (materials and construction assistance) for this activity was not forthcoming; in many villages the people did make an attempt to build their own compost pits. The sandy soils, however, limited the effectiveness of their work.
- o Vegetable gardening was promoted in villages with sufficient water supplies by the provision of improved seeds and tools.

A well deepening and new well construction program for the first 28 project villages did not actually get underway until August 1987, due to many administrative and contractual delays. At the present time it is uncertain if the work will be finished.

There were a significant number of training activities including:

- o Short seminars for the project field staff on various aspects of agroforestry, with written manuals provided;
- o U.S. tours and seminars for senior SODEVA and DCSR staff; and
- o Tours of similar projects in Senegal for mid-level SODEVA and DCSR staff.

Support for the Documentation Center at SODEVA's CEIAD training unit in Fout included a three week training seminar at VITA (Volunteers in Technical Assistance), in Washington D.C., and the purchase of a microfiche reader. Books and audio-visual materials ordered through USAID's SMO have not yet been received.

Research activities funded under the project and executed by Senegalese consulting firms were:

- o Field sampling and laboratory analysis of soils from seven project villages to determine their degree of degradation and relative fertility.
- o A survey of villager attitudes towards agroforestry activities undertaken to date and plans they may have to continue these activities after the end of the project. Their impressions of the various tree species used was also examined. The survey took into account differences among social and economic groups in the villages. Fifteen (15) villages were sampled.
- o A systematic evaluation of the silvicultural response of the species used in the different types of plantations under various ecological and human-influenced growing conditions. The study also evaluated the efficiency and cost of the different types of fencing used. The study involved taking detailed measurements in 15 of the project villages.

Recommendations for future projects of this type are also included.

1.0 Introduction

This is the last in a series of reports covering the execution of the Agroforestry Pilot Program of The Cereals Production II Project no. 685-0235. It is written in fulfillment of the contract between USAID and the International Science and Technology Institute, Inc. to provide technical assistance to the project.

The report will cover primarily the technical aspects of the project. Due to the limitations of the contractor/advisor's scope of work (see Annex 2), administrative and financial aspects will be covered only inasmuch as these specifically influenced project implementation.

As explained in the Project Paper Supplement (PPS), the Cereals Production II project was to be extended by 33 months with a change of emphasis in the project objectives and interventions. The new purpose of the project was to carry out a pilot program of agroforestry and soil conservation activities in portions of Senegal's Groundnut Basin. The project strove to work with villagers to find ways to associate tree planting and protection with agriculture to increase production and conserve and improve the soil, as well as to meet local needs for various forest products.

Taken from the PPS, the specific objectives were threefold.

- 1) To initiate a series of agroforestry activities in 60 villages in the Thies and Diourbel regions to:
 - o Reintroduce trees into the production system
 - o Demonstrate the role and importance of tree planting in maintaining soil productivity, in satisfying the needs of villagers for fuelwood, construction materials, and livestock and human food, and in improving farm revenue; and
 - o Demonstrate the beneficial use of agricultural subproducts (i.e. compost, animal waste, livestock fodder) in connection with forestry.
- 2) Test and validate agroforestry techniques by conducting adaptive research of tree species, plantation techniques, use of animal wastes and crop residue.
- 3) Obtain adequate information on the degree of environmental degradation, the interest of villagers, and the economic feasibility of project interventions to permit the elaboration of a long-term, large scale agroforestry project.

2.0 Project Organization, Institutional Arrangements

2.1 Participating Agencies, Cooperative Approach

A joint arrangement to conduct applied agricultural research between SODEVA and ISRA was begun in the Cereals Production II project. This same cooperative spirit was carried over to the Agroforestry Program, with several agencies each contributing to the project in its particular area of expertise.

The activities of participating Senegalese agencies were to be financed directly by USAID through project implementation letters (P.I.L.) with indirect oversight by SODEVA. A condition precedent for the project required that working protocols be signed between SODEVA and each of the participants before funding could begin.

The Direction de Conservation des Sols et du Reboisement (DCSR) provided technical advice on reforestation and species selection. Its nurseries were used to produce many of the plants needed. On a regional level, both the Inspections Forestieres of Thies and Diourbel assigned an agent to work on the project. Funding for DCSR came directly from USAID through a P.I.L.

ISRA, through its forestry research branch (DRPF) was to provide research assistance in the form of follow-up of field activities and controlled research of various aspects of agroforestry associations. In addition ISRA was to provide soil analysis of samples taken from field sites. The complete list of research activities to be undertaken is listed in Annex 1. ISRA withdrew from the project in March 1987, due to failure to agree with USAID on the level and types of project support and the length of time available to carry out the research program. Several of its research functions were carried out by outside Senegalese contractors (see section 6). Like DCSR, ISRA/DRPF funding was also to come directly from USAID.

The Peace Corps provided two volunteers in 1985 followed by four more in 1986. Each volunteer was based in one of the project villages. Although original plans called for the volunteers to advise CA working in other villages and conduct training programs as needed, they confined their activities, for the most part, to their home villages. For the volunteers to have served more of a coordinating role, they would have had to have been assigned to the chef de secteurs at the prefecture level, and their role would have to have been better explained to SODEVA regional officials. They did, however, provide useful assistance to the villages in which they served.

2.2 SODEVA's Contribution

SODEVA had the major responsibility for project implementation and coordination of participating agency input. A project director, resident in Dakar, was delegated direct operational authority. At the regional level, responsables regionaux de reboisement (RR) were assigned in Thies and Diourbel. They oversaw the day-to-day project activities in their regions.

SODEVA's management structure was in a state of transformation during the life of the project. The delegations changed from operational structures implementing activities under instructions from headquarters to administrative units to house independent projects. The RR regional were under the control of the delegations, which at first continued in their traditional role of managing activities. As the resources of SODEVA's central management diminished, the project management took a more active role in directing field operations.

2.2 Technical Assistance

The International Science and Technology Institute, Inc. provided the services of a long-term forestry advisor. Resident in Thies and assigned to SODEVA, the advisor was to help coordinate the inputs of participating agencies in field activities and give technical advice on agroforestry and extension. The complete scope of work is listed in Annex 3.

The PP called for ten months of short term technical assistance. Little of this time was utilized by consultants. Instead local consulting firms were funded through subcontracts to conduct three research activities (see section 6). It should be noted that a consultant was used to oversee a U.S. based agroforestry study tour (section 7).

In January 1987, the contract was modified to give responsibility for maintenance of two of the project vehicles and the hiring of a chauffeur for the flatbed truck to the contractor. The contract was extended by four months to allow the forestry advisor to complete the last planting season and to participate in the project evaluation.

3.0 Extension, Information Diffusion Methods

3.1 Extension Agent Working Methods/Profile

The actual work of village extension was carried out by Conseils Agricoles (CA). The CA were assigned to villages where SODEVA had ongoing activities. Under the terms of the PP they were to spend 1/3 of their time on agroforestry and the rest on other SODEVA projects. During the first two years of the project these other activities included:

- o Improved millet variety duplication and dissemination,
- o Nlehe seed (cowpea) dissemination,
- o Management of millet mill operation and repayment of loans, and
- o Fertilizer distribution and loan repayment.

It was hoped that an extension agent wearing many hats would be better able to influence villagers to adopt agroforestry practices. This was the case in many instances, especially in intercropping in the woodlots. In other cases the agents used the workload of one project to reduce their productivity in another. This coordination of the field agents' time was under the responsibility of his chef de secteur at the prefecture level.

The CA held agent technique level training, usually in agriculture, although a few had livestock training. Their lack of formal forestry training was remedied by their hands-on experience in SODEVA's previous reforestation efforts and specific project training. Many of them were government employees assigned to SODEVA; although a significant number were SODEVA contract employees. Most of them had had previous training by SODEVA in village extension methods.

In their usual agricultural programs the CA were used to fulfilling fixed production objectives that were set by higher management. Their main working method was to convince villagers through meetings and training to accept the technical packages offered by SODEVA. They were less skilled at eliciting villagers' objectives and helping them fulfill them, although there were some notable exceptions to this.

3.2 Village Selection Criteria

Criteria used to select villages were as follows:

- o Population of between 200 and 300 full-time inhabitants to insure maximum participation of the whole village;
- o Having a more or less central location so that surrounding villages could observe agroforestry activities;
- o Availability of land for tree planting;
- o Availability of adequate water supplies either in wells or in a high water table, to minimize the need for well drilling; and
- o Interest and motivation of the villagers to undertake these activities.

Beginning in June 1985 field staff in the Thies and Diourbel regions began searching for villages fulfilling these criteria. The most difficult criterion was that of availability of adequate water supplies. Very few villages were found that did not have a shortage of water for drinking, let alone gardening or tree watering. In most cases the villages chosen had a long relationship with SODEVA and were well known by the field agents.

Final selection for the 1985 season was made following a series of village meetings and discussions where project staff described the project objectives and the respective roles of the project and the villagers in fulfilling them. For the second year a similar process was undertaken, but beginning in December 1985. Village meetings were held in January and February 1986.

Thirty villages were selected in 1985, 16 in Thies and 14 in Diourbel. One of the villages in Thies was subsequently dropped due to lack of interest on the part of the villagers. The second year of the project called for 20 villages to be selected. The prefecture of Mbacke in Diourbel was added because of strong interest expressed by SODEVA staff and villagers. Consequently the Diourbel region was allocated 14 and Thies 6 new villages. A decision was made by SODEVA management in June 1986 to take as many villages as were interested up to the 60 called for in the PP. The disposition of participation by prefecture for the 1986 season was as follows:

Tivaouane	8
Thies	7
Mbour	6 total of 21 for Thies Region
Mbacke	9
Diourbel	15
Bamhey	12 total of 34 for Diourbel Region
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57 for the project as a whole

In 1987 6 more villages were added in the Diourbel region to bring the project up to 63.

3.3 Project Philosophy, Village Organization

To a greater extent than many other rural development projects, the new agroforestry program of the Cereal Production II Project relied on the cooperation and the initiative of the villagers themselves. A locally elected management committee, in most cases with both men and women members, was set up to oversee the management of the woodlot and associated activities. Selection of the species to be used was done locally with the help of the project staff. All of the work necessary to install and maintain the woodlots was done by the villagers themselves. Every effort was made so that the villagers would feel that the trees they planted belonged to them to do with as they felt best. The project staff and extension workers were there to offer help and advice, but the people had to decide for themselves how much they were willing to commit to the work.

3.4 Technical Ideas Diffusion

Agroforestry and soil conservation themes were disseminated to villagers during village meetings conducted by the CA and during visits of the project staff. From these discussions the villagers would decide what activities they could undertake. During the first two years of the project minimum objectives were established, but in reality villages only undertook what they felt capable of doing. The project used technical handouts and short training sessions to present technical themes to the CA.

3.5 Obstacles to Tree Planting Encountered

Significant obstacles exist to work against or limit tree planting in the Peanut Basin. Several of these were beyond the scope of this project and difficult to deal with, or would require a longer time to surmount with extension methods. Among these were:

##3 Throughout the Thies and Diourbel regions there is an acute scarcity of land available for agriculture. The villagers are loathe to take any of their land out of agricultural production. Typically a village would consent to plant one hectare of land in trees to make their gesture of participation in reforestation, but would be unwilling to expand further. Table 5 shows by how much the rate of new plantings in all categories diminished in 1987 for villages with 1 or 2 years of experience in the project. Although there were other factors involved in their decision, land scarcity is a major problem. This problem can be diminished by intercropping in plantations or by sugges-

ting alternate ways of planting trees that take up less space.

Competition among land uses is also tight. In those livestock raising activities, villagers follow an extensive strategy, whereby animals (goats, sheep and some cattle) are expected to roam free during the dry season and find their own fodder. There are also migrant herders going through the area. Agroforestry and most soil conservation activities are more intensive, requiring greater manpower and material inputs, and greater control over the land. Young seedlings have to be protected from grazing. Many of the villages were unable to provide adequate protection to their trees. As long as this conflict in strategies continues, tree planting will be a risky enterprise with a high chance of failure. More work must be done to demonstrate the benefits of increased tree cover (particularly in economic terms) and to create conditions more favorable to tree survival.

Land tenure is also an important constraint. Villagers enjoy user rights but not ownership of their land. This leads them to emphasize short rather than long-term investments in their agricultural decision making.

Villagers in the project's working area have witnessed many other projects come and go over the years. Many of the people have a "gift" mentality that has been reinforced by experience. They would often consent to undertake project activities with the expectation that other things would follow. The major example of this is the work of well deepening and construction. Water is a crucial problem of the region. When in the first contact with villages, it was mentioned that there was a possibility that wells could be improved, this was taken as a promise, that in the minds of many, overshadowed all other aspects of the project. When the work took so long to start, the enthusiasm of many villagers diminished greatly, and in some cases turned to hostility.

In some areas of the project, particularly the Prefectures of Diourbel and Mbacke, attention on the important themes of tree planting is diverted by the competition between projects. Although the DCSR is making strong efforts at coordinating the inputs of forestry projects and the activities of Nongovernmental Organizations (NGO)s, there are still some problems. The Inspection Forestiere of Diourbel continues to hand out food from the World Food Program to villagers participating in reforestation activities. SODEVA villages complained strongly that they too should receive the food aid that their neighbors were getting, even though SODEVA does not deal in food aid. (In December 1986 the Inspection did make available quantities of foodstuffs which were distributed to SODEVA villages.)

The precarious financial and economic situation of villagers limits their ability to invest in tree planting. They need to see an immediate return on their work. Some of the long-term benefits of tree planting, particularly in soil conservation and improving soil fertility, are difficult for them to justify. Fruit trees are an investment that they are all willing to undertake and can be used as a beginning point to afterwards

introduce other things, such as windrows around the orchards. Also as older woodlots come into production, people are beginning to see them as a source of revenue and materials.

An example of this took place in the village of Babel, where in July 1987 an exercise in woodlot harvesting was held. Peace Corps trainees worked with villagers to harvest eucalyptus poles from a one hectare woodlot. This woodlot had been planted in 1983, with help from SODEVA and seedlings from the USAID sponsored Forêt de Bandia project. The PAFOCSE plantations are added on to it. The village's resident Volunteer, Leslie Welch, contacted local Eaux et Forêts authorities to gain their authorization and insure compliance with Senegal's forestry laws. 155 poles were harvested. A client from Mbour had already been found to purchase the poles at 500fcfa each; for a profit of 77,500fcfa for Babel. The poles will probably be used in construction or in fencing.

This was one of the first times a woodlot had been systematically and legally harvested. The operation was very successful. According to Ms. Welch, many of the villagers did not quite believe the trees actually belonged to them until after they were able to sell them and keep the profits. Another project village, Tatene Toucouleur near Thies, has been harvesting poles from a 1982 plantation and selling them at 200fcfa each.

*** Many of the smaller villages experience shortages of people able to carry out the necessary preparatory and maintenance work involved in tree planting. During the dry season most of the younger men go to the larger towns to find work or engage in commerce. In fact during village meetings the need for an improved water source to permit vegetable gardening and cattle fattening to provide money-earning opportunities in the village for the young people is an often expressed priority. During the rainy season most of the village labor force is concentrated in the fields. It takes a great deal of commitment and organization to get tree planting work accomplished. Several villages (Nquimbe for example) have instituted woodlot workdays with a fine system to insure everyone's participation.

*** A difficulty encountered in the maintenance of plantations was the conflict between community versus individual interests. Unless the village group was very well motivated and organized, followup work (weeding, fence maintenance, etc) tended to suffer. The project did offer the option to establish individual plantations with mixed results. (see section 5.3.4)

3.6 Audio-Visual Methods

An agroforestry brochure written in both phonetic and arabic scripts of Ouolof and containing numerous illustrations was distributed in June 1986. The brochure was also translated and printed in Serer. Fifteen copies were distributed to members of the village supervisory committees in each village. No evaluation has yet been made on the effectiveness of the brochure or on whether or not the CA used it in their extension messages.

Originally the project planned to produce a series of brochures each dealing with a specific aspect of the project, such as composting or village nurseries. However the project's financial difficulties ended those plans.

An aspect of SODEVA's original extension approach was to continue literacy training previously undertaken in the project villages. If this program had gone through, the audience for the brochure would have been broadened (although a considerable number of people are familiar with the arabic script of ouolof). These plans were never carried out, in spite of numerous meetings between project staff and CETAD trainers, due to failure to come to agreement on a viable training plan and budget, and questions as to whether or not this was an appropriate activity for the project to be involved in.

The project paper called for extensive use to be made of CETAD's considerable audio-visual capabilities in producing and disseminating extension programs for the villages. This collaboration did not take place as expected. The appropriateness of the video programs and slide shows that CETAD was used to producing, to the village setting of the project, was questioned. Instead, the project placed greater emphasis on using the CA in direct contact with villagers.

Also, as SODEVA's funding problems increased, branches of the company like CETAD, that could earn money by working for and charging outside projects, preferred that to working with an internal project that would not pay the same rates.

3.7 Village Exchange Visits

A series of exchange visits between villages, called "jumelage", was planned beginning in April 1986. Consequent conflicts in scheduling during the busy agricultural season and the project's financial limitations, delayed the program until June and July 1987. A contingent of visitors from several villages came to a host village. The day's program usually included visits and explanations of the hosts' agroforestry accomplishments, a joint work activity (usually plantation hole digging), a meeting to discuss activities and exchange ideas and a communal meal. Plans for an audio-visual program put on by SODEVA's CETAD had to be dropped after the first visit, due to the difficulties in finding a dark room. The CETAD did, however, film most of the activities on videotape. The tape now needs editing and condensing to a convenient length for use. The program of visits undertaken to date are as follows:

Date	Host	Guests
June 25	Keur Gallo Kebe	Merina Sarr, Ndialit
July 1	Thiendieng	Keur Balla Lo, Mbourouk Toucouleur
July 2	Sinthiane, Babel	Banane, Ndourene
July 9	Ngadiaga, Tabi	Nguimbe, Ndieffoune Pal, Ndieffoune Parba

The visits provided an opportunity for villagers to observe other villagers doing similar activities. They were able to exchange experiences and discuss problems. In each case the visits increased the motivation of the participants to undertake tree planting and agroforestry activities.

The project inputs to these activities included providing transportation for the guests (renting a bus) and financing the meal.

4.0 Logistical Arrangements/Project Inputs

4.1 Plant Production

Unlike many reforestation projects, the agroforestry pilot project did not produce its own plants. Instead the cooperative arrangements with other agencies, especially DCSR, provided the bulk of its plants. Table 1 shows the distribution of plants to project villages by source, year and by region over the life of the project.

Table 1 Plants Distributed for the Agroforestry Pilot Program by Source, Year and Region

<<< 1985 >>>					
SOURCES		THIES	DIOURBEL	TOTAL	% OF TOTAL
TOTAL		20095	24385	44480	
FOREST SP.			19926	19926	
FRUIT SP.			4459	4459	
INSP. FOR. DIOURBEL		300	300	600	1.34
INSP. FOR. THIES		5114		5114	11.49
SODEVA LOUGA		13121	5467	18588	41.78
SODEVA DIOURBEL			17786	17786	39.98
SODEVA KAOLACK				0	0.00
PROJ. VILL NURSERIES				0	0.00
OTHER VILL NURSERIES			832	832	1.87
PRIVATE NURSERIES		1560		1560	3.50
CETAD SODEVA				0	0.00
<<< 1986 >>>					
SOURCES		THIES	DIOURBEL	TOTAL	% OF TOTAL
TOTAL		39154	49526	88680	
FOREST SP.		25957	43003	68960	77.76
FRUIT SP.		7462	6523	13985	15.77
INSP. FOR. DIOURBEL			23539	23539	26.54
INSP. FOR. THIES		20771		20771	23.42
SODEVA LOUGA		9425	14991	24416	27.53
SODEVA DIOURBEL				0	0.00
SODEVA KAOLACK				0	0.00
PROJ. VILL NURSERIES		4918	8976	13894	15.66
OTHER VILL NURSERIES			460	460	0.51
PRIVATE NURSERIES		2497	1560	4057	4.57
CETAD		1543		1543	1.73

SOURCES	1987		TOTAL	% OF TOTAL
	THIES	DIOURBEL		
TOTAL	58739	56457	115196	
FOREST SP.	44522	50874	95396	82.81
FRUIT SP.	14216	5583	19799	17.18
INSP. FOR. DIOURBEL	3797	36387	40184	34.88
INSP. FOR. THIES (1)	20966		20966	18.20
SODEVA LOUGA	2982		2982	2.58
SODEVA DIOURBEL		0	0	0.00
SODEVA KAOLACK	2831	1985	4816	4.18
PROJ. VILL NURSERIES	13707	15467	29174	25.32
OTHER VILL NURSERIES			0	0.00
PRIVATE NURSERIES	14456	2618	17074	14.82
CETAD			0	0.00

(1) includes trees provided by DCSR Dakar and PREVINOBA

The arrangement with DCSR called for plants to be produced in the Inspection Forestiere nurseries. The DCSR was mandated to provide 60,000 seedlings per year, for which USAID agreed to pay 200fcfa per seedling, beginning in 1986. In 1985, DCSR provided 12.8% of the plants used. Funding for 1986 did not come until July of that year. The DCSR did, however, provide 50% of the plants used. For 1987, preliminary figures show DCSR providing 53.1% of plants used.

The DCSR is a new agency, created in 1985 from the breakup of the old Direction des Eaux et Forêts et Chasses. As the Inspections Forestieres continue to be under the direct responsibility of the Direction des Eaux et Forêts, there were sometimes coordination problems between Dakar and the regional offices. For this reason, the project had more contact with the Inspections, especially in coordinating plant production and deliveries. The Inspection Forestiere of Diourbel did a particularly good job in both 1986 and 1987 in supplying plants to the project, even beyond their requirements.

SODEVA's regional delegations also provided considerable support in plant production, especially in the first two years of the project. The nurseries at Diourbel and Louga together provided 82% of the trees distributed in 1985. In 1986, the Diourbel nursery was not functional, but Louga did provide 27.5% of plants distributed. In 1987 Kaolack provided many of the fruit trees used with 4.2% of the total. Louga contributed 2.6%.

Privately owned nurseries came to play an important part in the provision of trees, especially fruit trees. Prices varied, but averaged 60fcfa for forestry species and 200fcfa for fruit trees. The quality of trees taken from private nurseries was usually higher than in public agency nurseries. The use of private nurseries increased from 3.5% in 1985 to 4.5% and 14.9% in 1986 and 1987 respectively.

Village nurseries were an important part of the project's extension program, even though the number of plants ultimately produced did not cover all of the villagers' needs. These nurseries produced 15.7% of plants in 1986 and 25.3% in 1987. For a further discussion of village nurseries see section 5.9.

4.2 Material Support for the Project

4.2.1. Infrastructure

USAID's material support was limited to items directly necessary for the project. There was to be no infrastructure support for SODEVA as a whole.

SODEVA was responsible for providing transportation for its agents. As the project advanced this became more and more of a problem. The CA did have their own mopylettes, but in most cases these were old and often broken down. There were few resources for their repair which often limited CA's visits to their villages.

At the regional level the RR relied on the motor pools of the delegations. During the first two years of the project, transportation was usually available, although fuel was sometimes a problem. Beginning in 1986, the project did provide gasoline as needed. By 1987, Diourbel had no serviceable vehicles for field trips. This had one car that was seldom available. The RR were obliged to rely on the vehicle assigned to the T.A. forestry advisor, which limited the number of field trips they could take. The RR of Diourbel began doing his field trips on weekends, when the truck was available. These problems of SODEVA's inability to provide the agreed to level of support, through their lack of resources, did hinder the effective implementation of the agroforestry program.

USAID purchased two four-wheel drive Mitsubishi Pajeros. One was for the use of the long-term forestry advisor. The second was originally planned to be kept for consultants and the USAID staff to visit the project. When it became apparent that the SODEVA project director did not have adequate transportation to carry out her functions, USAID agreed to assign her the vehicle.

A ten-ton flatbed truck was purchased to transport seedlings and other project materials. The model acquired (Renault GLC 190) proved to be less than adequate for going to villages during the muddy conditions of the rainy season. A smaller four-wheel drive vehicle would have been more useful.

Six Honda 125cc motorcycles were purchased. Four were assigned to Peace Corps volunteers and two to the Eaux & Forêts (E&F) agents assigned in the Inspections Regionales. It should be noted that the E&F agents used their motorcycles primarily for routine inspection functions and coordination work in their nurseries, and not for field trips to project villages.

The PP called for the CA to receive an indemnity of approximately 40,000fcfa per month to defray their increased transportation expenses caused by their work on the project. Difficulties arose when agents worked in more than one project, each paying an indemnity. SODEVA regulations did not allow them to collect more than one indemnity at the same time.

To get around this problem and continue to provide a monetary incentive to the CA, USAID and SODEVA agreed in February 1986 to convert this indemnity into a bonus payment to reward superior performance. Subsequently, an evaluation system was worked out. The CA were separately evaluated by the project director, the T.A. forester and their respective RR. The grades were averaged to provide a score for each agent based on the achievements of their villages and their effectiveness as extension agents. Bonus payments were made on a semi-annual basis beginning in July 1986. Payments ranged from 0 to 120,000fcfa per period, with most agents receiving 80,000 to 90,000fcfa. The RR and the chef de secteurs also received bonuses.

4.2.2. Tools and Materials for Villages

Beginning in 1985 and continuing through 1987, tools were distributed to the village supervisory committees. At first these were primarily for demonstration purposes with one of each type provided. As time went on and project resources permitted, greater numbers of tools were provided. Greater support was given to villages with nurseries. This included providing plastic sacks. Table 2 gives a breakdown of what was provided in each village.

Table 2. Tools Distributed to Project Villages

	2 200l. barrels
	2 20m. hoses
*	1 watering can
*	1 sieve for soil
*	1 spray adjustor
*	plastic nursery pots
	1 round shovel
	1 flat shovel
	1 100m. cord for measuring plantation
	1 5m. string for measuring spacing between trees
	1 plastic pail
	1 plastic basin
	1 knife to cut open pots
*	1 sack of 5kg. Mocap
	1 sack 10-15kg. dielpoudre
*	1 sack 15-20 kg. rat poison

*-Items given to villages with seedling nurseries

In addition 17 portable eucalyptus germination beds left over from a previous project were given out in Thies.

Note that numbers of items given to each village did vary, depending on individual needs and the availability of materials.

The project also had two signs made for each village with the village's name painted under the project's insignia. This was to provide an identity for the project in the minds of the villagers and create publicity for the project. Larger signs were ordered by the project director in June 1987.

In the first half of 1986, T-shirts and caps with the project logo were distributed to members of the village supervisory committees as part of the extension and promotional effort.

4.2.3. Chemical Pesticides, Seeds

The project furnished pesticides for use on wodlots and in village nurseries based on current practice in Senegal and on the advice of DRPF researchers. Among these were:

dieldrin powder (dielpoudre) for use during tree plantation as anti-termite protection and also for follow-up treatments as needed. At times when the project was unable to provide enough dielpoudre to all the villages, mortality of newly planted seedlings was considerably higher.

Maposol a combination herbicide-fungicide-insecticide liquid for use in preparation of potting soil for nurseries. As it requires at least a fifteen day lead time from application to sowing and there was never enough lead time in the preparation of the nurseries, it was never used for this purpose. However, in the 1987 season, due to the lack of dielpoudre, it was used by some villages to pretreat tree planting holes.

Mocap an insecticide used to treat potting media. It proved to be more useful for villages since it required no lead time before sowing. This was sometimes used in preparation of planting holes.

rat poison a mixture of assorted grains coated with poison for use in village nurseries. However, the numbers of rats made its application less than effective even after reinforcing the pesticide dosage.

Several of the CA experimented with cypermethrine dimethoate when the project was unable to provide enough dielpoudre. This is an insecticide for use on niebe plants provided under another SODEVA project. It seemed to give good results to eliminate termites infestations. The use of such heavy duty chemicals was warranted by the extreme danger of termite and other insect attacks to the plantations.

The project provided improved varieties of various vegetables to the project villages in April 1986. These were distributed on a cost reimburseable basis after the harvest.

The project also provided tree seeds for village nurseries. For 1986, seeds were obtained from DRPF. In 1987 they were purchased from local sources. Among the species used were Prosopis, Eucalyptus, Leucaena, two Australian Acacias and several local Acacias.

4.3 Logistical Organization of Plant Distribution

The tree planting season in the Sahel is generally very short. There is usually only a very limited time when the soil has received enough rain to permit planting and enough rains will follow to maximize the chances of survival of the young trees. It is critically important that the trees arrive on time and that they are planted as soon as possible.

The tree distribution was coordinated by the PP, based on the demands for trees previously expressed by the village supervisory committees. Based on what was available in nurseries, trees were sent to villages as soon as possible. In 1985 and 1986, trees were not delivered until adequate rains had fallen, which resulted in distribution bottlenecks that prevented some villages receiving trees on time.

In 1987, many villagers agreed to take trees earlier and water them until the time was ready for planting. Consequently, tree delivery was able to finish sooner, with probably a better chance of survival of the trees delivered. Diourbel finished by August 25. Thies finished the bulk of the deliveries by the end of August, with some fruit tree deliveries continuing until mid-September.

The single project truck was not sufficient by itself to do the job. Vehicles from the Inspections Forestieres of Thies, Diourbel and Louga were also used. The pickup trucks of the SODEVA chefs de secteur were useful in delivering small numbers of trees, or going to where the larger trucks couldn't. In addition, three large trucks of SODEVA's FIDA project helped out in 1987.

4.4 Water Resources

The PP provided substantial amounts of money to deepen existing wells or dig new wells in project villages in order to facilitate vegetable gardening, nurseries and composting. The road to implementing this activity was tortuous indeed.

In December 1985, the Service Hydraulique Rurale regional offices of Thies and Diourbel were asked to visit the then 29 project villages to assess their water resource needs. The two regional offices also developed cost estimates for the necessary work. From their study it was determined that 10 new wells had to be dug and 18 older wells repaired.

Funding for the well work was provided in a Project Implementation Letter in March 1986. After the well specifications and cost estimates were submitted in January 1986, the project management decided to solicit estimates from private companies.

Following the reception of bids from several companies, one was selected. Following a lengthy administrative procedure to negotiate a contract and gain administrative and technical approval from SODEVA and USAID management, a contract was signed in February 1987 by the director general of SODEVA. The first advance payment was received by the contractor in April 1987.

Work did not begin on the first three of the new wells until August 1987.

At this writing, little progress has been made on the well work. Disputes between SODEVA and the contractor make it unlikely that the work will be completed before the end of the project. The lateness of this work has already had an adverse impact on the success of project activities. The water situation of the Peanut Basin is so serious that, rightly or wrongly, many of the villagers base their enthusiasm for the projects' activities on the acquisition of improved water resources. The project is currently examining the possibility of using Service Hydraulique to complete the remaining work not finished by the contractor. The project will be unable to assist the villages that started with the project in 1986 and 1987.

5.0 Technical Package Description/Results

5.1 Definition of Agroforestry

One of the major constraints of agriculture in the Peanut Basin of Senegal has been the declining fertility and physical degradation of the soils leading to ever poorer crop yields. Continued demographic growth prevents any land being taken out of production to be put into fallow for any lengthy time that would naturally restore soil fertility. Adding to this the area's poor rainfall, farming becomes very risky indeed. The major goal of the project was to provide a technical package to villagers that would enable them to continue agricultural production on the same land, and to halt or reverse its degradation. At the same time the techniques used had to be simple enough so that the villagers could manage and continue their use even after the end of the project.

According to Nair (1984): "Agroforestry represents an approach to integrated land use involving the deliberate mixture or retention of trees or other woody perennials as part of the crop/animal production enterprises. Thus, it combines elements of agriculture, whether crop- or animal-based, with elements of forestry in sustainable production patterns on the same piece of land, either simultaneously or sequentially. The objective of most agroforestry systems is to optimize any beneficial effects of the interactions of the woody components with the crop and/or animal components to obtain a production pattern that, in terms of total quantity, diversity of end-products, or sustainability, is preferable to what is usually obtained from the same resources under prevailing social, ecological and economic conditions."

None of the technical ideas proposed to villagers under this project are particularly new. All have been tried at one point or another in the area, especially in SODEVA's previous extension programs. What is new is the attempt to put them all together in a package that could be managed and carried out by the villagers themselves.

5.2 Project Working Objectives

During 1985, the first year of the project, the CA were given standardized objectives for their villages to complete. These included a one kilometer windbreak and a one hectare woodlot.

Although as much as possible, responsibility for determining individual village objectives was left up to the village supervisory committees, with the advice of their CA, it was found to be necessary to establish a minimum set of objectives for the 1986 season to serve as guidelines. These are listed in table 3.

Table 3: Village Agroforestry Objectives

In Villages in Their Second Year

1. Replanting of trees lost in the woodlot.
2. Two hectare extension of the woodlot either in a communal woodlot or in individual plantings.
3. Replanting of trees lost in the windbreak.
4. Extension of the windbreak by 500m.
5. Planting of fruit trees either communally or individually, provided that the other objectives are met.
6. Planting of at least 100 cadd in fields, and protection of an equal number of natural regeneration trees.
7. The establishment of five compost pits in each village.
8. Construction of at least one improved woodstove in each quartier.
9. Intercropping of low crops in the woodlots and individual plantings, and vegetable gardens in woodlots where water supplies are adequate.

In Villages in Their First Year

1. Planting of one hectare of forestry species in a communal woodlot and one hectare in individual lots.
2. Planting of a two km windbreak.
3. Planting of a separate fruit tree orchard provided other objectives are met.
4. Protection of cadd, same as above.
5. Establishment of compost pits, same as above.
6. Woodstove construction, same as above
7. Intercropping and vegetable gardens, same as above.

Difficulties that many village groups had in fulfilling these objectives and the fact that each village had its own aspirations and problems led to a more open procedure in 1987. Following meetings held with the CA at the prefecture level in June, individual objectives were discussed and adopted for each village subject to approval by the villagers. Because of limitations encountered in many villages to expansion of the community plantations, emphasis was placed on individual plantations. The Programme Technique that was to have come out of these meetings was not completed due to a change of project directors.

5.3 Plantation Types, Discussion of Results

Achievements of the project in reforestation and agroforestry along with survival rates at various times are given in Tables 4 and 5.

Table 4 Overall Project Plantation Achievements (1985-1987)

Plantation Type	Area (hectares)	Length (Kilometers)
Community Woodlot	74.4	
Community Orchard	30.8	
Community Windbreak		61.6
Community Windrow		25.7
Individual Woodlot	0.3	
Individual Windrow		12.0
Individual Plantings (in fields and orchards)	103.6	
Compound Plantings 20400 plants		
Acacia albida regeneration	215.1	

Note that the Protection of Acacia albida in fields is an estimate based on the number of trees planted.

These figures count only new plantations and not the replanting of lost trees each year.

However, these figures are only indicative and not necessarily reliable for the following noted reasons.

1. Spacing of trees varies greatly between plantations.
2. Estimates of the area planted are not uniform.
3. The low survival rates of trees planted, especially in the windbreaks, means that area or length estimations are only valid at the moment of planting.

Table 5 1987 Plantation Achievements in Detail

New Plantations

	Diourbel			Thies			Total Project		
	No. vill.	Dim. (ha./km.)	No. plants	No. vill.	Dim. (ha./km.)	No. plants	No. vill.	Dim. (ha./km.)	No. plants
Community Woodlot	9	6.3	3436	8	4.7	4049	17	11.0	7485
Community Orchard	9	5.6	2125	3	2.1(1)	496	12	7.7	2621
Community Windbreak	9	4.5	3112	3	2.8	2585	12	7.3	5697
Community Windrow	21	7.6	9689	9	8.5	3553	30	16.1	13242
Individual Woodlot	1	0.3	374	-	-	-	1	0.3	375
Individual Orchards	3	1.1	418	15	31.5	4439	18	32.6	4857
Individual Windrows	3	1.7	1600	10	10.3	5697	13	12.0	7297
Acacia albida regeneration	14	102.6	2420	-	-	-	14	102.6	2420
Individual Field Plantings (at wide spacings)	9	22.8	1843	15	80.8	12037	24	103.6	1388
Compound Plantings	19	-	3892	17	-	9496	36	-	13388

Mortality Replacement Plantings

	Diourbel			Thies			Total Project		
	No. vill.	Dim. (ha./km.)	No. plants	No. vill.	Dim. (ha./km.)	No. plants	No. vill.	Dim. (ha./km.)	No. plants
Community Woodlot	28	34.7	7906	14	14 (1)	8395	42	48.7	16301
Community Orchard	23	8.6	2107	11	4.7(1)	1646	34	13.3	3753
Community Windbreak	29	28.1	12360	8	7.7	2749	37	35.8	15108
Community Windrow	5	1.2	591	1	(1)	924	6	1.2	1515
Individual Woodlot	-	-	-	2	11.3	2665	2	11.3	2665
Individual Orchards									
Individual Windrows									
Acacia albida regeneration									
Individual Field Plantings (at wide spacings)									
Compound Plantings	-	-	-	1	-	33	1	-	33

(1) Area or length information not complete.

Of the nearly 45,000 trees distributed to all project villages in 1985, Diourbel reported 82% in forestry and fodder trees (Prosopis, Eucalyptus and Acacia holosericea and linnaroides) 18% in fruit trees (mango, citron and qoyave). Thies had a similar distribution.

In 1986 and 1987 greater efforts were made to use local and more drought resistant species. Table 6 shows the distribution of trees delivered to villages in both years.

Table 6 Percentages of Various Tree Species Included in Trees Distributed to Project Villages in 1986 and 1987

Forestry and Forage Species	1986		1987		Total Project 1987
	Diourbel	Thies	Diourbel	Thies	
Eucalyptus Cawaldulensis	16	62	7	36	20
Prosopis juliflora	62	24	52	34	43
Acacia holosericea	5	6	14	1	8
Acacia occidentales	6	-	6	7	6
Acacia senegal	8	-	-	a	a
Parinsonia aculeata	b	-	5	4	4
Acacia linnaroides	-	-	7	2	4
Acacia nilotica	b	-	3	3	3
Acacia albida	b	-	6	2	4
Albanites aegyptiaca	-	-	-	3	1
Leucaena leucocephala	b	-	c	1	1
Fruit Tree Species					
Mango	5	51	9	35	27
Lemon	57	23	27	42	38
Guava	24	7.5	39	17	23
Other (d)		7.5	25	7	12

- The above listed and following species make up 82% of the trees used in Thies and 42% of the total project in 1987: Flamboyant, Acacia raddiana, A.seyal, A. bivenosa, Tamarindus indica and Ziziphus mauritiana. In addition 200 henna plants were also delivered in Thies.

- The above listed and the following species made up 112% of the total used in Diourbel in 1986: Acacia raddiana and A. tortillis.

- Only 250 leucaena were used in Diourbel in 1987.

- Others includes mandarins, grenadines, carassoliers, papayas and grapefruits.

Note: A dash indicates species not used. Percentages are for the category of tree (either forestry or fruit) and not for the total number of trees used.

Due to losses before and during planting, the number of trees actually planted is somewhat less than that of trees delivered; but the proportions of species should be roughly the same.

5.3.1. Community Woodlots

Each of the villages was expected to plant a communal woodlot of at least one hectare. The thirty villages then participating in the project planted 32.5 hectares of woodlots in 1985. By 1986, with 57 villages, the total had grown to 63.4 hectares. In 1987 11 hectares of new community woodlots were added.

Objectives for the 1985 season called for one third of the woodlot to be in fruit tree species such as mangoes, lemons and guavas. These were by far the most popular. Most villages have had some previous experience in growing them.

One third of the woodlot was to be in species known primarily for their value as animal fodder. Principal among these were two Australian Acacias, *A. holosericea* and *A. linnaroides*. These are experimental, having been introduced in the past few years. So far they seem to be doing well. *Prosopis* was also used for this purpose in a few villages. Given the great need for animal fodder, especially at the end of the dry season, and the strong market that exists for hay and peanut plants, trees with a high fodder value should be quite popular.

The final third of the plantation was to be devoted to "forestry" species, primarily for the production of firewood and poles. One of the major species used was *Eucalyptus*. Even though most of this region falls below the minimum rainfall needed by *Eucalyptus*, it is still one of the most popular species. This is because it has been strongly pushed in the past. Villagers appreciate its straight poles, and it is often used in local medicine. Most nurseries in the region know how to propagate it. Other species used include *Prosopis* and several of the local Acacias. *A. senegal* and *A. nilotica* do well in plantings, but their slow initial growth can be discouraging to villagers, even though in the long run, they are most apt to survive. For the 1986 and 1987 seasons greater emphasis was placed on the hardier local species and on *Prosopis*.

The trees actually planted depended on species availability in local nurseries. Although the one third distribution was the norm, it was not possible to follow in all cases. Villager preference also had to be taken into account. The desire for fruit trees was very strong. In three of the villages in the Diourbel region, only fruit trees were planted.

Spacing of the trees varied between the two regions and among different villages according to the recommendations of the CA and the desires of the villagers. In Diourbel fruit trees were usually planted 5m X 5m, while all others were 3m X 3m. In Thies forestry species were planted 5m X 2.5m. Forrage trees were spaced 3m X 3m. Fruit trees were planted 5m X 5m and 10m X 10m according to species. Some woodlots were planted at 3m X 3m. Some were planted irregularly.

In March 1986, the survival rates for the woodlots of 1985 were 83% in Thies and 85% in Diourbel. By August 1986, these had dropped to 75% and 70% in Thies and Diourbel respectively. Combined survival rates for all species in the community woodlots after two years of growth were 62% in Diourbel, 58% in Thies and 58% for the two regions combined. Survival rates may actually be slightly higher since the CA included replacement plantings for trees that died after one year in the total number of trees planted.

One of the major advantages of the community woodlots is that their layout, with a relatively more easily defined perimeter, allows for more secure protection. The woodlots provide visible achievement for village groups to focus their efforts on. The community woodlot lends itself to vegetable gardening or inter-

cropping if other inputs (such as seeds and a nearby source of water) are available.

Among the principle problems of this type of plantation is the difficulty in motivating groups of people to participate in the work. It requires strong community organization to ensure that maintenance operations are carried out over the long-term. Part of the importance of the CA is that their presence in the village serves as a reminder and encouragement. In the long run there will be the question of the division of benefits. This shouldn't be too much of a problem since the villages have a tradition of having a community fund. The recent program to organize Groupements d'Interet Economique (G.I.E.) in the villages consolidates this form of cooperation.

Community woodlots have had a tendency to isolate reforestation efforts and to prevent people from trying other things. Villagers point to their small block of trees as an end in itself. If the goal of agroforestry is to combine trees with agriculture, then this limiting tendency must be overcome. Villagers often see the woodlot as tying up useful land and do not wish to expand after their first one or two hectares. The extension agents must emphasize that this is not land lost by explaining its production and conservation possibilities.

5.3.2 Village Orchards

Starting in the 1986 season, the project's objectives included creating a separate fruit tree orchard on a site that would be more favorable for their survival (that is nearer to a source of water or on an area protected from the wind) than what is usually accorded to the village woodlots. 23.1 hectares of community orchards were reported by the CA. An additional 7.7 hectares were added in 1987. Those villages with this type of plantation experienced a 59% survival rate in Diourbel, 17% in Thies and 44% for the project as a whole in June and July 1987. Note that some villages kept the fruit trees in the community woodlot, but counted the fruit tree section separately.

The PPS called for all fruit trees to be sold at full cost to the participants. As a practical matter, recovering the cost of these from villagers was not possible. The fruit trees were seen as an incentive to interest reluctant villages in tree planting. Also, with so many of the other promised project inputs arriving late or not at all, it would have been very difficult to sell them.

An advantage of the community orchards is that even though it is a community effort, a strong motivation exists to succeed. People are very aware of the profitability of fruit trees. There is strong motivation to locate fruit tree orchards on more favorable sites with more fertile soils and nearer a watering source. This permits activities like vegetable gardening or intercropping to be carried out on the same spot, which in turn will provide greater care for the trees. It is a good beginning point to introduce further agroforestry activities, such as the planting of protective windrows.

Among the disadvantages are that fruit tree orchards may monopolize all villagers' efforts so that fuelwood and fodder trees or windbreaks are not planted.

5.3.3 Windbreaks

In 1985, 26.7 kilometers of windbreaks were planted. After the 1986 season this had been extended to 54.3 km. During the 1987 season only 7.7 hectares of new windbreaks were planted along with extensive replantings in the old plantations.

During the first planting season, each village was to plant at least one kilometer of windbreaks in double lines. Objectives for 1986 and 1987 called for extension of the windbreaks where possible and replanting of trees lost. In Thies they were spaced either 5m or 3m between trees and 3m between the lines. In Diourbel all the windbreaks were 3m between trees and 3m between lines. There was no technical reason for this difference.

The species used was usually *Prosopis* because of its fast growth, hardiness and dense foliage. Cashews have often been used in the past for this purpose. Several villages used it either in part, or in whole. Since the rainfall in this region is at the low end of cashew's tolerance, and because of its susceptibility to rodent attacks, cashew does not survive as well. *Acacia senegal* was used in several villages in the Ti-vaquane sector of Thies. The trees planted, though quite small compared to fast-growing exotics, are doing well.

Windbreaks continue to be the most difficult aspect of the program to succeed. Survival rates in March 1986 for the 1985 windbreaks were 51% in Thies and 36% in Diourbel. This had dropped to 23% and 26% in Thies and Diourbel respectively by August 1986. Cumulative survival rates after two years were 35% for Diourbel, 34% in Thies and 34% for the project as a whole in June and July 1987. In many of the project villages, the entire windbreak was destroyed. Often the trees left are merely leafless stems that continue to show some green. Both SODEVA staff and the villagers are discouraged over the whole windbreak program.

The extremely poor results of the windbreaks call their use into question. On the technical side there is no doubt that windbreaks are a useful way to stop soil erosion, especially in areas with light, sandy soils as is found in the Peanut Basin. The problem with windbreaks comes with their acceptance by villagers and the practical difficulties with their maintenance. For most of the farmers, the establishment of windbreaks means that valuable land is lost to crops. This has been especially evident when one or two landowners refuse to allow the communal windbreak to cross their fields. Future efforts to establish windbreaks must emphasize that the land will not be lost. For the first few years crops can still be grown with the trees. When the trees are bigger there is the protection they afford. Also, the trees can be expected to provide secondary products of animal fodder, poles and fuel over the life of the windbreak.

The issue of windbreaks may also be related to land tenure. Many of the villages placed their windbreaks on the outer edge of the village's lands to serve as a boundary marker. It was often difficult to get people to agree to let the trees be planted on their land. If the planting of the trees is a traditional sign of land ownership, then planting of windbreaks will have to be promoted in cooperation with those who control the land.

As a practical matter, the maintenance of a windbreak is extremely difficult. The young trees are much more exposed to wind desiccation or damage from windblown sand. The long lines of trees are especially vulnerable to grazing livestock. The importance of planting the seedlings at the correct time with large holes becomes very evident here. Until the conflict between the extensive land use strategy of letting animals roam free and the more intensive one of planting trees is resolved, only chain link or barbed wire fencing could ensure the protection of the windbreak.

Beginning in the 1986 season windrows (tightly spaced rows usually of *Prosopis* or *Acacia* sp.) were planted around the interior perimeter of village woodlots or fruit tree orchards for wind protection. 9.6 kilometers of this type of plantation were reported, with an additional 16.1 kilometers added in 1987. Sometimes they were planted around compounds within villages. Survival was 75% in Diourbel, 37% in Thies and 62% for the project as a whole.

5.3.4 Individual Plantations

Individual plantations, whether of trees dispersed in fields or in small private woodlots of one quarter to one half hectare did not perform as well as expected, although there is still a great demand for this type of plantation on the part of the villagers. Difficulties may have come from the fact that often the individual plantations may have been served after the community plantations in the distribution of plants. Also the difficulties in watering and protection from animals are very severe. Almost twenty hectares of this type of plantation were reported in 1986. One year survival rates were 54% for Diourbel, 34% for Thies and 37% for the project as a whole.

Plantations within compounds, usually of fruit trees, had a survival rate of 44% in Diourbel, 56% in Thies and 48% for the project as a whole. Here again the difficulties experienced in protection and watering are very important. The major advantage for promoting individual plantations is that motivation to succeed is quite strong. The ownership of the trees and the distribution of any possible benefits is clear.

A serious objection raised by the CA was that the individual plantations would eclipse the communal efforts. So far the strong communal orientation of the project with the village supervisory committee has prevented this from happening.

5.3.5. Regeneration of Acacia albida in Fields

Acacia albida, called kad in oulof, have been a traditional part of the farming system throughout this region. In many villages not enough new kads have been allowed to survive to replace the older ones. In the 1985 season in the Diourbel region, 100 or more kad seedlings were distributed to each village for planting in fields. In 1986 and 1987, more trees were distributed to interested villages. These trees are perhaps more difficult to protect than the windbreaks. Kad foliage is an extremely good fodder. In fact, branches from older trees are continually lopped off to provide forage for local animals. Therefore the trees need extensive protection which villagers seldom provide. Transplanted kad are difficult to establish due to their long taproot, which, if damaged, results in the mortality of the plant.

In many of the village woodlots, just the act of fencing has allowed an abundant natural regeneration of kad to sprout up. These trees have a greater chance of succeeding since their taproot is well established. In fact, protection of naturally occurring kad seedlings may prove to be a much more efficient way of regenerating the species. The CA have promoted protection of natural regeneration in their meetings with villagers.

Both the planting of Acacia albida and protection of natural regeneration require confirmed long-term ownership of the land in question. The unsure land tenure situation and the inability of villagers to control access to the land (especially grazing use) limit the effectiveness of this necessary activity.

5.4 Plantation Protection and Maintenance

The usual method of protecting the woodlots was by planting euphorbia bushes on the periphery. This natural fencing was reinforced with thorn bushes and branches (often from Acacia albida trees) until the euphorbia grew together. Several villages used only branches and thorns woven together. Some of the fences were reinforced with rubber waste mats provided by the project. The large number of animals and the scarcity of fodder during the dry season made vigilant maintenance of the fence extremely important. Those village groups that were able to maintain their fences had a better success rate. Many villages, especially in the Bambey and Diourbel sectors, faced a severe lack of materials for constructing fences. The people pointed out the absurdity of having to deforest (i.e. cut kad trees) to protect their plantations.

Protection from grazing animals is the major problem of the windbreaks. The long lines of seedlings are often nearly impossible to protect from browsers. There are several types of protection used. The woven branches (with leaves) of Combretum shrubs, resembling baskets, would seem to be most efficient. However, they are often not made wide or tall enough, and can end up strangling the trees. Also, they can be easily overturned by cattle. Combinations of thorn branches and sticks work better to avoid the problem of excess shade. But hungry goats can penetrate them.

The project has provided approximately 15,000 rubber waste mats from the manufacture of rubber sandals to most of the villages. These do work well if adequately supported by a framework of sticks and thorns. However, there weren't enough available to really fulfill all the demand.

An interesting development in the use of the rubber mats came in the village of Thiendieng in Diourbel. There the villagers set up a fence of the mats around the surviving portion of the windbreak. The usual method of installing the rubber mats is to stake one or two around each individual tree. The importance of this experience is that the windbreak was protected as a unit, instead of each tree by itself. Exposure to browsing animals is therefore reduced. This seemed to work well, although it consumed alot more mats.

Ideally, once planted, the trees should not need further watering. However, the unreliability of the rains and the often poor quality of some of the seedlings used, have made watering a necessity in many villages. Watering of trees is a definite hardship for the villagers, whose supply of water is very low to start out with. Most are unable to continue watering much beyond January. Although they try to continue watering the fruit trees, it is often not enough. For this reason, the project has tried to shift fruit trees to individual plantings and to reduce their number, in spite of the great demand from the villagers.

Wind dessication is a problem where the trees are exposed to the full force of the Harmattan with no screening from fencing, nearby shrubs or land formations. Mango trees have proved to be particularly sensitive. These require individual mats or woven grass protection, at least for the first year. Prosopis, Acacia holosericea and local acacia species are the least bothered by the winds.

Insect damage came primarily from termites. Eucalyptus are particularly susceptible and require the protection of pesticides. Rodents are attracted to cashew trees, which require some form of poison or wire mesh to be effectively protected.

5.5 Intercropping of Plantations

Intercropping within the woodlots and fruit tree orchards has been encouraged in each of the project villages. SODEVA's niebe seed distribution program provided a source of seeds for use. Results of intercropping in the woodlots were not systematically measured at the end of the 1986 campaign. Diourbel reported 11 villages doing intercropping of niebe or cowpea, with 180 kg of seeds yielding a 1,553 kg harvest. Harvest results from Thies are incomplete. Nine villages planted niebe. Five intercropped with peanuts.

Other crops tried in intercropping were manioc, beref (a type of melon) and peanuts.

More research needs to be done to determine the proper spacings and what effects intercropping has on the trees and the crops under the harsh growing conditions prevalent in the area. Also, competition for available moisture and possible adverse competition between the trees and annual crops needs to be studied.

Ideally, intercropping provides an important incentive for villagers to do the weeding necessary for tree maintenance, especially in areas with higher rainfall, such as Mbour. It is hoped that the annual crops will benefit from wind protection and improved soil fertility from nitrogen fixing trees.

For the 1987 season approximately 2,500 kilograms of peanuts were loaned to villages for use in intercropping. The performance of the peanuts will be followed closely by the CA and compared with yields of peanuts grown outside the woodlots. This will provide an estimate of the effects of intercropping on crop yields under actual field conditions. Under the terms of contracts signed between SODEVA and village supervisory committees, the cost of the seeds will be repaid before the end of the project.

5.6 Improved woodstoves

The project promoted the use of improved woodstoves, called "ban-ak-suuf", in project villages. In cooperation with CERER (the Centre d'Etude et de Recherche sur les Energies Renouvelables) field teams approximately 500 stoves were built in the Diourbel region in 1986 with a similar number in Thies. During sessions with CERER trainers and masons, village women learned to build and repair the mud stoves themselves. This is one of the most popular of the project's activities, which has also spread to surrounding villages. Most of the stoves are still in use. For 1987, training planned for the CA to learn the techniques of stove construction and dissemination did not take place due to the project's financial difficulties.

5.7 Composting

In its past agricultural extension programs, SODEVA has linked production of compost and improved manure to its promotion of cattle fattening in villages. The two aspects are still linked in villagers' and field agents' minds, even though the cattle fattening is no longer as widely practiced as it once was due to a lack of credit programs and sufficient water and feed.

The agroforestry project has promoted the more efficient use of manure and agricultural wastes that are otherwise lost. In many of the villages there are piles of straw or peanut wastes lying around along with manure from goats, sheep, horses and donkeys. If composted, this material could make a valuable addition to the fields and vegetable gardens.

As part of its 1986 campaign, the project planned to aid villagers by providing cement and, if necessary, the services of a mason, to line the pits they would dig. Objectives called for five compost pits to be dug in each village. Each pit was to have the dimensions 1 meter deep by 1 meter wide, and as long as was needed. Water needed for the composting process could

come from waste water, and the new or improved wells the project was to provide. Although this effort would not provide the quantity of compost traditionally recommended by ISPA (ten tons per hectare), the addition of any new organic matter to the degraded soils of the region would be helpful.

The difficulties in project funding prevented the execution of this activity. Villages that had dug pits had problems with the pits falling in due to the sandy soils. 28 pits were dug in 1986 in Diourbel, and a smaller number in Thies. Many of these were used, however, to provide compost for the millet crop.

On the resumption of project funding in April 1987, the project management decided to contract out the construction of the compost pits to facilitate administration of the program and ensure uniformity and quality of the pits. At this writing, this idea has not received the approval of senior SODEVA or USAID management.

5.8 Soil and Water Conservation

The possibility of constructing retaining walls to reduce surface runoff or of deepening areas where rain-water stagnates to facilitate water conservation was examined in several of the project villages. Lack of technical assessment, time and resources prevented any great development of this activity.

5.9 Village Nurseries

As part of its efforts to make villagers as self-reliant as possible in their tree planting activities, village nurseries were established on a voluntary basis starting in 1986. In that year ten villages in Diourbel and thirteen in Thies attempted nurseries. Although experiencing many difficulties, these nurseries did quite well. For 1986 those in Diourbel produced almost 9000 plants and Thies produced almost 12000. Production figures for 1987 were 13700 in Thies with 13 nurseries and 15467 seedlings planted in Diourbel from a production of 21444 seedlings with 13 nurseries. The excess seedlings may have been used in other villages. Diourbel also reports a 63% success rate overall for sacks filled and sown.

The project provided tools (Table 2) and seeds as available. Villagers provided labor, water, potting soil, a nursery site and protection materials. In 1987, woven bamboo mats, called "crintings", were provided for nurseries in Diourbel. Technical advice came from the C.A., who had undergone a training program in January 1986 and were given a technical manual.

The major difficulty encountered was in watering. Although the nursery program was undertaken only on a voluntary basis, virtually all of the villages experienced difficulties at some point with an inadequate supply of water. The well improvement program provided for in the project, but not yet completed due to problems with the local well contractor, would certainly relieve this situation.

Plant pests proved to be a very serious problem. Birds, rodents, insects, and fungi were all drawn to the nursery sites, often with catastrophic results. The project did provide rat

poison. However, the great numbers of rats and the relative impotency of the poison combined to reduce its effectiveness. The nurseries started too late to use the Maposol suggested by the DRPF (a general insecticide/fungicide/herbicide requiring at least a fifteen day interval between application and sowing of seeds). However, the Mocap substituted did prove to be an effective insecticide.

An additional consideration with the village nurseries, was the organization of the people. This activity was presented as a community effort. Therefore, where the group was well organized, the results were impressive. Where disagreements arose, or where people did not have such organization, the results suffered. Often a single volunteer took responsibility for overseeing the nursery work. Even without having benefitted from a formal training program, there were enough success stories to merit the continuation of village nurseries, with the proper inputs and followup.

For 1987, the project agreed to pay villagers 35fcfa per plant of surplus tree production beyond their own needs that could be used in other villages. The price was in line with a proposal from the DCSR, in their January 1987 project coordination meeting to sell forestry species seedlings at this cost. A total of 4435 seedlings were taken from nurseries in Diourbel for this purpose.

6.0 Research Activities

The DRPF began research activities under its own financing in 1985, on its research stations at Bandia and Thienaba. Among the trials started were:

- o A study of the effects on crop yields of growing niebe under a seven year old plantation of three different species of local acacias;
- o A study of the effectiveness and best spacing for windbreaks of Australian acacias; and
- o A study of the influence of various combinations of planting spacings and species of local trees on crop yields of niebe.

None of these studies were carried on into the 1986 season due to the lateness of funding and differences over project support (a vehicle requested by DRPF and refused by USAID) to be provided to DRPF.

After DRPF participation in the project ended in March 1987, a meeting was held April 8 between project and USAID staff to explore ways to continue some of the research activities outlined in P.I.L. 26. Following these discussions terms of reference were drawn up to conduct a study of soil conditions in project villages including the following trials:

- o Field sampling and laboratory analysis of soils from seven project villages to determine their degree of degradation and relative fertility;
- o Studies of the effects of nitrogen-fixing trees on

- o crop yields; and
- o Studies of the effects of composting on soil fertility.

Bids were received from two of the three local consulting firms contacted. Because of the time constraints (only one working season available), it was decided to conduct only the first study. A contract was signed between the firm selected (Sen-agrosol) and SODEVA on June 17. The contract was funded from the consultant/subcontract line item of the technical assistance contract between USAID and ISTI for the project. Field work began June 20. The preliminary report was submitted for review on October 25 and the final report on October 26.

Two terms of reference for further studies were drawn up, and sent out to local consulting firms in mid-September 1987. These studies are outlined below.

1. A survey of villager attitudes towards agroforestry activities undertaken to date and of plans they may have to continue these activities after the end of the project. Their impressions of the various tree species used are also to be examined. The survey is to take into account differences among social and economic groups in the villages. 15 villages are being sampled.

2. A systematic evaluation of the silvicultural response of the species used in the different types of plantations under various ecological and human-influenced growing conditions. The study is also to evaluate the efficiency and cost of the different types of fencing used. Also, the study involves taking detailed measurements in 15 of the project villages.

Bids were examined for technical competence and cost by a committee made up of SODEVA financial management and project staff. Final selection of the consulting firms was made October 5. The results were submitted to USAID for approval. Contracts were signed between SODEVA and the firms during the week of October 26, with work beginning immediately. Funding is through the same mechanism as for the soil study. Work on both studies will be completed before the end of project funding at the end of December, 1987.

7.0 Participant Training

The project objectives outlined in the PP estimated that 20 Senegalese from SODEVA and participating agencies would receive training in the management and evaluation of agroforestry and soil conservation activities either in third countries or in the United States. The CA would receive in-country training in various agroforestry and soil conservation practices and extension methods, primarily using SODEVA's CETAD, or other facilities.

Training activities and programs undertaken under the project are outlined below.

An introductory training session for the CA and representatives of participating agencies was held on July 18 and 19, 1985 at CETAD. An introduction to the project's objectives and working methods was given by the project director, R.D. Fall. Michel Cazet of DRPF gave a primer on plantation silviculture. The fruit tree experiment station at MBoro was visited to provide an introduction to fruit tree culture and grafting.

On January 8 and 9, 1986 an intensive session on village nursery management and nursery propagation of selected species was given by Jean Roussel of DRPF. Mr. Cazet returned to lead a review discussion on silviculture.

A review and criticism by SODEVA field staff of the 1985 planting season took place March 13 and 14, 1986 at CETAD. Plans were discussed for the 1986 season. The village composting program was also introduced.

In May, 1986 a visit was organized for the project field staff to visit the Projet Gonakie in Podor. This is a Dutch funded, community reforestation project in the Senegal River basin near Podor. Due to unforeseen problems, the staff of the project was not available the day the group arrived.

Also in May, 1986 the project director and T.A. forester visited the Projet Anacardier Senegalais-Allemand (PASA) in Sokone, near Kaolack. This project works to promote the plantation of cashews, both in village and larger-scale plantations. The main purpose of the visit was to observe the extension methods used by the project, the types of plantations done and planting and growing requirements of cashews.

A series of field trips was organized during the months of June, 1986 (in Diourbel) and July, 1986 (in Thies) to visit each of the project villages. All of the C.A. in a particular prefecture took part in the visits of his prefecture. This allowed the C.A. to compare their results with their colleagues' and to exchange ideas. After a tour of each village's accomplishments, a general meeting was held with the whole community. This provided a useful forum for villagers to voice their concerns over the project's activities and to express their needs; and for the project staff to review each village's situation and capacity to continue with agroforestry. The C.A. also participated in these discussions.

Following the field trips, a review meeting was held within each sector. Participating, in most cases, were the project director, the T.A. forester, the delegate of the region, the R.R., the chef de secteur, the C.A. and the regional representative of the Forest Service. These meetings were useful to clarify project objectives, discuss the problems facing the C.A., determine their needs to best do their job and evaluate the project's mode of operation.

In December, 1986 a comprehensive training plan was developed for the remaining time of the project which included:

- o Training seminars for villagers on various project activities, including village nurseries, improved wood-stoves, composting and intercropping.
- o Training for the CA in the above activities and project management.
- o Ideas for training tours and trips both in Africa and the U.S. for field and ingenieur level project staff.
- o A program for "jumelage" village visits to include all of the project villages over a three month period.

The plan was submitted to USAID in January, 1987. Various logistical and financial problems kept many of the activities from being realized.

Two of SODEVA's documentalists were sent to a three week information management seminar in May, 1987 sponsored by Volunteers in Technical Assistance (VITA), in Washington D.C. The program, taught in french, consisted of two parts: library management and organization, and computerized database applications for information storage and retrieval. In addition the trainees visited various libraries and documentation centers around Washington. This training was part of the project's objectives to strengthen SODEVA's documentation capabilities in forestry and agroforestry at CETAD.

A planned two week tour of forestry projects in Niger for four of the field staff (two each from SODEVA and DCSR) in May, 1987 was called off when scheduling difficulties arose with the Nigerien hosts

Three SODEVA staff members were sent in July to a USAID-sponsored management training seminar at the University of Pittsburg that lasted until the end of August.

On June 16 and 17, 1987 four villagers and the two RR attended a seminar at the rural development training center at Bamba Thialene (near Tambacounda) sponsored by Catholic Relief Services and the Peace Corps. The theme of the discussions was village reforestation. All of the participants were quite pleased with the program.

Five ingenieur level personnel from SODEVA and DCSR participated in a tour of agroforestry and soil conservation research activities in the United States from September 12 to October 15, 1987. The tour was arranged by the USDA Forestry Support Program with the help of the USDA Office of International Cooperation and Development. ISTI provided the services of a translator/technical forestry facilitator to accompany the participants. Among the points visited were:

- o The College of Agriculture, Utah State University to study grazing systems and dryland farming research and demonstrations.

- o The School of Forestry Fisheries and Wildlife, University of Missouri, Columbia to visit erosion control plantations, intercropping of trees with corn and soybeans, and the use of various grasses for fodder and soil filtration.
- o The Department of Forestry, Kansas State University, to visit windbreak research concerning their design, layout and utilization in agriculture.
- o The Department of Forestry, Fisheries and Wildlife, University of Nebraska to visit research on windbreak influences on agricultural crops and demonstrations of windbreak design and layout.
- o The School of Renewable Natural Resources, University of Arizona to visit agroforestry research plots and dryland forestry systems for fuelwood production. Also windbreak/crop research on natural upland desert sites.

Five participants from SODEVA attended a week-long farming systems research seminar at the University of Arkansas in October.

Four members of the project field staff (the SODEVA RR and the E&F agents assigned to the project) visited the *Projet de Promotion et Protection des Forêts du Sud* in Ziguinchor from November 11 to 14, 1987. This project works with village groups in the Casamance to control and prevent wild fires. Comparisons were made between the extension methods used in the two projects.

Various technical handouts have been written and distributed for use by the CA. Among these are:

Bases de Sylviculture Appliquées au Reboisement Villageois by Michel Cazet, July 1985, a village reforestation silvicultural manual.

Atelier sur les Techniques d'Agroforesterie et de Conservation des Sols by R.D. Fall and P. Linehan, May 1986, a village nursery and species selection manual.

Technique d'Agroforesterie Conservation des Sols et des Eaux by R.D. Fall and P. Linehan, June 1986, a windbreak establishment manual.

A Propos des Cultures Intercallaires July, 1987, a technical sheet on intercropping.

8.0 Documentation Center Support

The PP provided considerable support (\$20,000) to provide books, other documents and audio-visual materials on agroforestry/soil conservation themes to be housed at the SODEVA training center at Pout (CETAD). Working in conjunction with the documentalist at CETAD, a list of books and journals to order for the training center was compiled in March and submitted to

USAID in April, 1987. These included publications and audiovisual materials from various development organizations and publishing houses. Procurement of the items was entrusted to USAID's Supply Management Office (SMO). This order is still being processed.

9.0 Recommendations for Future Activities and Improvements in Project Implementation

Following are some recommendations for improving the implementation and management of future village based agroforestry/soil conservation projects.

Project Organization and Administration

1. Within SODEVA there are presently two tendencies. One is for projects to operate as integrated parts of SODEVA's traditional setup of semi-autonomous regional offices with their own programs. The other is for totally independent projects with their own separate management implementing a specific program over SODEVA's zone of operations, with minimal input from the regional offices. Present financial considerations make the second model more likely for future SODEVA activities. Whichever model does win out; there must be a clear decision made for each project. The execution of this project has often suffered from being in between the two options.

2. The director and support staff of any similar projects should be in the field to better respond to day-to-day operational problems and have greater input into the development of a technical and extension approach. Although Dakar continues to be the administrative center for solving problems, a village-based project shouldn't be cut off from the field.

3. SODEVA unrealistically promised to provide most of the logistical support necessary for the project (telephones, office supplies etc.). In reality, the project had to take on many of these responsibilities when it became apparent that SODEVA just did not have the resources. The field program did often suffer from lack of timely transportation and logistical support, especially for the RR. Future projects should make more adequate provisions to provide these resources.

Extension Methods

1. Multi-purpose extension agent should be kept instead of switching to single-purpose agents. Villagers do not see their activities sectorially. Agriculture, livestock-raising, money producing activities and any other endeavor are all part of a single battle for survival. A multi-purpose extension agent can have a stronger influence in helping villagers meet their needs and find resources for development. The catch is that the agents have to be motivated and resourceful enough themselves to fulfill different roles.

2. Too often villagers saw the project as a service organization to provide things in return for their participation in project activities. There is a need for SODEVA to adopt a community objective developing approach to help villagers determine their own needs. As long as agricultural and reforestation programs seek to impose new ideas instead of developing them with the villagers, results will be short-lived.

3. For the extension personnel to perform multiple tasks and work to help communities develop themselves, they will need better support. This includes technical support from their supervisors and material support in the form of a reliable means of transportation and supplies.

4. In line with an integrated vision of the problems facing villagers, the notion of agroforestry, combining trees with agriculture, should continue to be promoted as a model for future reforestation, soil conservation or rural land management efforts.

Technical

1. The environmental problem facing the Peanut Basin is essentially a land use problem. The same land is expected to produce food, fodder, building materials and cash crops with no significant inputs for its maintenance. No single project will succeed until the necessary political decisions are made to permit a rational management of the fragile land base.

2. The urgent need for a reliable water source for people in the Peanut Basin is beyond doubt. However, digging deeper wells or more new wells will not solve the problem permanently. The reforestation and soil conservation activities proposed in the technical program of this project, as well as others, would go a long way to improve the water resources. However, these measures will take a long time to work.

When in the initial contacts with village groups, SODEVA's extension teams mentioned the possibility of digging new wells; that became the primary goal for the people. Future projects should be careful that water resources for today and land improvement activities for the future do not become joined.

3. The accessory activities for this Project of village nurseries, improved woodstoves and composting should be included in future similar projects as they provide immediate benefits to villagers. Village nurseries could become especially profitable as the government and forestry projects pull out of direct tree seedling production.

4. Finally, anyone undertaking reforestation and soil conservation must realize these are long-term activities. Any immediate benefits are nice, but the true benefits will not be realized until much later. Both the extension approach used and those financing the activities in question must take this into account.

10.0 Conclusion

The Agroforestry Pilot Program of the Cereals Production II Project has shown that there is genuine interest on the part of villagers to undertake the rehabilitation of their environment through reforestation and soil conservation activities. It has shown that different agencies involved in working for and with villagers can also work together to further a common goal. As a pilot program, it has also shown where there are problems and technical and administrative hurdles to overcome. It is hoped that this sort of program will continue to interest Senegalese agricultural extension and rural development agencies, and local and international funding sources; for the need is certainly great.

Literature Cited

P.K.R. Nair, Soil Productivity Aspects of Agroforestry, International Council for Research in Agroforestry, P.O. Box 30677, Nairobi, Kenya, 1984.

Annex 1: Objectives of the Research Program for DRPF from
Project Implementation Letter No. 26

1. Soils analysis to assess the level of soil fertility and degradation in six representative sites of project area.
2. Fertilizer trials comparing different combinations of chemical and organic (i.e. animal wastes, compost) fertilizer in six different sites within project location.
3. Performance trials of at least ten different tree species in a variety of ecological zones.
4. Evaluate the acceptability by villagers to plant various tree species for fuelwood and construction materials in thirty participating villages in Thies and Diourbel.
5. Evaluation of various types of fencing (living fences, local materials) for performance, cost and acceptability in six villages.
6. Commence preliminary testing of Nitrogen fixing tree species on crop yields in six different sites in project area.
7. Complete assessment and finalize report of various planting arrangements for village windbreaks.
8. Timely submission of quarterly activities report to SODEVA and participation in the annual evaluation and submission of a final comprehensive report on this component by September 1987.

Annex 2: Contractor Scope of Work and Responsibilities

The Contractor shall perform the following tasks:

a. General

The contractor shall provide 24 person-months of services of an expatriate forester with experience in agroforestry and soil conservation extension activities in the semi-arid tropics to assist host monitoring, and evaluation of the Cereals Production II pilot agroforestry/soil and water conservation program. This technician will be assigned to the primary host entity, SODEVA, and will be based in Thies.

b. Specific

The long-term forestry technician will serve a crucial role as technical coordinator of the project's agroforestry pilot program activities and shall:

- 1) Aid in the identification of target villages and elaboration of annual pilot program workplans;
- 2) Monitor all pilot program field activities (i.e. research, extension, training) in close collaboration with other agency representatives;
- 3) Consolidate relevant documentation from Senegal and elsewhere on agroforestry and soil conservation;
- 4) Assist in the preparation of progress report and the evaluation as described in the section entitled "Evaluation";
- 5) Provide guidance in the use of pilot program audio-visual materials in both SODEVA and the Eaux & Forets extension programs; and
- 6) Serve as a member of the pilot program field-level coordinating committee and as liaison among the host entities involved and between the senior technical level committee and the USAID/Senegal.

The long-term technician shall have the following qualifications:

- 1) MS or PH.D. in forestry or soil science;
- 2) Minimum of five years work experience in agricultural development activities in semi-arid or arid regions with preference for the Sahel;
- 3) Experience with extension, research, agroforestry and soil conservation programs; and
- 4) Fluent French language ability (oral and written minimum FSI 3/3).