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Abbreviations

ADO	Agricultural development officer
AFRENA	Agroforestry Research Network for Africa
CIMMYT	International Center for Maize & Wheat Improvement
CERAI	Centre d'Enseignement Rural Artisanal Integre
CIAT	Centro International d'Agricultura Tropical
CIP	International Potato Center
COP	Chief of party
DES	MINAGRI Division des Statistiques
EOPS	End of project status
FSRP	Farming Systems Research Program
FSIP	Farming Systems Improvement Project
FSR/E	Farming Systems Research/Extension
FSSP	Farming Systems Support Project
GNP	Gross national product
GOR	Government of Rwanda
GTZ	German Society for Technical Cooperation
IBRD	International Board for Research and Development
ICRAF	International Council for Research in Agroforestry
IITA	International Institute for Tropical Agriculture
IARC	International Agricultural Research Center
ISAR	Institut des Sciences Agronomiques du Rwanda
LOP	Life of project
LTTA	Long-term technical assistance
MINAGRI	Ministry of Agriculture, Rwanda
NPK	Nitrogen, phosphorus and potassium
NRMP	Natural Resources Management Project
OICD	Office of International Cooperation and Development
PACD	Project agreement completion date
PP	Project paper
PROAG	Project agreement
PSC	Personal services contract
REDSO	Regional Economic Development Services Office
RRS	Rapid reconnaissance survey
STTA	Short-term technical assistance
TDY	Temporary-duty officers
UNR	Universite Nationale de Rwanda
UOA	University of Arkansas
USAID	United States Agency for International Development

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Executive summary

The Farming Systems Research Program (FSRP), USAID Contract # 696-0110-C-00-5016-00, began in 1984 with the launching of preliminary diagnostic survey during the project's design phase. The survey was implemented in four communes, Nyamugali, Nyarutovu, Cyeru and Butare in the Ruhengeri Prefecture.

The final evaluation team found the project's training efforts, improvements to infrastructure and work with women farmers were beneficial. However, the project suffered as a result of poor management, the implementation team's lack of expertise in farming-systems research and because recommendations from previous project evaluations were not followed.

Positive aspects of the project were the training program and AFRICARE's construction of infrastructure. A total of 22 Rwandans earned Ph.D., M.S. and B.S. degrees from U.S. universities, and more than half of these graduates were reemployed by Institut des Sciences Agronomiques du Rwanda (ISAR). However, because of GOR policy constraints, their future in ISAR is uncertain.

AFRICARE, for a modest sum of $750,000, repaired roads, installed potable water systems, built training centers and constructed storage hangars in the project area. These improvements will be of continuing value to the rural community.

The project had a significant impact upon women although women were not specifically targeted. The rapid reconnaissance survey (RRS) of the 1992 evaluation team revealed no difference between men and women's access to project personnel, resources or information. Unfortunately, FSRP's failure to collect data on the number of women participants rendered impossible any disaggregation of project impacts comparatively between women and men.

However, FSRP worked with women farmers, who composed an estimated 40 percent of total farmers; women were recruited as extension agents, and women were represented among Rwandan counterparts for long-term training.

One constraint to project success was that the FSR/Extension team that was to implement the project had no experienced leadership, nor were they adequately qualified to practice farming-systems research. They conducted no complementary diagnostic or verification surveys to explore further findings of the preliminary survey and, thus, failed to characterize recommendation domains or to identify and prioritize real constraints and problems of farmers. Since farming-systems methodology was not implemented, practically none of the developed or proposed technology were subjected to requisite socioeconomic analysis. Consequently, those technologies, such as the Lime and NPK treatment and the agroforestry species, *Sesbania,* were found to be unacceptable to farmers. Much on-station testing and even some on-farm trials conducted could be classified under upstream research; only a few on-farm trials fell under the category of down-stream research or research oriented towards solving problems and constraints of farmers.

A series of evaluations, internal and external, took place although most recommendations of the evaluating teams were not followed. The 1986 evaluation led to the fourth project amendment, in which, unfortunately, USAID unilaterally eliminated the extension component and the extension advisor's position, compromising the project's relevance to farming-systems research and extension. In 1988, the

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inspector general found the changes in the fourth amendment unacceptable and recommended an evaluation to determine the significance of extension for continued project implementation.

The 1989 project evaluation that followed led to a fifth amendment, in which the extension component was reinstated and continued until the project agreement completion date (PACD).

Project management by the University of Arkansas (UOA), USAID and ISAR was unsatisfactory throughout the project. With a few exceptions, the UOA was not able to provide a technical-assistance team that was adequately trained and experienced in farming-systems research and extension or with multidisciplinary capabilities. Nor were the TA teams representative of required disciplines, including agricultural economics. The team was unable to integrate itself fully with ISAR. Administrative and financial management problems plagued the UOA.

USAID management was poor throughout the project. Some salient management errors were use of project funds for USAID management costs that were not budgeted and for revision of the 1986 mid-term evaluation, with subsequent elimination of the extension component.

Effective implementation of the project was rendered extremely difficult by the advent of armed hostilities in October 1990. The hostilities led to the evacuation of the expatriate staff from the Rwerere Experiment Station in November 1990. Subsequent to that date, the expatriate staff made monthly or bimonthly visits to the stations from Kigali, which led to a commiserate reduction in levels of effort by research-station staff.

The station was directly attacked in June 1992 and activity at the station had ceased at the time of this final evaluation.

ISAR was unable to provide counterparts to the expatriate team. Those counterparts who were assigned were continually replaced, resulting in a lack of continuity and commitment to sustained research.

Because of the absence of an experienced farming-systems economist, the socioeconomic program was seriously compromised. The sociologist who was appointed as a socioeconomist was unable to fulfill the task of adequate economic analysis or even partial budgeting. This problem was likely the reason that the economic analysis contained in the final report for the FSRP was prepared without his knowledge and/or participation.

Because technologies tested among farmers did not undergo rigorous scrutiny of farming-systems methodology, their sustainability was not fully assured. Although the higher yielding varieties of beans, wheat and potatoes continued to be used by farmers, the value of the much preferred bean variety G2333 was compromised by the onset of a fungal root disease. Other technologies, such as the Lime + NPK treatment and the agroforestry species, *Sesbania*, were either abandoned or recognized as inappropriate.

1. Introduction

1.1. Setting

Rwanda is a land-locked country of 26,338 square kilometers, located in central Africa and bordered by Zaire, Uganda, Tanzania and Burundi. Rwanda is overwhelmingly rural, with more than 90 percent of the population residing in the countryside. Major cities are the capital, Kigali, as well as Gitarama, Butare, Gisenyi and Ruhengeri. Rwanda is the most densely populated country in Africa; its rate of annual population growth is 3.7 percent. The total population is approximately 6.8 million. Agriculture accounts for more than 44 percent of the gross national product (GNP), employing approximately 93 percent of the total work force. Per capita annual income is estimated at $323. Major agricultural crops include beans, sweet potato, manioc, banana, sorghum, maize, Irish potato and coffee. Major cash crops are coffee, tea, pyrethum and cinchona. Until recent years, increases in food production matched population growth. At present, however, increasing amounts of marginal land has been brought under cultivation as average farm size has declined to less than one hectare (ha). One quarter of Rwandan farm households have access to less than half an hectare.

The Farming Systems Research Program (FSRP) was located in four communes in the northern Ruhengeri prefecture. The four project communes of Butaro, Cyeru, Nyambugali and Nyarutovu are located in the Buberuku highlands zone. Altitudes in the project zone range from 1,500 to 2,500 meters, with an average altitude of 2,000 meters. Annual rainfall ranges from 1,100 mm - 1,650 mm. In the altitudes of less than 2,000 meters, major crops include banana, beans, cassava, coffee, maize, sorghum and sweet potato. In altitudes higher than 2,000 meters, maize, peas, Irish potato and wheat are the major crops. Parts of the project communes of Butaro and Cyeru have been held by rebel forces since 1990, when the civil war between the rebels and the GOR began in the north, where the project was located. In November 1990, the FSRP expatriate team was withdrawn from Rwerere Experiment Station and relocated in Kigali.

1.2. Background and historical review

USAID and the Government of Rwanda (GOR) signed The Farming Systems Improvement Project agreement in September 1984. The $15.8 agreement was to assist the GOR in developing a farming-systems approach to research and extension (FSR/E), including a mechanism for linking research and extension institutions and their activities. The major implementing agency was the Institut des Sciences Agricoles du Rwanda (ISAR), with technical assistance provided by the University of Arkansas (UOA) as the lead institution, with collaborating Title XII universities of Illinois and Minnesota and Lincoln University.

GOR interest in farming-systems research resulted from a 1983 ISAR/ISNAR report that recommended the farming-systems approach to agricultural research and refurbishment of several research centers, one of which was the Rwerere station. The GOR was interested in having USAID finance development of a centrally located FSR/E program, to be located at ISAR headquarters in Rubona. But USAID preferred concentrating on developing FSR/E in one location, at the Rwerere research station in the Ruhengeri prefecture. Farming Systems Improvement Project (FSIP) operations began in 1985 with arrival of the UOA technical-assistance team. The project-completion date was September 30, 1992. In 1989, the project title was changed from FSIP to the Farming Systems Research Program (FSRP).

Through institution building, adaptive research and effective extension, the project aimed to raise levels of agricultural technology and its extension and to increase trained human resources and subsequently raise agricultural productivity, so important in a country with rapidly increasing population, a shortage of arable land and a lack of off-farm employment.

1.3. Summary project description

In order to achieve the stated project purpose of developing a farming-systems approach to research and extension, the project was to provide a multidisciplinary team of six scientists -- three U.S. advisors and three Rwandan counterparts. The group was to be an effective, operating FSR/E team, situated at the Rwerere research station. By the completion of the project, advisors and their Rwandan counterparts were to develop, select and potentially diffuse at least five economically viable and socially acceptable strategies to farmers in project communes.

Long-term academic training in the U.S. was also to be provided to Rwandans at the Ph.D., M.S. and B.S. levels. At the international agricultural-research centers (IARCs), technical/non-degree training was also to be provided to Rwandan FSR/E participants both within Rwanda and in other African countries. Periodic, in-service training courses, workshops and field days were to be offered to agricultural technicians, extension personnel and project farmers. Special studies to support on-farm research and extension activities of the FSR/E team would be undertaken by faculty and students of the National University of Rwanda and students from participating U.S. universities.

Under the terms of the contract, the Rwerere research station would be refurbished, and an office and laboratory complex would be constructed, as well as a training and conference center at Rwerere. Residences would be constructed for both expatriate and Rwandan personnel. Multipurpose offices, combining offices, classrooms and storage facilities would be constructed in each of the four project communes.

A rural-infrastructure component was added to the project to improve rural access roads and a reliable supply of water.

1.4. Evaluation scope of work and methodology

Tropical Research & Development, Inc. in 1992 provided a team leader/agronomist and an agricultural economist to conduct a final evaluation of the Rwanda Farming Systems Program. The evaluation took place between September 3 and October 7. The terms of reference for the evaluation included the following:

- an assessment of administrative and scientific performance of FSRP contractors (UOA and Africare) and ISAR;
- an evaluation of the efficiency of UOA in filling long term technical assistance (LTTA) positions;
- an examination of the fourth and fifth amendments to the project grant agreement and their impact on the project;

- a review of the appropriateness of the agricultural technologies developed for problems facing Rwandan farmers;
- an examination of major constraints faced by farmers and the project;
- a discussion of the impact of the war on project activities, including evacuation of LTTA in 1990; and
- an examination of gender issues as they relate to the project.

The evaluation team spent the first week examining project documents and other secondary data. Relevant USAID, ISAR and MINAGRI personnel were interviewed. In the following weeks, visits were made to ISAR headquarters in Rubona and to the project site in Rwerere. A rapid-reconnaissance survey was also undertaken of 40 randomly chosen area farmers, including both project and non-project, male and female farmers. Farmers were interviewed about major agricultural constraints, about cultural practices and about their perceptions concerning project technologies.

2. Findings concerning project goal and purpose

2.1. Project goal

The sector goal of FSRP was to assist the GOR in increasing agricultural productivity in Rwanda. The goal remains pertinent today, given the rapidly growing rural population, the already densely populated land base, the reduced farm size and natural resource degradation.

2.2. Project purpose

The stated project purpose was to strengthen the capacity of ISAR to undertake agricultural research using a farming systems research and extension (FSR/E) approach that effectively links research to extension services. However, the project made little headway toward achieving the project purpose. While the long-term training component greatly enhanced the capacity of ISAR to undertake agricultural research, the Ph.D., M.S. and B.S. received little training in farming-systems research. The project's progress toward attaining the envisioned end-of-project status is discussed in chapter four.

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3. Attainment of project objectives and development of FSR/E

3.1. Introduction

Development of FSR/E within a project implies that a multidisciplinary team brings all its expertise to bear in a holistic fashion upon farmers' problems and constraints to higher production. This method is necessary in order to arrive at realistic, acceptable and adoptable solutions. First, individual team members need to be knowledgeable of the methodologies of farming-systems research. Second, the team members need to have the ability to work as members of a unified team. Third, they must be able to identify farmer constraints and to prioritize these constraints so that the team can address them. In the context of the FSRP, FSR/E was not successfully achieved.

3.2. Farming-systems methodology

Farming systems research is an iterative research methodology which stresses the need for analytical input from all stakeholders; research scientists, extension agents, and farmers, to develop and extend agricultural technologies which meet farmers' needs and which can be adopted over the long-term by farmers. FSR/E begins with implementation of either a rapid-reconnaissance or diagnostic survey conducted by all members of the team. During the exercise, the team meets several times to discuss findings, problems, possible reorientation and change of emphasis. By the time that the final report is written, the team should have produced a relatively good description of the prevailing farming system within which recommendation domains may subsequently be identified and characterized. Constraints and problems would have become apparent for itemization and prioritization. Some problems will require long-term effort to resolve, such as low soil fertility. Other problems could be solved within a couple of seasons although solutions might give rise to further problems, requiring additional research.

On-farm tests are devised in order to address problems in collaboration with farmers themselves. An example of this kind of approach is that used by the FSRP agronomist,

> Before installing any trial on the farmers' fields, we clearly explained to the farmer-cooperator the objectives of the study, stressing that the study was research and not demonstration and that we would work together as researchers and do the evaluations together.
>
> Furthermore, we arrived at a clear understanding that the farmer-collaborator would provide land and labor free of charge, that we would furnish all the necessary inputs free of charge and that the harvest was for him/her to keep. (Paul, #17)

As results of these tests come in, feedback from farmers, from both research and extension scientists and from both research and extension field assistants, they are analyzed and evaluated in order to determine effectiveness of the solution applied. Changes are made in technology if necessary and testing is repeated the following season, thus illustrating the iterative nature of the FSR/E process. If technology is found to be profitable for, acceptable to and adoptable by farmers, it is then extended to other farmers within the recommendation domain.

Nowhere in all the progress reports of the FSRP is found the most rudimentary statement of the elements of this methodology. Nor is the methodology found in the implementation of periodic diagnostic,

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verification, bench-mark and baseline surveys to complement the preliminary survey done by Franzel et al. in 1984. This lack had been pointed out by one of the temporary duty officers (TDYs) two years later. (Wailes, 1987). No surveys were being conducted, and there was little or no direct contact with farmers; no extension system existed through which feed-back from farmers could be obtained. No regular team meetings were held to discuss farmers' problems or the solutions that could be proposed to solve them.

3.3. Overview of major constraints faced by farmers

The most important constraint for farmers in the project zone was limited land area, due to population pressure. Continuous cropping on small family plots resulted in the next most critical constraint, low soil fertility. In addition, the majority of soils were found to be acidic, having low pHs. Without regular crop rotations, diseases intensified. Without application of soil-conservation technologies, erosion carried away rich top soil of the slopes and continues to do so. Local markets only afford limited outlets for farm produce while larger markets in towns and cities are generally inaccessible to farmers living in remote areas. Mountain roads are steep and hazardous and means of transportation are a lacking in these communities. Production inputs such, as chemical fertilizers, pesticides, good-quality seed, lime and suitable implements are either unavailable or unaffordable or both.

These major constraints reveal the existence of a subsistence-economy agro-ecosystem, subject to two major issues forcing gradual degradation. These forces are population pressure, causing widening exploitation of marginal land on steep slopes, and a steady rate of erosion that occurs with every rainy season. A long-term strategy to ensure sustainability in the system would entail conservation of soil. The soil scientist was correct in giving priority to research in soil-conservation technologies. However, the choice of leguminous tree species for use as hedge rows, especially *Sesbania*, was inappropriate because it went against the Rwandan Ministry of Agriculture's (MINAGRI) recommendations to farmers to use *Pennisetum* and because of the manifest disadvantages of *Sesbania*. Reasoning behind the choice of *Sesbania* as a living hedge species is given in Marx/Hanson (1986).

> The Soil Scientist explained in detail how he planned to conduct his research. The research, especially in the area of agro-forestry, will have to be conducted very quickly. Although our goal is to consult on statistical design here and we are not an agro-foresters, (sic) it seems that the time frame is too short to accomplish all that is required. For example, the selection of the appropriate tree or shrub to work with must be made in one year. This gives no indication how the shrub will behave under constant pruning or at maturity.

The salient characteristic that *Sesbania* exhibits in one year is its vigorous rate of growth, which easily exceeds its competitors. And this rapid rate of growth was likely the reason *Sesbania* was selected. If the soil scientist had talked with MINAGRI or farmers about the choice of species for living hedges, he might have been able to arrive at a compromise solution, in which a combination of species, such as grass and leguminous trees, could have been tested jointly by the project and through extension and in collaboration with farmers. Although some effort was made to assess the major constraints faced by farmers, the assessment was not a team exercise, as it should have been. The agronomist reported:

> Based on the preliminary diagnostic survey the major constraints faced by farmers in the project zone limiting bean production were identified as a) low soil fertility, b) lack of

improved varieties, c) diseases, d) difficulty in obtaining stakes for climbing beans and e) traditional cultural practices (Paul, #17).

3.4. Development of appropriate technologies

3.4.1. Diagnostic phase

Development of appropriate technologies implies that solutions developed to solve existing problems must be appropriate to the farmers' socioeconomic situation. It is during the diagnostic phase that socioeconomic considerations are taken into account and borne in mind when solutions are proposed. For example, a major constraint for farmers is the high level of acidity in the soil. The solution to this problem is application of lime at the rate of two tons - eight tons per ha. The diagnostic survey should have shown: a) these acid conditions were found throughout the zone; b) a high cost would be entailed in obtaining lime and transporting it, therefore; c) an economic study should have been initiated to determine the feasibility of transporting and stocking large quantities of the material in the zone; and d) the need for pilot trials to ascertain cost/benefit ratios

The project conducted none of the above-described tasks. It did provide 25 kg of lime per farmer together with one kg of bean seed with the proviso that five kg of seed be returned to the project at harvest. Farmers followed instructions for lime application faithfully and wheat yields increased from 1,653 Kg/Ha (control) to 2,128 Kg/Ha with eight tons per hectare of lime (Yamoah, #65). Unfortunately, provisions were not made for farmers to obtain lime after the first harvest. In addition, lime technology was not subjected to an economic analysis. If it had been, the uneconomic nature of its use would have become readily apparent. In addition, there should also have been responsible action in determining the extensiveness of lime deposits and whether a mining operation could have been supported by some donor to make raw material available for farmers.

The diagnostic phase was rudimentary. Other than the preliminary diagnostic survey, the team left little else behind. Bizimana et al. in 1986 ostensibly conducted an FSIP area diagnostic survey, of which no trace was found. Results of the Bizimana et al. diagnostic survey were never published because of the accidental death of the agricultural economist, Louis-Marie Murekezi. Serigne N'diaye published some of these earlier results in 1989.

3.4.2. Agronomic aspects of the FSRP

The 1989 evaluation team reviewed agronomic aspects of the FSRP as various technologies: a) bean technology; b) tuber-crop technology; c) wheat technology, d) alley-cropping technology; and e) lime technology. Each was discussed separately and salient characteristics of each technology were noted.

In further considering agronomic aspects of the FSRP program, the 1992 evaluation team commented upon: a) cultural practices; b) use of chemical fertilizers, manures, composts and lime; and c) better-quality seeds.

3.4.2.1. Cultural practices

It was deplored by one researcher that farmers never produced a fine seedbed for planting beans on slopes (Paul/Grosz, #15). But farmers deliberately prepare a coarse, rough seedbed on slopes because the

degree of erosion is greatly reduced by rugosity of the soil surface. They know that a smooth seedbed would erode much more quickly than a coarse one.

Results of the evaluation team's rapid-reconnaissance survey revealed that farmers liked sowing using predetermined plant spacing and demonstrated how to implement the technology for any neighbors who wanted to know. It is uncertain whether they preferred the practice for its effect upon yields or for the orderly aesthetic appearance of crops that resulted. Whatever the reason, regular plant spacing, although it requires higher inputs of time and labor, is important in Rwanda because of land scarcity and the need to achieve optimum production per unit area.

3.4.2.2. Use of chemical fertilizers, manures, composts and lime

Chemical fertilizers in the form of urea (N) and phosphate (P) were applied to various agronomic trials conducted by the team. The soil scientist applied them to his five herbaceous legume species in order to obtain greater production of biomass. In US experiment stations, application of starter N to leguminous crops like soya beans or even peanuts is commonplace. In Africa, however, chemical fertilizers are expensive and difficult to come by. Even if farmers were able to obtain chemical fertilizers, they would prefer to apply them to their non-leguminous crops.

The project encouraged composting and gave farmers the possibility of increasing the volume of usable organic material. Farmers normally use livestock manures that accumulate in their yards. Before planting, they lay the manure in piles around the field. It is then worked into the seedbed before seed are sown. Farmers have always used compost pits, but the project taught them to increase volumes of organic matter. Compost pits were enlarged, and farmers were encouraged to incorporate manure with all waste vegetative matter generated on the farm and in the household. Although in the past, MINAGRI imposed sanctions of 600 FRw for failure to have at least one compost pit per farm, on a visit to one farmer during the 1992 evaluation team's RRS, manure accumulations of livestock, cattle and goats could be seen in the yard though there was no evidence of the material being added to the compost heap.

Use of lime has already been discussed elsewhere. As an agronomic practice, it offers considerable potential to crop production on acid soils. Research on its use showed a mean increase of 25 percent in yield of pole beans. Yields in excess of 2,000 tons of wheat per ha, with application of 8 tons of lime per ha (Table 3, page 7, Yamoah et al., #64) are, however, likely the result of inaccurate tabulating. In fact, all tables in the Yanoah et al., #64 report have inaccuracies in them and in their present state are unacceptable. Under the circumstances, it is unlikely that these research results could be exploited to benefit the Rwandan farmer, except perhaps for those who live and farm near the deposits. This fact emphasizes the need for response assessment and economic analysis.

3.4.2.3. Better-quality seeds

Some good research was done in preparation and storage of quality bean seeds. The agronomist initiated a program of seed production. He worked with farmers, who grew them according to specifications prescribed and sold them back to the project at a premium. These seeds were then distributed to other farmers, who either participated in the scheme or simply grew the seeds for production purposes. In seed storage, the presence of Actellic reduced pest infestation to a negligible level.

Positive aspects of the project were agronomic practices such as sowing according to predetermined plant spacing, composting and the use of good-quality seeds. However, other agronomic practices, such as the use of fertilizers and lime, were either wrongly or uneconomically tested or used.

3.4.3. Agroforestry and soil conservation

The Agroforestry and Soil Conservation Program was in the hands of the soil scientist, who conducted on-station tests to determine which was the best leguminous tree species for living hedge rows. He advocated use of *Sesbania* in spite its many drawbacks. It is admitted in several of the papers that *Sesbania* is unable to survive under the following conditions: if the leaves are removed (conceivably by a farmer for livestock feed) from trees established on sloping and eroded upland soils with low water retention; if coppiced below 50 cm after one year; or if the main stem was split or cracked when the shrub was cut back. The species was not generally regarded as suitable for alley cropping (Op cit. Balasubramaniam & Sekayange, unpublished.) When compared to *Cassia*, *Calliandra* and *Leucaena*, the species was average with respect to coppicing, biomass production and tolerance to poor soils. It was also less than average for stake production and resistance to nematodes. Farmers did not like it when it grew too big because it attracted birds that used it as a shelter from which to attack crops growing in alleys. And yet, in spite of all this, *Sesbania* was selected for hedge-row use in the project zone. One source claimed that the main reason behind the choice was that *Sesbania* flowered and seeded well at elevations where the project was sited (Kamana, 1992), and farmers were, thus, able to easily obtain seeds.

On the other hand, *Pennisetum*, Elephant Grass, which MINAGRI was promoting had many advantages to it. It was practically impossible to destroy, grew rapidly, produced large quantities of biomass that could be used for fodder or for mulching, was easy to propagate by means of cuttings and had alternative uses as stakes and roof material. In Haiti, it was observed that when the foliage was used as a thick mulch on alleys, it raised soil fertility to the extent that bean yields were raised from 150 Kg. to 285 Kg. per hectare on sloping land, (Cunard, 1991). Not only was the soil conserved, it underwent rehabilitation.

It would thus appear that some technological choices within the FSRP project were not very appropriate or useful for farmers. The 1989 evaluation team recommended that the on-farm agroforestry trials conducted by FSRP should be refocused on technologies that are acceptable to farmers, such as use of hedge-row species that are multipurpose and easily adoptable (Chaudry et al., 1989).

3.4.4. Evaluation phase

Under the methodology of farming-systems research, all proposed agronomic interventions are required to undergo a phase of socioeconomic evaluation. That such evaluation was rarely conducted in the project is indicative of how poorly suited the team was to conduct FSR/E. In perusing results presented in three reports concerned with alley cropping, no mention of partial budgeting was found (Yamoah/-Burleigh #37;Yamoah #38;Paul et al. #20).

3.4.5. Conclusions

Farming systems research was not implemented by the FSRP. No evidence indicates that diagnostic or verification surveys were systematically conducted nor that results derived from such surveys were used

to orient and fine tune on-farm and on-station research. The FSRP team was never a multidisciplinary team although potential elements existed among certain of the personnel. The FSR/E advisor and the three chiefs of party (COP) could have forged an effective FSR/E team had they been qualified as FSR practitioners. The FSRP team did not implement farming systems research methodology, did not systematically identify and prioritize farmers' major constraints that could be satisfactorily addressed, and, with a few exceptions, did not develop and disseminate appropriate technologies of sustained agronomic, economic or agroforestry value to farmers.

3.5. Extension of appropriate technologies

3.5.1. Diffusion of technology

Technology diffusion was handicapped by the fact that ISAR, within which the FSRP was located, did not have an extension service capability. The extension system that did and does exist is a hierarchical structure that extends from MINAGRI to the farmer with a partial feedback loop. Communications flowed from the ministry to the prefectural agronome, sub-prefectural/commune agronomes, bourgmestres, sectoral councilors, *monituers agricoles*, cell officials, and progressive and other farmers. Partial "feedback" from farmers went back to the prefectural agronome, via the commune agronome (Grosz, 1987). Either the minister or the president proclaim themes for extension every season, and these themes, whether they be soil conservation or tree planting, are extended to farmers.

The first extension specialist, who served in this capacity from 1985-1987, recognized the potential that lay in this highly organized system. He strongly recommended that FSRP tie into it so that it could channel technology down the line to the farmer. However, the extension division was poorly supplied with materials, equipment and machines. The FSRP would have been hamstrung with logistical difficulties had it become integrated with the extension division. This reason is likely why USAID eliminated the extension component from the project and terminated the position of extension specialist.

The lack of a close relationship with MINAGRI's extension system created difficulties in transferring developed or identified technology. The FSRP tried to solve the problem with recruitment of their own extension staff. Arguments used by FSRP suggested that, when the project ended, MINAGRI would hire this trained personnel and absorb them into their operations. However, no funds were ensured in the budget for this exercise.

Extension agents, *moniteurs agricoles,* hired by the FSRP were trained to carry out extension work. They distributed seeds, lime, fertilizer and *Sesbania* seedlings and showed farmers how to plant in rows with correct spacings. In the 1992 evaluation team's RRS, farmers reported that the extension agents visited them once or twice a week. They visited participant farmers at least twice a week and, in addition, either laid down trials or monitored them. Technologies they disseminated comprised the following: a) bean technology; b) wheat technology; c) tuber technology; d) lime technology; e) compost technology; f) cultural practices; and g) agroforestry technology.

3.5.2. Integration into prevailing farming system

Some technology diffused was accepted by farmers, especially the supply of quality seeds of beans, wheat and potatoes. Farmers were impressed by the better yielding varieties of these crops and demanded more of them. The rapid reconnaissance survey revealed that at the moment, they are conserving their seed

for planting after each harvest and buying them from the local markets. How long this process will continue is uncertain.

Where bean poles are concerned, many farmers interviewed stated that they had not been able to use those from *Sesbania* or the other tree species, because they had not grown sufficiently as yet. They all preferred *Pennisetum* bean poles or those derived from *Eucalyptus*. They truly appreciated lime technology, but were dissatisfied that the material was not available. Seed treatment was greatly desired, but chemicals were not readily available. Although farmers wanted to adopt the technologies that they saw worked, they were unable to do so because the project team had not considered whether these inputs could be made available on a sustained basis, either by the GOR or by private enterprise.

4. Establishment of an effective FSR/E team

4.1. Introduction

According to established practice worldwide, an FSR/E team should be multidisciplinary, composed of scientists from various disciplines who combine their various capabilities in a single unit that tries to solve farmers' problems and constraints through developing, testing and providing appropriate and suitable technology that is acceptable to farmers. The usual method is to work collaboratively in addressing constraints from ground level up, using as bases the results of diagnostic and reconnaissance surveys. An interdisciplinary team, however, is one in which each team member functions independently. From this standpoint, the FSIP Team that began the project and continued work over several years did not have the characteristics of an FSR/E team. It had more the nature of an interdisciplinary team.

The project suffered from a lack of both required expertise and collaborative effort. First, in view of the complex nature of prevailing farming systems in the project zone as revealed in the pre-project diagnostic survey conducted by the design team, appropriate representation of several important disciplines were missing on the team, these missing disciplines included economics and livestock. Secondly, published reports and presented papers indicated that the team did not conduct collaborative FSR/E. For example, participation of an agronomist should have been imperative to the soil scientist's work on "Choosing Suitable Intercrops Prior to Pruning *Sesbania* Hedge-rows in an Alley Configuration." In another collaborative study in which the soil scientist was joined by the Rwandan counterpart and the extension specialist in investigating "Early Growth Performance of Leguminous Alley Shrubs in the Highland Region of Rwanda," manure and lime were added to four leguminous tree species, *Sesbania*, *Calliandra*, *Markhamia* and *Leucaena*, planted as living hedges. Farmers in the project area can not be expected to accept an extension recommendation to apply precious manure and more precious lime to a living hedge of leguminous trees. Such a practice would be economically unjustifiable. The farmer would much rather apply them to the bean and/or potatoe crop to improve production. From this standpoint, the results of this particular research were irrelevant to Rwandan farmers in the project zone. If an economist had initially participated in the design of this particular trial, the economist could have pointed out this flaw. The extension specialist should have considered whether these farmers would accept the new technology if it was extended to them. These oversights were further indication that the team conducted very little truly integrated FSR/E research.

The soil scientist should have been aware that MINAGRI had recommended that farmers use *Pennisetum* sp. as living hedges to counteract erosion, provide fodder for livestock, building material for roofs and bean poles for the beans. The soil scientist could have discussed this recommendation with representatives of the GOR and arrived at some kind of compromise in the use of an alternative combination of leguminous tree species and grass. Instead, however, he went ahead with his four leguminous species, ignoring the GOR's recommendation and conducting various studies on leguminous hedge rows.

The agronomist, however, seemed to understand what FSR/E was and how it should be conducted as a multidisciplinary exercise. In his proposed research plans for Season 1987B, the four research problems that he advanced (Paul, 1987) were each characterized by four headings, Introduction, Objectives, Methodology and Possible Collaboration. He invited comments and contributions by the team to his proposals. It is not known whether they responded, but, apparently, all the studies he conducted were successful as tests although not necessarily as FSR/E work oriented towards providing acceptable solutions for farmers' problems. For example in the study on minimizing on-farm, grain-storage loss

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(Paul, #24) it was found that after four months, the compound Actellic reduced to 0.8 percent (treated), (untreated control, 53 percent) the infestation of insects and pests in stored sorghum. A most vital component that should have been included in this study is missing -- the economic analysis. No evidence existed of partial budgeting, taking into consideration the various costs involved for chemicals, containers, labor inputs for preparation and application. However, provision was made in the planning document for FSIP socioeconomists to look into Actellic's cost/benefit aspects. If these figures existed, they would have strongly support the technology and built up a worthy case for farmer-adoption and extension.

These observations provided further evidence that the team was not functioning effectively as an integrated, FSR/E team.

4.2. Long-term staffing of expatriate and Rwandan team

The FSR/E Specialist and Administrative Leader, who was located in Rubona, preceded the team and arrived in October 1984. The incumbent lacked previous experience in farming systems research/extension. The director of ISAR requested the Leader's for health reasons.

The other long-term technical assistance (LTTA) members arrived in 1985. They included the FSR/E agricultural economist and scientific team leader whose work within his disciplinary expertise seemed handicapped by his administrative duties. As it turned out, however the incumbent had had little or no practical experience applying his academic knowledge the a project. He requested to be relieved of his administrative duties so that he could devote his time to agro-economics (Corres.'84-'92). He was never granted his wish and ultimately resigned.

The FSR/E soil scientist was a team member, "who received his research training at IITA on FSR, using shrub legumes for soil improvement and erosion control. He was employed by the IBRD financed ILORIN Ag Development Project in Nigeria from 1981-1983 as a postgraduate research student to conduct on-farm agroforestry field trials on the performance of *Gliricidia*, *Cassia* and *Flemingia* as hedge legumes in improving soil fertility and reducing erosion from cereal crops produced on sloping land, as well as studied farmer reaction to this practice." With this in mind, it is easy to understand the plethora of reports and papers that he produced dealing with the subjects of leguminous tree species for living hedges, alley cropping and soil fertility.

The FSR/E extension specialist tried to convince other members of the team of the critical importance of extension in an FSR/E project. He wrote an excellent report describing the existing extension system, extending hierarchically from the minister of MINAGRI down to the *monituers agricoles* -- the extension agents who were the closest to the farmers -- with a feed-back loop. It was with great reluctance that he tendered his resignation in 1987 when USAID eliminated the extension component from the project.

The agronomist who arrived in 1985, did some good on-farm field testing, identifying technologies that could be adopted by farmers. Of all the LTTA, he seemed to best understood the nature and purpose of farming systems research. An Administrative Officer, appointed to handle the administrative affairs of the project, was located in Kigali. The team also included a workshop supervisor.

Of the above mentioned officers, the team leader resigned in 1987 and the administrative officer was replaced in 1986. Rwandan counterparts were appointed for the positions of agronomist, agricultural economist and station chief and project director,. Also appointed were an FSIP direct-hire administrative

officer and an administrative assistant. A UOA graduate student, Marcie Brewster, arrived in the same year to conduct an economic investigation under special studies.

In 1988, a socioeconomist was appointed who had expertise in rural sociology; his counterpart was an agronomist and who left for long-term training after a few months and who was never replaced.

The expatriate agronomist was appointed in 1985 and replaced by another, and another Rwandan counterpart agronomist was named. The Rwandan station director was replaced once.

In 1989, the wife of the agronomist appointed the previous year, was employed as training and administrative coordinator. When the first extension officer left in 1987, no replacement took his place because the extension component of the project was eliminated. In 1989, however, when extension was back on line, the position of research extension liaison officer was created and filled.

In 1990, ISAR made only one appointment of a Rwandan Agronomist.

In 1991, a soil scientist/station director was appointed from the candidates who had been in the US for long-term training. Two other Rwandan agronomists were appointed from ISAR and, finally, almost toward the end of the project, an animal scientist was appointed.

The changes that took place over the seven LOP years meant that the composition of the team at the end was totally different from what it was when it began (see Attachment C for FSRP staffing). One of the consequences of these changes was a lack of continuity in project implementation and progress. The lack of a strong leadership was also the root cause of other problems among the expatriate staff. At least two of the personnel, the extension officer and the first chief of party left because of personality differences.

To meet objectives of the project, the FSR/E Team should have been composed of the following personnel with their associated Rwandan counterparts:

- SR/E advisor -- experienced in and knowledgeable of FSR/E;
- chief of party -- a generalist located at Rwerere;
- administrative officer -- at Rwerere to assist the COP;
- agronomist -- FSR/E-oriented with experience in crops;
- agro-economist -- FSR/E-oriented;
- livestock specialist -- with knowledge of fodders/feeds;
- soil scientist -- experienced in soil fertility management using organic amendments;
- agroforester -- experienced in watershed management and erosion control; and
- extension specialist -- experienced in feedback training.

They should all have had more than five years experience in farming systems research in Africa, as well as experience working as members of multidisciplinary teams.

4.3. Short-term technical assistance (STTA)

Under STTA, there were 29 TDYs over a period of six years, an average of six scientists visiting per year. Of these, four participated in the mid-term evaluation and six came to provide support for computer-based operations, rather excessive in view of limited training provided for Rwandan

counterparts. Two TDYs came to combine the 1989B and 1990A data sets derived from the whole-farm survey. Two TDYs came to revitalize the extension component, which had become moribund after a USAID decision in 1986. (For details, refer to the report section on USAID management.)

Some STTA personnel (Wailes, 1987; Wailes/Parsch, 1988; Parsch, 1988) recognized constraints and limitations under which the project functioned. One of them identified needs for the following: a) a documentation and publication center; b) complete and controlled use of the laboratory so that it met minimum scientific standards; c) ensured availability of vehicles and drivers for the researchers; and d) development of technical documents, scientific papers as well as educational materials on the adaptive technologies of farmers. A need for economic analysis in agronomic experimentation was emphasized in view of its absence.

Another TDY, three years after the project began, (Wailes, 1987), elaborated on serious shortcomings of the project (already noted elsewhere in this report),

> While there have been several initiatives in economics, including the bean enterprise budget work and an initiative on market structure, on the whole the economic research has been poorly organized and integrated into the project. The lack of multi-disciplinary research and collaboration among the team researchers is apparent throughout.

One TDY (Parsch, 1988) reported that the low morale of the team was the result of Project Director and Station Manager M.C. Ntambabazi's denying the team access to chauffeurs and vehicles. On the whole, the STTA personnel who visited the project had a good, objective perception of its progress and its shortcomings. They made good suggestions and recommendations, which they left behind in the documents. As in most cases, however, the recommendations were general, and no one in particular was designated with the responsibility to carry through on the recommended measure. It was not surprising, therefore, that many of the measures were left undone. For example, one TDY (Wailes, 1987) noted:

> to date only one major survey has been conducted and reported (Preliminary Diagnostic Survey of Five Communes of Ruhengeri Prefecture, Rwanda, Franzel et al, 1985)

All kinds of surveys, base-line, diagnostic, reconnaissance and verification are the life blood of farming systems research. The fact that for two years after the inception of the project, none of these methods had been used casts serious doubt upon the validity of the on-farm research conducted during this period. There were no survey findings on which to base the parameters for on-farm experimentation. As a result, much of the research results achieved are not applicable to farmers' situations and conditions, nor do the farmers find them acceptable or adoptable.

Another TDY (Zalla, 1987) wrote as follows:

> The most serious lacuna in the current situation is the lack of an experienced, competent, farming systems economist who can communicate effectively in French and command the respect of his peers. All research needs to be placed in an economic context as soon as possible in order to avoid fruitless pursuits.

These comments turned out to prophetic in regard to the fruitless Lime & NPK on-farm trials conducted by the project.

Generally, there seems to have been a lack of STTA support in certain key areas -- watershed management, organic agriculture, agricultural economic, livestock and fodders/feeds.

4.4. Team leadership

Team leadership was of very poor quality. To quote from the 1989 evaluation document:

> None of the COPs posted by the UOA were conversant with, or practitioners of Farming Systems Research and Extension. The first had little input into the program. The second passively tried to accommodate an FSR/E approach to team activities, and the third seems to have actively avoided the methodology of adaptive research the basis of technology development for Farming Systems.

The Farming Systems Support Project, located at the University of Florida, in one of its regular publications, touted the University of Arkansas as being one of the foremost institutions supporting and disseminating farming systems research. However, UOA performance in this project left much to be desired, especially in terms of selection of leaders for the project's FSR/E team.

The heart of an FSR/E team is the team leader, who should have many years of experience on the FSR/E. Because each of the three COPs appointed lacked such experience the team was not effective in providing workable solutions to farmers' problems.

4.5. Team functioning

There is already abundant evidence that the team did not function as a multidisciplinary unit, unitedly addressing all farmers' problems and constraints from a holistic standpoint. Instead, the team's approach was interdisciplinary, each member carrying out his research activities in his own narrow field. The soil scientist, on the basis of "review of secondary data, exploratory surveys with farm families, consultations with scientists who have experience in Rwanda and direct communication with local administrators and key informants," had identified and prioritized the lack of soil conservation as a major constraint and set about developing technology in the realm of agroforestry to counteract the erosive forces resulting from rainfall and slopes. This entailed alley-cropping on the slopes protected by living hedges of leguminous tree species (Yamoah #65). The soil scientist disregarded MINAGRI's extension-program recommendations to the farmers concerning plant species useful for living hedges. Neither was the team's agronomist consulted as to what kind of crops should be grown in the alleys (Yamoah/Burleigh #37; Yamoah, #38 & Yamoah/Getahun, #102). The agronomist unsuccessfully attempted to initiate some studies that sought to draw other team members into the exercises, but only the farmers participated.

4.6. Linkages to on-farm/on-station research

All alley-cropping/living-hedge trials conducted by the soil scientist were sited in the Rwerere Experiment Station and, in one case, on communal plots sited outside the experiment-station perimeter. These trials were managed by researchers, and the results of the trials were not extended into farmers' fields.

In all studies undertaken by the agronomist, farmer collaborators participated, and the experiments were sited either on farmers' fields or on fields belonging to the Centre d'Enseignement Rural Artisanal Integre (CERAIs). To conduct tests minimizing on-farm, grain-storage loss, farmer collaborators were recruited, and the Rwerere storehouse was used for storage (Paul, #24). For the study on Bean--seed treatment with pesticides, the fields of farmer collaborators and CERAIs were used (Paul/Trutmann, #23). In the FSRP bean-varietal research, in which high-yielding cultivars were used, a total of 60 farm families participated (Paul, #17). Farmers from 19 farm families were also asked to evaluate the distributed climbing-bean varieties using their own criteria (Paul, #77). In all these instances, farmers participated fully, and considerable effort was expended to gain farmer feed-back and, in one case, follow-up measures were taken to satisfy farmers' needs. Apparently, demand for quality bean seeds was so great that the agronomist initiated a program of seed multiplication by farmers themselves, in which they would grow the beans and sell them back to the FSRP project to be distributed, in turn, to other farmers (Paul/Grosz #15 & #16).

In these two approaches, there is wide divergence. The agronomist worked almost exclusively with the farmers with technologies that were acceptable to and adoptable by them. The soil scientist, however, stayed within the confines of the experiment station, developing technologies with no demonstrable application to farmers' needs. An example of these efforts was his intensive research of the leguminous tree-species, *Sesbania*, while farmers were planting *Pennisetum* in accordance with MINAGRI's recommendations and also because it afforded them multiple advantages.

The evaluation team found little or no on-station/on-farm research linkages.

4.7. Linkages to extension

As has been seen elsewhere, FSRP established through recruitment of *moniteurs agricoles* -- extension agents -- an extension system parallel to that already in existence. This FSRP-established extension system was the means by which technologies were extended to farmers, including quality seeds of crops and application of lime and/or fertilizer. This extension arrangement worked very well while the project operated, but by the end of the project, the system had become almost nonfunctional. ISAR, which had initially agreed to take over this arrangement for trained personnel, was unable to do so because of budgetary constraints. At the date of writing, many of the *moniteurs agricoles* had left the war zone, and others had been employed by other projects. Those who remained did not have seeds to distribute nor improved technologies to deliver. Since the FSRP project bypassed the existing extension system, no permanent linkages were forged with it that could be used by the host-country FSR team that was supposed to have been established and left behind.

4.8. Conclusions

Poor leadership and team members' misapprehension of the nature and character of an FSR/E team meant that serious multidisciplinary research was not conducted. None of the project's three team leaders had any experience in Farming Systems Research, nor did any of the individual team members, except the agronomist and perhaps the extension specialist. Two evaluators noted in their report, "K.B. Paul spent much time indicating exactly how farming systems research is supposed to be done." (Marx/Hanson, 1986). It appeared, however, that little heed was given to his advice.

A team leader fully conversant with FSR/E methodologies should have been able to correct the deficiency and put the team on course with firm leadership. Unfortunately, because the situation was allowed to drag on over the years, and the major issues were not resolved, little of significance is left to show for all the immense investment of time and money.

The 1992 evaluation team is obliged to conclude from the evidence reviewed that an effective FSR/E team was never established during the LOP.

5. Review of appropriateness of developed technologies

5.1. Introduction

For developed technology to be accepted by farmers on the grounds of appropriateness, several conditions have to be fulfilled. It must be acceptable socioeconomically, that is, cost-effective and fitting the social conditions of the farmer. It must be available and within reach of the farmer. It must be a technology that the farmer could grasp, understand and use easily. Its economic value to the farmer must be significantly large in order for the farmer to undertake the risk of using it.

5.2. Research quality

In farming systems research and extension, the degree to which developed technology is appropriate for farmers indicates the quality of research. When farming systems research is well thought out and backed by a multidisciplinary effort, chances are greater that technology developed will be successfully received by farmers. This is the likelihood because the technology will have been subjected to a wider range of conditions that determine its acceptability or non-acceptability. The project's lime technology was not subjected to economic analysis, and, as a result, farmers were left unsupported after having been shown its advantages. Farmer use of the project-introduced, high-yielding bean variety, G2333, was compromised due to fungal root disease and pest depredation; not enough time was spent testing the bean variety on the experiment station. *Sesbania* is at best a risky leguminous tree species for use in living hedges; but in spite of the indicators, it was selected for research and extension.

5.3. Conclusions

The farmer is the ultimate judge of any technology proposed. When the farmer says that he or she prefers *Pennisetum* as a living hedge species, it is because the farmer has many purposes for it and is able to handle it and grow it to suit his or her uses. The species provides the farmer with fodder for cattle, roofing material for the farmer's home, poles for climbing beans and a living hedge for slopes. It is also easy to propagate and harvest. Where the farmer is concerned, these uses are the meaning of appropriate technology that is acceptable. If, on the other hand, the farmer is recommended a species that dies after two or three seasons, it would be unacceptable to the farmer, even if it fixed significant amounts of nitrogen in the soil where it stood.

The 1992 evaluation team concluded that the FSRP produced too little appropriate technology. It also found that this lack was the result of the absence of any serious farming systems research being conducted.

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6. Project management

6.1. Introduction

The original project paper delineated various roles and responsibilities of major actors: USAID, the donor agency; ISAR, the primary implementing agency; and the UOA, the lead institution chosen for both design and implementation of the project.

In accordance with USAID regulations, USAID was responsible for overseeing management and monitoring of project implementation and expenditures. USAID approval was required for all project work plans, for candidates for long-term training and for long-term and short-term technical advisors.

The University of Arkansas, in collaboration with the University of Illinois, Lincoln University, the University of Minnesota and the University of Puerto Rico (Mayaguez), was to provide technical assistance, participant training and most of the equipment procured under the project. The UOA team, under the leadership of the chief of party, as project director, was responsible for implementing the project as described in the project paper.

In the fourth and fifth amendments to the project agreement (PROAG) and in the project-paper supplement, the role of project director was removed from the UOA chief of party to the ISAR/Rwerere station chief, who became responsible for the project's day-to-day implementation. The UOA chief of party, while remaining responsible for the supervision of both the OUA field team and the UOA office in Kigali, became a senior advisor and counterpart to the project director.

6.2. University of Arkansas management

The long-term expatriate technical staff provided by the UOAr was not trained in FSR/E methodology. UOA management of the FSRP contract did not, especially in the early years of the contract, provide timely administrative and financial support for either the UOA team based in Rwanda or the long-term training participants in the U.S. UOA management problems were the cause of the FSR/E team's inability to integrate itself into the ISAR structure. The lack of any tenured UOA faculty serving as long-term technical assistants suggests that UOA was not committed to developing long-term institutional ties with farming systems research in Rwanda.

6.2.1. Lack of FSR/E training among expatriate personnel

The lack of FSR/E experience among the long-term, expatriate personnel severely limited the project's effectiveness. While individual team members conducted valid, traditional commodity research, farming systems methodology was not respected. Indeed, after six years, farming systems and recommendation domains had yet to be identified in the project area. The lack of an experienced, competent farming-systems economist meant that proposed technologies, which were eventually diffused, were never placed in an economic context. Numerous evaluations and consultant reports mentioned this lacuna, but UOA never posted an FSR/E-trained economist or a livestock specialist to the team.

The UOA compounded this problem by not providing its expatriate personnel with FSR/E training although such training was readily available, either in nearby Nairobi at the International Center for Maize and Wheat Improvement (CIMMYT) or in short-term courses at the University of Florida.

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6.2.2. Lack of integration within ISAR

The FSRP team did not integrate itself within ISAR. Although previous evaluations in 1986 and 1989 recommended the need for heightened integration and collaboration with other ISAR researchers, the FSRP team remained in near-total isolation from the rest of ISAR. Although the FSRP team sent in their annual work plans for ISAR approval, FSRP counterparts and other ISAR national and expatriate personnel reported that communication and collaboration with the farming-systems division (EM.S.P) or with other researchers was minimal. FSRP's absence at the biannual meetings for research planning and presentation of research results was indicative of the project's lack of integration. FSRP research results were never approved and rarely published under ISAR auspice; instead, the results were published by the UOA and almost always published in English.

6.2.3. UOA administration

UOA administration of the FSRP experienced serious problems in the early years of the project, but improved in later years. Indeed, USAID correspondence between the project manager and the representative revealed that UOA's poor support in procurement, in payment of personnel salaries, in negotiating the UOA-USAID contract and in providing local operating funds to finance the initial administrative team had led the USAID representative to threaten to cancel the contract and hire the FSR researchers as PSCs. Team members in the early years cite lack of support in the part of the UOA and poor communication with the project. The first team leader's letter of resignation states that UOA's failure to support his administrative decisions led to his decision to resign after two years.

Financial-management problems continued, and the 1989 evaluation specifically recommended that the controller be fired for his lack of expertise in budgeting and cash management. And in later years, as key personnel were replaced, financial and administrative problems were resolved.

OUA's management of participant training through a subcontract with Lincoln University was also unresponsive to student's needs, according to several returned, long-term training participants interviewed during the 1992 evaluation. In 1989, however, the Lincoln University subcontract ended, and UOA successfully managed participant training throughout the rest of the project.

6.3. USAID management

USAID's management of FSRP was characterized by a high turnover of personnel and by vastly different management styles, which ranged from intensive micro-management in the early years to an attitude of *laissez faire* in the middle years. However, in the final years of the project, USAID financial and technical monitoring of FSRP activities improved greatly.

Major issues concerning USAID's FSRP management include:

- the question of contractor selection;
- use of project funds for USAID management costs that were not budgeted or for other USAID-funded projects;
- USAID's late intervention when the UOA early on was not respecting the FSRP methodology set forth in the project paper and when the UOA did not provide the project with appropriate technical-assistance personnel experienced in FSR/E; and

- lack of response to the 1989 mid-term evaluation recommended an immediate project redesign, including the reinsertion of the extension component and hiring an extension advisor.

6.3.1. Contractor-selection process

The former ISAR director, who participated in program design, contractor selection and project management, complained to the 1992 evaluation team that the GOR and ISAR were not given sufficient choice when making site visits and interviewing proposed institutions. Indeed, according to the ISAR director at the time, the GOR and ISAR were given a short list of only two lead institutions -- the University of Minnesota and the University of Arkansas. Given the total lack of interest on the part of the University of Minnesota as perceived by the GOR representative, they expressed a sense that they had no choice but to choose the University of Arkansas, whose ties with farming systems research were, in their opinion, tenuous.

6.3.2. Use of project funds for expenses that were not budgeted

Use of project funds for significant USAID management costs not budgeted in the project paper and for other unrelated projects has been well documented. (See project evaluations of 1986, 1989, the UOA final report (1992) and the FSRP final comments by James A. Graham, former director of the USAID/-Rwanda Mission.

A technician with the United States Department of Agriculture Office of International Cooperation and Development (USDA/OICD), worked on the design of the project and was project manager for more than a year. He was replaced by a PSC project monitor until mid-1987. Both were funded through the project, even though their services had not been budgeted in the PP. In later years, FSRP was managed by USAID agricultural-development officers and their Rwandan counterparts. FSRP funds were also used to finance a PSC engineer and mechanic, in addition to funding PSC positions for spouses and other project activities, such as RRAM. These actions created an impression within ISAR that the FSRP was not operating within ISAR, the primary implementing agent.

6.3.3. Slow USAID response to UOA problems in upholding project commitments

Early on in the project, USAID should have noted UOA's inability to provide appropriate personnel with suitable FSR/E experience for long-term and short-term positions and should have noted UOA's digression from established FSR/E procedures, such as informal, diagnostic and verification surveys, identification of farming systems and recommendation domains. However, USAID personnel did not realize until the last year of the technical portion of the project that UOA had not made significant progress toward planned project outputs and purpose. UOA's response to valid questions raised by USAID personnel responsible for agriculture and project evaluation further indicated UOA's lack of familiarity with the fundamentals of farming systems research.

6.3.4. Revisions in the 1986 evaluation and project purpose

USAID's revisions of the conclusions and recommendations of the 1986 evaluation team report were severely criticized in the 1988 audit of Rwanda FSRP. The audit was conducted by the inspector general, the FSRP evaluation (1989) and by departing mission director (Graham 1992). The FSRP 1986 evaluation had recommended that the unfilled FSR/E advisor position be quickly filled and that a study

be conducted on the existing extension system and the future role of the extension advisor. These recommendations were intended to better achieve the stated project purpose of bringing about an effective extension of new technologies to farmers.

The USAID/Rwanda ADO made major and minor changes to the evaluation recommendations. These changes resulted in the redesign of the project in the fourth amendment to the project paper. That amendment removed the extension component and terminated the extension-advisor position, did not fill the FSR/E advisor position that had been requested by ISAR and caused the Rwandan Rwerere station director to take over as FSRP project director, leaving the UOA team leader as advisor. In the 1988 audit, the inspector general found these personnel changes to be untenable, given the stated purpose of the project -- to develop a farming-systems approach to research and extension, including development of a mechanism for linking research and extension. The 1988 audit strongly recommended that USAID promptly evaluate the project in order to determine specifically how it would address the missing extension component. The 1989 evaluation recommended reinstatement of the extension component and the advisor. The fifth amendment to the PP contained these changes recommended by the 1989 evaluation team.

6.4. ISAR management

The project grant agreement stipulated that the GOR was responsible for furnishing to the project technical services, facilities and equipment. The GOR was to provide the services of counterparts to the UOA team including:

- one project director (five years);
- one agronomist (five years);
- one extension specialist (five years);
- one agricultural economist (five years); and
- one soil scientist (three years).

In addition, the GOR agreed to assign four A2-level or equivalent agronomists and three A2-level agronomists to work with the FSR/E team in the communes and/or at the Rwerere research station.

Throughout the project, ISAR did not provide the stipulated number of counterparts to the project. In addition, those counterparts and technicians assigned to the project were constantly changed, resulting in disruption of planned research activities. ISAR did not place a Rwandan social scientist at the project. ISAR's inability to supply the necessary number of counterparts was due to the paucity of researchers within ISAR and due to insufficient funds available to hire additional researchers. Lack of counterparts can perhaps explain some of the isolation of FSRP expatriate researchers vis a vis ISAR.

Delays in providing employment to returning long-term B.S., M.S. and Ph.D. graduates tempered their positive effects on FSRP, as did the GOR's unwillingness to effectively recognize the U.S.-earned degrees. As a result, all returned students interviewed by the 1992 evaluation team were earning salaries lower than when they departed. This situation certainly cannot encourage returned participants to remain at ISAR.

7. Economic impact of FSRP technologies

7.1. Introduction

Lack of an experienced farming-systems economist during the life of the FSRP was one of the project's major faults, and one of the reasons that the project did not conduct farming systems research. An FSR-experienced agricultural economists could have led the way during the preliminary diagnostic work, which was needed in the early years in order to identify farming systems and appropriate interventions proposed. To avoid long years of research and on-farm testing of inappropriate technologies, proposed technologies need to be placed in an economic context as early as possible. But the above-mentioned preliminary work was not adequately undertaken, and the proposed and diffused FSP technologies were not evaluated for their cost-effectiveness or sustainability.

This evaluation-report section provides a brief overview of the FSRP socioeconomic program and personnel, as well as a discussion of the economic impact of FSRP technologies. Implications for sustainability are then discussed.

7.2. FSRP socioeconomic program

The normal process for the first years of a farming systems research process requires that a strong social scientist (usually an agricultural economist or a rural sociologist) lead a team in preparing diagnostic research necessary to identify farming systems and recommendation domains. This sort of preliminary work needs to be conducted prior to implementation of on-farm research and before possible interventions are chosen. Follow-up verification surveys then need to be conducted to confirm the validity of proposed interventions. The FSRP did not follow this process. Very little diagnostic work was accomplished apart from the preliminary diagnostic survey completed in the PP design phase (Franzel et al, 1985).

The first FSRP team leader was an agricultural economist with no farming-systems experience. The heavy load of administrative duties typical of project start-ups consumed most of his time. A Rwandan agricultural economist began diagnostic work, but his work remained incomplete after his accidental death. When the first FSRP agricultural economist departed in 1987, he was never replaced. In 1988, the first agronomist was replaced by an agronomist with no training in agricultural economics. This replacement departed after several months for training in Germany. In late 1988, a rural sociologist was appointed to the FSRP team, and he remained until November 1991.

Internal (ISAR) and external evaluations undertaken in 1986, 1988 and 1989 point out the failure of the FSRP team to conduct the diagnostic studies necessary to a true understanding of existing farming systems. In addition, verification surveys would have allowed researchers to confirm their impressions concerning problems with the farming system, constraints and potential previously hypothesized. In essence, failure to undertake this preliminary research indicates that the technologies tested and diffused by FSRP were not necessarily those best suited to existing area farming systems.

The project area was never divided into recommendation domains based on socioeconomic or agro-ecological zones. As a result, the technologies tested and diffused by FSRP were given to all project participants without regard for agro-ecological conditions, such as soil characteristics, or socioeconomic considerations, such as farm size. However, technologies appropriate for a resource-poor farmer with

minimal land and poor soils is far different from technologies appropriate to farmers with abundant land and significant numbers of animals.

After orchestrating the preliminary work in diagnostics, verification and identification of homogeneous zones, the second major activity of an FSRP socioeconomic program would be to put the research into an economic context. All proposed technologies, before they are extended, need to be analyzed in terms of costs and benefits to the farmer. The impact of the technology on farm income and availability of resources is essential to avoid non-cost-effective strategies.

Technologies tested and diffused by FSRP were not placed in an economic context before diffusion. The costs and benefits of the proposed technologies were not analyzed for potential impact on farm income and resource levels. This lack of analysis is evident in the widespread diffusion of lime and chemical fertilizers that could never be cost effective regardless of how high the resultant yields. Lack of knowledge of the farming systems and the multiple roles played by *Pennisetum* led to years of attempted extension of agroforestry species unappreciated by local farmers.

The 1989 evaluation strongly recommended that partial budgeting be carried out immediately for all proposed technologies, but by the project's end, this economic analysis had not been carried out. In all fairness, the FSRP socioeconomist, was not by training an economist but was a sociologist. He produced some needed work on farmers' perceptions of the proposed technologies. (Ndiaye, 1988; Niang & Ndiaye, 1991; Ndiaye et al, 1991, 1992.)

A 1991 study of the role of climbing-bean staking, undertaken by Niang, of the International Council for Research in Agroforestry, (ICRAF) and Ndiaye, showed that farmers limit their area planted in climbing beans because of shortage of stakes. And the study showed that farmers participating in the agroforestry interventions did so primarily for forage and stake produced, not for soil fertility enhancement. Farmers had concluded for themselves that *Pennisetum* was a better choice for them, given its capacity to produce stakes and forage, in addition to its use as construction material. Results of a study conducted by Ndiaye on the socioeconomic determinants of bean yields with lime and NPK illustrate the need for economic analysis. However, the study concluded that socioeconomic variables should not be a major concern in the diffusion of the lime and NPK technology package. No consideration was given to economic factors in the diffusion of lime and NPK; as a result, farmers did not use it again. It was not cost-effective.

Toward the end of the project a whole-farm research study was conducted of thirty-six farms in the project area, and preliminary results (Ndiaye et al., 1991 & 1992) included partial budgets of major area crops cultivated with traditional technologies. No economic analysis or partial budgeting of project technologies was included.

7.3. Economic impact of FSRP technologies

It is extremely difficult to analyze the overall economic impact of the FSRP without having undertaken any analyses of the on-farm costs and returns involved. In discussions with 40 farmers interviewed during the final evaluation in September 1992, farmers were found to almost universally favor the new varieties of bean, potatoes and wheat distributed by the project. The farmers expressed their sense that the additional labor costs almost always were covered by the increased value of the crops. Unfortunately, however, this information was anecdotal. In order to calculate the true benefits of the technologies,

economic analysis of the inherent costs and benefits should be conducted at the farm level. However, such analysis was not conducted.

The UOA final report of February 1992 estimates the economic impact of FSRP on Rwanda. However, the report's estimation is not based upon valid data. The first step in assessing the costs and benefits and the impact of new technologies is to assess the impact on-farm -- the comparative costs and benefits of new versus traditional technologies for all farm types. FSRP did not identify the various types of farms in the area, nor were analyses conducted of the costs and benefits of the proposed technologies. Because the FSRP team did not dispose of the data necessary to understand the benefits for one farm, it was irresponsible to purport to calculate the total benefits for the project area.

In addition, the economic-impact analysis contained in the FSRP final report was prepared without the knowledge or participation of the project socioeconomist, who, although being a rural sociologist by training, would seem to be the team member most knowledgeable about the socioeconomic impact of the project.

An economic analysis depends on the veracity of the assumptions underlying the projected cost and benefit streams. In this case, several assumptions are unfounded, including those concerning the number of farmers adopting strategies, the increased incomes resulting from the adoption of these new techniques and the inaccurate suggestion that few area farmers cultivated climbing bean varieties before FSRP. Rwandan Rwerere Station and other ISAR staff refute as too high the number of participating farmers estimated in the project's final report at more than 40 percent of total area farmers using FSRP-diffused bean varieties. Given that extension activities were recommended only in 1989, this rate of adoption is incredibly high. According to the UOA final report, the 45 project extension agents were working directly with 12,690 farmers in the bean program alone, visiting each farmer twice a week. These numbers suggest that each extension agent was seeing 282 farmer two times per week -- making 564 farm visits per week (or one farm visit every four minutes) for the bean program alone.

Other assumptions concerning adoption of project-promoted agroforestry species and liming technology were similarly implausible. Farmers have not accepted the agroforestry species recommended by the project, and the liming-NPK strategy is not sustainable, given the high cost of inputs and the inability of governmental sources or private traders to supply the required inputs to the project area.

But even if assumptions concerning project benefits were realistic, the analysis contained in the final report's FSRP economic-impact assessment would be far overvalued; it did not take into account additional costs incurred in using the new technologies nor the opportunity cost of employing the new technologies. An assessment of the economic impact of FSRP technologies cannot be concerned only with the increased benefits, but must also consider the greater costs incurred when using an improved technology package.

8. Sustainability

Technologies introduced by FSRP into the four communes of Ruhengeri differ in their demand for on-farm resources. Cost-free innovations, such as the introduction of new varieties of climbing beans, wheat and potatoes will prove to be much more sustainable than those technologies that require cash outlays on the part of the farmer, such as the FSRP-introduced liming/NPK treatment. Another category of technological innovations comprise those which require an extra effort by the farmer, such as introduction of climbing bean varieties (and the need for poles) or the increased labor time needed for the transport of organic manure to the fields. If new technologies are to be effectively sustainable, they must fit into the farmers' economic circumstances, labor availability and needs.

8.1. Sustainable innovations: Introduction of new seed varieties

Introduction of new varieties of climbing beans, wheat and potatoes, developed by Centro International d'Agricultura Tropical (CIAT), International Potato Center (CIP) and other IARCs, and extended from FSRP to local farmers has met with considerable success and appear to be the most sustainable of the technologies introduced by FSRP (see section on the bean variety G2333 under Section 10 - Other Issues). The 1992 evaluation team noted a considerable diffusion of new varieties to non-project farmers, who had bought or exchanged new seeds with neighboring project farmers who were impressed with the high yields obtained.

The bean varieties extended by FSRP, (G2333, G2341, Mwirasi and Puebla Criollo) are in wide use in the project area. Most farmers interviewed overwhelmingly preferred the variety G2333 ("Umubano") although some expressed a preference of Mwirasi, a local variety. Problems concerning the over-concentration of a single variety, necessitate, however, continued oversight by research and extension. Farmers interviewed continue to cultivate the new varieties, using their own seed stocks. Many farmers who received project seeds several years ago continued to provide extension advice to former project farmers concerning new developments affecting the G2333 and other varieties.

Wheat (Rugezi and Cyihure) and potato (*Cruza, Sangima*) varieties extended by the project are also sustainable innovations.

8.2. Less-sustainable innovations: Bean seed and lime/NPK

Treatment and agroforestry species

Far less sustainable are those technologies calling for recurrent expenditures on the part of the farmer. Introduction of lime and NPK treatments is not sustainable and has been rejected by area farmers. Use of purchased inputs by Rwandan farmers is minimal. According to MINAGRI's Division des Statistiques (DSA) estimates, Ruhengri farmers spend only three FRw per farm household on purchased inputs for all crops per season (Loveridge, 1992). While farmers gladly used highly subsidized lime, NPK and seed treatments, they could not sustain their use, due to lack of funds to purchase these inputs and to their general non-availability. Farmers perceived FSRP as a substitute for purchased inputs.

The agroforestry species extended by FSRP were rejected by area farmers because they did not correspond with farmers' perceived needs for construction materials and forage, in addition to the need

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for poles and the anti-erosion benefits of *Sesbania*. While *Sesbania* poles arguably last longer than *Pennisetum* and *Eucalyptus*, farmers prefer the latter two.

8.3. Recommendation

Given the necessity of continuing to extend information about the bean varieties already extended by FSRP and new varieties becoming available, it is recommended that the ISAR station at Rwerere, together with the MINAGRI Unite Operationelle, located in Kirambo, give priority to extending to local farmers the latest information available from CIAT concerning the G2333 and other bean varieties, to local farmers.

9. Training of Rwandan personnel

Although the training component of FSRP is widely viewed as the major, lasting contribution of the project, the amount of training in farming system research and extension was minimal. The original project output objective to "train Rwandans at several levels who are familiar with FSR/E" was, therefore, not effectively met. Participant training cost were approximately $1.7 million, accounting for approximately 17 percent of the University of Arkansas contract, (No. 696-0110-C-00-5016-00).

The following host-country nationals were trained

- Three Rwandans trained to the Ph.D. level in US universities;
- 10 Rwandans trained to the M.S. level in US universities;
- 14 Rwandans trained at the B.S. level in US universities;
- 14 A-7 GOR staff trained in FSR/E methodology and related topics through short-term, in-country training;
- At least 125 person-days of in-service training on farming systems management and implementation concepts; and
- An unspecified number of local extension workers and farmers trained in improved agricultural technologies.

In addition, the project was to have funded at least 20 research studies, including five M.S. theses of FSR/E counterparts and three doctoral dissertations of Ph.D. candidates. The remainder of the studies were to be undertaken by the faculty and students of U.S. universities and the University of Rwanda.

In the fifth amendment to the project grant agreement of June 1990, project output and magnitude of outputs were revised to four Rwandans to be trained at the Ph.D. level, 12 at the M.S. level and eight at the B.S. level. Short-term, in-country training was reduced from 68 to 37 person-months. Project outputs and magnitude of outputs had been earlier revised in the fourth amendment to the project in July 1988.

9.1. Long-term training

The project successfully trained four Rwandans at the Ph.D. level, 10 at the M.S. level and eight at the B.S. level, meeting expected project outputs at the Ph.D. and M.S. levels. By all accounts, the students performed remarkably well, maintaining high grade-point averages, and were often recommended to pursue further studies. Indeed, only one M.S. student in biometrics failed in his course, as he apparently did not have the necessary background in quantitative studies.

In spite of difficulties and delays experienced in being reinstated at ISAR, 11 of the 18 long-term-training participants, who returned to Rwanda, were, at the time of the evaluation, working with ISAR, and two were with the project. Four returned students were pursuing higher degrees outside of the project, two were in the private sector and one was waiting for reinstatement at ISAR. The table below summarizes the current status of the 22 students chosen for long-term training in the United States.

Status of long-term-training participants
(9/30/92)

STATUS	NUMBER
ISAR	11
Awaiting ISAR Reinstatement	1
Finishing Degree Programs (USA)	3
Pursuing Non-Project Related Higher Degrees	4
Left ISAR	2
Failed Program/Non-returnee	1
TOTAL	22

Returning students initially faced delays in reinstatement at ISAR although at the time of the evaluation, 11 were working at ISAR, with one still awaiting reinstatement. Students returning after several years of study abroad were paid at salary levels lower than when they left. One returned Ph.D. student was earning 28,000 FRw ($209) per month when he left for the US in 1986, and was earning 25,000FRw. ($149) per month following completion of his degree program. A returned B.S.-degree holder was earning 23,000 FRw ($172 per month) when he left, and was earning 20,000 FRw ($149) per month on his return.

The salary discrepancies are very discouraging for the returned students, as is the GOR failure to recognize the Ph.D., M.S. and B.S. diplomas earned. No significant distinction is made between the degrees, and little merit or change of status is awarded to returned trainees. This lack of recognition increases the likelihood that ISAR will lose some of the 11 students it employs. Several returned students, who were encouraged by their universities to pursue higher degree, maintain that they were told by USAID and the FSRP for several years that they would be given priority in the second phase of the project. These students feel that they were penalized for returning to Rwanda, unlike the four students who refused to return to ISAR and continued higher degrees in the United States, Canada and China.

9.2. Choice of field of study

Given the notable lack of social scientists in the project and within ISAR, it is unfortunate that not one participant pursued an advanced degree in agricultural economics. One student received an M.S. in rural sociology but left ISAR to work in the private sector. Two students pursued B.S. degrees in agricultural economics, but one refused to return to ISAR and is in Canada; the other has yet to complete his degree. Therefore, the net gain to ISAR capability in social-science research is a B.S. level agricultural economist, assuming he returns to ISAR.

9.3. Lack of training in FSR/E

None of the long-term-training participants received any training in FSR/E while in the United States. Several M.S. and Ph.D.-level students requested to attend short-term courses in FSR/E given at the University of Florida, but the University of Arkansas denied the requests, according to the returned students interviewed during the 1992 evaluation. All students did attend one annual FSR/E seminar held

at the University of Arkansas. The lack of training in FSR/E for the long-term participants is a direct contradiction of the stated project purpose, which was to assist the GOR in developing a farming-systems approach to research and extension.

Long-term training was initially managed by the training subcontractor, Lincoln University, from January 1985 until the end of December 1989. Lincoln University was responsible for student placement, program monitoring and the eventual repatriation of students. But student and project-staff dissatisfaction with the resources and support provided by Lincoln University necessitated termination of the Lincoln University subcontract. From January 1990, until the end of the contract, the University of Arkansas International Agricultural Programs assumed management of the FSR/E long-term-training program.

9.4. Short-term technical training

Short-term technical training under the project includes three types of in-country training:

- short-term training of A2-level GOR staff in FSR/E methodology and related special topics;
- in-service training of farmers, A2s and extension agents in concepts of farming-systems management and implementation; and
- training for local extension agents and farmers in improved agricultural technologies.

Out of a targeted 45 person-months, the project provided 25.5 person-months in short-term-training courses, workshops and conferences. Project staff attended short courses in agroforestry and extension, database management, farming-systems methodology, cereal agronomy and pea production and disease control. International conferences and workshops on agroforestry, farming systems research and plant pathology were among those attended by project staff. Less than 20 percent of the courses, seminars and conferences were related to farming systems research.

The UOA team's absence from a short-term-training course on FSR/E methodology at CIMMYT or elsewhere had serious ramifications for the project. Proper training in FSR/E procedures would have guided the team in the early stages in following established steps in preliminary diagnostic surveys and in identifying target farming systems or recommendation domain.

The project exceeded the level of in-country training of farmers, A2s and *moniteurs agricoles* in terms of concepts of FSR management and implementation, as well as in the training of local extension agents and farmers in improved agricultural techniques.

9.5. Special studies

The original project paper provided funding for 15 special research studies to be undertaken by U.S. and Rwandan students and faculty. These special studies were to supplement the on-the-job research undertaken by the FSR/E process. The fifth amendment to the project grant agreement significantly reduced funding for special studies.

Seven special studies were undertaken during the project period. Two University of Arkansas students completed their M.S. thesis research, and two University of Rwanda students completed their memoire

research at Rwerere under FSR/E staff supervision. In addition, three of the Rwandan long-term-training participants completed their Ph.D. research under project auspices.

The lack of linkages between FSRP and local research and academic institutions meant that research efforts by other ISAR researchers and by faculty of the Universite Nationale de Rwanda (UNR) were not funded.

Among the special studies recommended in the project grant agreement, but that were not undertaken, were studies addressing the following: role of livestock in local farming systems; economic analyses of farming systems; interventions; marketing; acceptability of new agricultural products; evaluation of agricultural education; roles of gender in agriculture; implication of farming systems for agricultural policy; and the nature and availability of agricultural inputs and services.

9.6. Recommendations

USAID should undertake discussions with GOR in order to ensure that university degrees earned by returning students be recognized by the government and that graduates' status reflect this recognition of the B.S., M.S. and Ph.D. degrees. Although recognition of U.S.-earned university degrees is a policy issue, such recognition will be crucial to the GOR in retaining participants returning from long-term training.

10. Other issues

10.1. Effect of the fourth and fifth amendments on project implementation

The original PP was amended in July 1988. The recommendations, which partially formed the basis of Amendment number four to the grant agreement, redesigned the project. Amendment four eliminated the extension component of the project, as well as the extension-specialist position. In addition, the FSR/E-advisor position was dropped, and the Rwandan Rwerere station chief replaced the UOA chief-of-party as project director. These changes were in direct contradiction to the recommendations contained in the 1986 FSRP project evaluation, which had requested a review of how best to address the extension component. The extension component was always an integral part of the project purpose, which specifically mentioned development of a farming systems approach to research and extension, including a mechanism for effectively linking research and extension institutions and their activities. With removal of the extension component of FSRP, the project could not attain the stated project purpose. The 1988 audit conducted by the inspector general found the changes in the fourth amendment to the PP to be untenable, and the audit found that important issues concerning extension and project leadership were completely altered from what had been recommended by an impartial evaluation team. The 1988 audit strongly recommended that USAID promptly evaluate the project in order to determine the content of the extension component and the nature of project management.

In response to the 1988 audit, an evaluation was conducted in June-July 1989; it recommended that an extension component be added to the project by integrating project activities with the newly created MINAGRI Unite Operationnelle. USAID funding of $750,000 was available, but MINAGRI did not assign personnel until late 1991.

The fifth amendment to the PP of July 1990 added $2.7 million to FSRP and extended the PACD from Sept. 30, 1991, to September 30, 1992. The fifth-amendment changes essentially undid changes included in the 1988 fourth amendment to the PP. Linkages between FSRP and MINAGRI's extension services were to be strengthened in order to more-effectively disseminate the improved technologies developed through the project. This renewed emphasis on technology extension, or diffusion, had a positive impact on FSRP, as the number of participating farmers had by mid-1990 risen to nearly 2,000. Other fifth-amendment modifications concerned 1) establishment of procedures to ensure that FSRP researchers at the Rwerere station functioned as an integrated, multidisciplinary team, consistent with the methodology of farming systems research and extension and 2) increase in the integration of the FSRP research team into ISAR's overall system for research management and administration. These recommendations, however, met with limited success.

10.2. Impact of the war on project activities

10.2.1. The war

In October 1990, the war between the rebels and the GOR began in the north, where the project was located. In November 1990, the expatriate team was withdrawn from Rwerere Experiment Station and relocated in Kigali, from where it was supposed to make regular visits to the station to conduct its research.

10.2.2. The rebel attack

At 7 pm on June 25, 1992, the war came to Rwerere. Rebels attacked the experiment station. They set fire to two of the project vehicles and riddled three others with bullets. They burned files and destroyed an IBM typewriter.

The rebels looted the dispensary of drugs and medicines and set the ambulance on fire. They departed at about 2 a.m. but continued to bombard the station with mortar fire (Nizeyimana, 1992a). Those who were living on the station when the rebels struck hey had to trek about 30 km to the main asphalt road. It took the band of men, women and children about eight hours to reach the road (Nizeyimana, 1992b).

10.2.3. Experiment-station activity

The station was evacuated, and for a week after the attack, there was no activity on its premises. After the first week, the staff returned to work but stayed only during daylight hours. For several reasons, however, the staff's level of effort diminished over the course of time. Some of the station staff left and never returned; the expatriate staff visited the station with reduced regularity, and the morale of station workers was adversely affected by the continuing tension.

10.2.4. Expatriate-team performance

Because of hostilities, the expatriate team was installed in Kigali, and the FSRP offices became their base of operations. With some exceptions, members of the FSRP team would go to Rwerere only once or twice a month. Those who arrived there would not stay beyond half an hour. Under such circumstances, the level of effort became considerably reduced. The ADO's office moved to terminate the project because the team, being removed 80 kilometers from its sphere of activity, could not effectively carry on its work of FSR/E research. The United States ambassador, however, intervened to prevent the project from being terminated.

10.2.5. End-of-project status of the experiment station, Rwerere

The station was unofficially shut down and all expensive equipment in the laboratory and the computers were taken to Kigali for storage. The 1992 evaluation team found the equipment store room in disarray although the cupboards full of analytical chemicals were still intact. The samples laboratory was filled with soil and tissue samples awaiting analyses. It was uncertain when the samples would be processed, or, if the samples were processed, whether the results would be relevant.

10.2.6. Housing

For want of occupants, the on-site houses are beginning to deteriorate. When the houses were inhabited, heaters were in use and kept the dampness and the mold out. Without regular heating, however, mold is beginning to form on interior walls. One rainwater-collection system is missing several lengths of pipe leading to the reservoir.

10.2.7. Offices

Experimental station work has ceased although the station director claimed to be making periodic visits to manage the station and to monitor some permanent trials. Trials that were already laid down had been harvested when the 1992 evaluation team visited the station on September 11, 1992, and the harvest was being disposed of by sale to some station staff and neighboring farmers.

The experiment station offices are all closed, and work is at a standstill. Distribution of seeds to farmers by the *moniteurs agricoles* were terminated, so were regular visits to farmers as of September; but work was ongoing as of last season.

10.2.8. Refugee impact on farmers

The war and the influx of refugees also had an impact on the existing farming systems. Farmers interviewed during the 1992 evaluation team's RRS complained about the damage to their crops caused by the refugees' freely roaming animals. Other farmers complained of the total theft of harvests from their fields and the loss of trees from their reforestation plots.

The price of eucalyptus for poles and firewood increased from 150 FRw to 200 FRw per tree in some areas. The prices of basic foods also increased in the local markets although some farmers admitted that they benefitted from the higher sale prices of their cash crops. Problems of health and hygiene abound as a result of the settlement of many thousand people in towns and villages, which lack proper infrastructure to support them. USAID has helped significantly by providing plastic tents for these refugees.

10.3. Impact of the project on women

10.3.1. Introduction

Women play an important role in agriculture in the project area, often participating in all agricultural activities and crop-production systems. While project activities did not particularly target women, women comprised a significant portion of project beneficiaries. The 1992 evaluation team's RRS of approximately 40 area farmers -- including, both men and women and project and non-project farmers -- determined no difference between men and women's access to project personnel, resources or information. However, because the FSRP team did not collect data on the number of women participants, it was not possible for the evaluation team to disaggregate project impacts comparatively between men and women.

10.3.2. Women and FSRP

According to project extension personnel and the current Rwerere station director, FSRP actively worked with women farmers, who accounted for approximately 40 percent of total project participants. The exact number female farmers participating in the project is difficult to calculate, as FSRP personnel did not separate female from male project participants, and all project lists cite the name of the male head of family, except in those rare cases of long-time widows or single-women proprietors of land.

The project recruited women as extension agents, and both male and female extension agents seemed to have excellent relations with female farmers. Indeed, no differences in attitude on the part of the extension agent or in access to FSRP technologies could be detected for female farmers. Male and female farmers interviewed in the RRS had similar characteristics as far as the number of active farm workers, major agricultural constraints, number of cash crops grown, number and type of project activities and number of monthly visits by extension agents.

The PP indicated that during project implementation, particular attention should be given to gaining a more complete understanding of the role of women in agricultural production. This understanding was to be achieved through disaggregation by gender of survey-research data and through a household survey to analyze gender roles in agricultural production and decision making about agricultural production. Although the household survey was undertaken late in the project, most of the socioeconomic or technical data collected during the life of the project were rarely disaggregated by gender. Except for sections in the preliminary diagnostic survey (Franzel et al. 1984) conducted during the design of FSRP, none of the research topics pursued, nor FSRP publications, nor special studies undertaken during the LOP were related to the role of women in local agriculture.

The PP also stated that a special effort be made to include women on the FSRP team, both as expatriate advisors, Rwandan counterparts and extension personnel. While no women researchers were included among UOA team members, two A2-level women Rwandan counterparts participated in the project. Approximately five women extension agents participated in the project, and four of the 22 students travelling to the United States for long-term training were women. Two women received B.S. degrees in crop science and in horticulture while the third received an M.S. in crop breeding. In addition, one of seven participants in short-term training was a female agronomist, who attended a CIMMYT short course on cereal agronomy. The project financed attendance at 12 internationally held conferences and workshops; a female agronomist attended a regional wheat workshop in Nairobi in 1989.

It is, therefore, concluded that although the project did not focus specifically on women's roles or issues of women in development (WID), FSRP did not discriminate against female farmers and seemed to have as much impact on female farmers as it did on male farmers. The project is to be commended for fully integrating women into the regular extension program. Setting up parallel, separate, but often unequal, extension systems for women have usually proven to be unsustainable in the long run. It must be noted, however, that integration of the extension system is not restricted to the project area but is a characteristic of MINAGRI extension in the zone.

10.3.3. FSRP technologies and the need for increased labor

Farmers interviewed, both women and men, were almost universally favorable toward the improved varieties of beans, wheat and potatoes introduced by FSRP. New varieties, accompanied by newly introduced techniques of in-line sowing (*semis en lignes)*, weeding and increased applications of organic fertilizer appreciably increased labor time necessary for both the male and female farmers interviewed. While some farmers were able to find additional labor on-farm, most had to hire daily workers. Finding farm workers was not a problem as there is an active labor market, given the scarcity of land and the supply of labor available. Increased labor costs cited by both and women farmers ranged from 300 FrW to 5,000 FrW per season. All but one farmer, a man, interviewed found that the additional labor costs were cost-effective; that is, the additional value of increased production more than accounted for the increased costs of production. (Results of the RRS of 40 area farmers are presented in the attachments.)

10.3.4. Women and FSRP methodology

Some authors contend that gender bias has been perpetuated and institutionalized within the FSR/E process, specifically in the definition of recommendation domains, in the conduct of diagnostic surveys and in the choice of farmers for on-farm trials (Jiggins, 1986). However, evidence regarding gender bias in FSRP methodology is incomplete.

While extension personnel confirm that on-farm trials were often conducted on female farmers' fields, no supporting data are available to indicate numbers or percentages. Given the lack of gender crop specialization in the project area, it seems evident that the crops under trial would be pertinent to women farmers. Because the FSRP team did not document the diagnostic survey by Franzel et al. (1984) the 1992 evaluation team was not able to assess the quality of the trials. Nor did the FSRP, in seven years of project activity, identify recommendation domains for either male or female farmers.

10.4. The G233 bean issue

In seasons 1987A and B, the project, in on-farm trials in collaboration with 60 farm families, tested high-yielding bean varieties, both dwarf and climbing, (Paul, #17, #77). Climbing varieties selected for the A season were Urunyumba 3*, Rwamirego, Kilyugaramwe, Mwirasi, Local Mixtures, FSRP Mixture (Rwamirego=20 percent; Mwirasi=30 percent; Urunyumba 3=20 percent; Nyaramushali=15 percent; Kilyugaramwe=15 percent), G858*, G811*, G2333*, Puebla Criollo and C10).

In season 1987B, the project used the following varieties and mixtures, Local Mixture, FSRP Mixture (Urunyumba 3=20 percent, Puebla Criollo=20 percent, G2333=20 percent, Rugandura=20 percent and Mwirasi=20 percent), G858*, G811*, G2333* and Puebla Criollo*. Those marked with an asterisk were ISAR/CIAT varieties. It will be noted that G2333 occurs in the varieties included in both seasons.

In both seasons, performance of some of the ISAR/CIAT varieties was outstanding, giving yields in excess of 2,100 kg per hectare in comparison with an average yield of 1,620 kg per hectare for the local varieties. Among these varieties, the farmers preferred G858, G2333 and Puebla Criollo over the others.

In the FSRP final report (FSRP #105) it was reported that originally there were four high-yielding varieties extended to farmers, Umubano (G2333), G858, Puebla Criollo and Mwirasi, but that Mwirasi had been dropped as a result of a survey conducted by the socioeconomist, Ndiaye (Ndiaye, 1988). In this report, advantages and disadvantages of both G2333 and Mwirasi are presented as rated by farmers, but not side by side on a comparative basis, thus rendering an objective comparison rather difficult. However, Mwirasi is rated superior to G2333 in terms of yield and taste and, therefore, it is uncertain why this local variety was dropped from the program. In addition, according to an earlier evaluation by the agronomist, the variety appeared to be an excellent performer. Under the local agro-climatic conditions, it matured in 135 days; the plants were relatively light weight, and Pennisetum stakes could easily support them. The seeds were of good size and had a brilliant, violet color, and best of all, the variety was an excellent producer (Paul, #17).

Variety G2333 was given emphasis in the extension program, and farmers liked it. In recent months, it was rumored to have developed a problem and CIAT was reportedly considering pulling it out of the program. In an interview, Dr. Urs G. Scheidegger, coordinator of the CIAT program in Rwanda,

provided some interesting information. The variety Umubano (G2333) had developed some problems in the field. It had been found to be susceptible to rust and a fungal root disease *Fusarium oxysporum*, the symptoms of infection being a drying up of the vine. (Please refer to ISAR extension circular in attachments.) Dr. Scheidegger's estimate was that in a couple of years, the disease would have spread sufficiently to affect about 40 percent of the planted crop. In his opinion, once the percentage of infection rises to 80 percent, farmers will automatically stop growing it. The best way to counteract the disease would be for farmers to practice crop rotation regularly.

The 1992 evaluation team's rapid reconnaissance survey revealed another major problem afflicting the G2333 Bean. In the Cyeru commune, almost all farmers interviewed claimed that even before the beans were harvested, rats consumed them, apparently preferring them to the other varieties grown. On the surface, G2333 seems to be becoming a liability to farmers rather than an asset. CIAT apparently intends to tighten its screening procedures before it releases any more high-yielding varieties.

Risk is always involved in introducing a so-called high-yielding variety into a local environment from a foreign environment. The bean may perform well in the beginning, but sooner or later, it is found to have weaknesses that make it unsuitable. This process happened with high-yielding sorghum varieties introduced into Mali, pearl millet varieties introduced into Senegal and cowpea varieties introduced into Niger. Local varieties that have adapted themselves well to the environment and could be improved by selection and breeding are often neglected and dropped from programs. Such seems to be the case with Mwirasi mentioned above. In the meantime, it was uncertain as to what kind of problems the other introduced varieties, such as G858, G2331, Puebla Criollo and Guatemala, would be subject to in the future, especially in light of what happened to G2333.

10.5. Infrastructure construction by AFRICARE

AFRICARE was accorded a $750,000 contract by USAID for construction in the four project communes of Butaro, Nyamugali, Nyarutovu and Cyeru. Work involved installation of gravity-flow water-supply systems, capping of springs, and construction of training centers, routes and bridges. From September 1988 to June 1992, the following were completed:

- capped 258 small springs;
- installed six gravity-flow water systems;
- installed Kubona Youth Center rainwater-catchment system;
- resurfaced 29.5 km of roadway;
- constructed three large, eight medium and 20 small bridges;
- constructed four rural training centers;
- constructed two veterinary dispensaries.

AFRICARE completed this contractual work satisfactorily (Laframboise, 1992). Dong Trong Viet, USAID engineer, affirmed that construction and installation performed under AFRICARE's supervision was well managed. Correctional effort was limited to less than 10 percent (Dong, 1992).

Provision of water points in rural areas of the project zone was a worthwhile undertaking; the water points provided a clean, potable-water supply to an estimated 2,639 families, about 15,834 persons. Risk of contracting water-borne diseases and subsequent incapacitation was greatly reduced for the rural communities involved. This is one of the aspects of the project which will have lasting value.

11. Assessment of the end-of-project status

11.1. Introduction

In assessing the EOPS, the evaluation team had recourse to interviewing the director of ISAR, who had for almost seven years been absent on studies for his Ph.D. in the US. According to the director, ISAR was able to provide the full complement of four Rwandan scientists to make up the national FSR/E team although they were only able to do so towards the end of the project, in 1991.

11.2. ISAR's institutional capability to perform adaptive research on food crops and livestock

A reorientation exercise has changed the organizational structure of ISAR so that farming systems research is conducted under programs. The German Society for Technical Cooperation (GTZ) has a program under an expatriate director that is implemented by both expatriate and Rwandan scientists. Rwandan scientists who were attached to the FSRP programs have, therefore, been reassigned to another program, including that of GTZ.

Indirect evidence from a published report (Paul et al., #29:Performance of Improved Wheat and Triticale Varieties under Farmer Conditions in Rwanda), indicates that at least two Rwandan personnel received hands-on training in methodologies of farming systems research. However, they were not the counterparts to the agronomist and did not form part of the core team.

ISAR scientific staff may have acquired the institutional capability to perform adaptive research, but it is unlikely that the acquisition came from being associated with the FSRP. It is more likely that the staff are undergoing hands-on training within one of the current FSR/E programs of GTZ or of the Cooperation Francaise.

11.3. Heightened FSR/E awareness and understanding among Rwandan agricultural scientists and extension personnel

The 1992 evaluation team noted an awareness among Rwandan scientists and agricultural personnel working with the project that they were involved with farming systems research. Whether they understood what it meant is a moot point. Two station directors, one soil scientist/station director, five agronomists, one economist, one socioeconomist and one animal scientist were attached to the project as members of the team. Agricultural and extension personnel working with FSIP collaborated in diagnosis, farmer selection, placement of on-farm trials and site selection and "umuganda." CIMMYT and FSSP assigned officers to train the team in farming systems research, and the FSIP agronomist also gave some courses (Ann.Rep.1986). In spite of all this effort, farming systems methodology never became institutionalized in ISAR.

Heightened awareness among team members of the farming-systems approach to agricultural development would be evident by team members participating in diagnostic and reconnaissance surveys, technical commission and team meetings, discussions and information exchange. Apparently, the team did not partake in any of these activities. The 1992 evaluation team found no integrated FSR/E databases and

no clearly defined recommendation domains in the project zone (Chaudhry et al, 1989). To quote from one of the recommendations from the latter source:

> The FSR/E Team should recognize system diagnosis as a dynamic, iterative process that must be jointly carried out by all team members. Particular attention should be given to the definition of "recommendation domains," at least in the context of specific technologies, and to the implementation of a verification survey to justify research priorities and provide baseline data.

Since none of these activities were implemented by the team acting as a whole, it cannot be assumed that Rwandan scientists, simply by virtue of having been associated with the project, gained a heightened awareness and understanding of the FSR/E approach. Because no linkages were established between the project and the extension system, the same may be said of Rwandan extension personnel. Very little awareness of the FSR approach was noted among extension staff. To quote:

> For the most part, the local extension personnel, and especially the communal *moniteurs agricoles*, seem largely unaware of the project's farming systems orientation and of its programmatic objectives. (Chaudhry et al., 1989).

Although a knowledge of the mechanisms of farming systems research existed among project personnel, there was little or no awareness of themselves as the active purveyors of FSR/E methodology in project implementation as a whole.

11.4. An extension service with close ties to agricultural research in Rwerere

It has been noted elsewhere in this report that the FSRP project could not avail itself of the services of an extension system, since ISAR did not possess one. This lack of an extension system was one major reason why one of the project's objectives was to form a functional linkage between ISAR's research and MINAGRI's extension capacities. It has already been seen that the parallel extension system developed by the project fell apart when the war brought an end to field operations, and trained *moniteurs agricoles* were reassigned to carry out extension in the farms between Kigali and Rwerere under an extension liaison officer.

Relationships that should have been established were linkages between ISAR's scientists, functioning as an effective FSR/E team, and MINAGRI's existing extension network, transmitting appropriate technology to farmers. But linkage between ISAR and MINAGRI did not exist from the beginning and no links were formed throughout the LOP.

The FSR/E team did not develop within the project area any extension service with close ties to agricultural research in Rwerere.

Attachments

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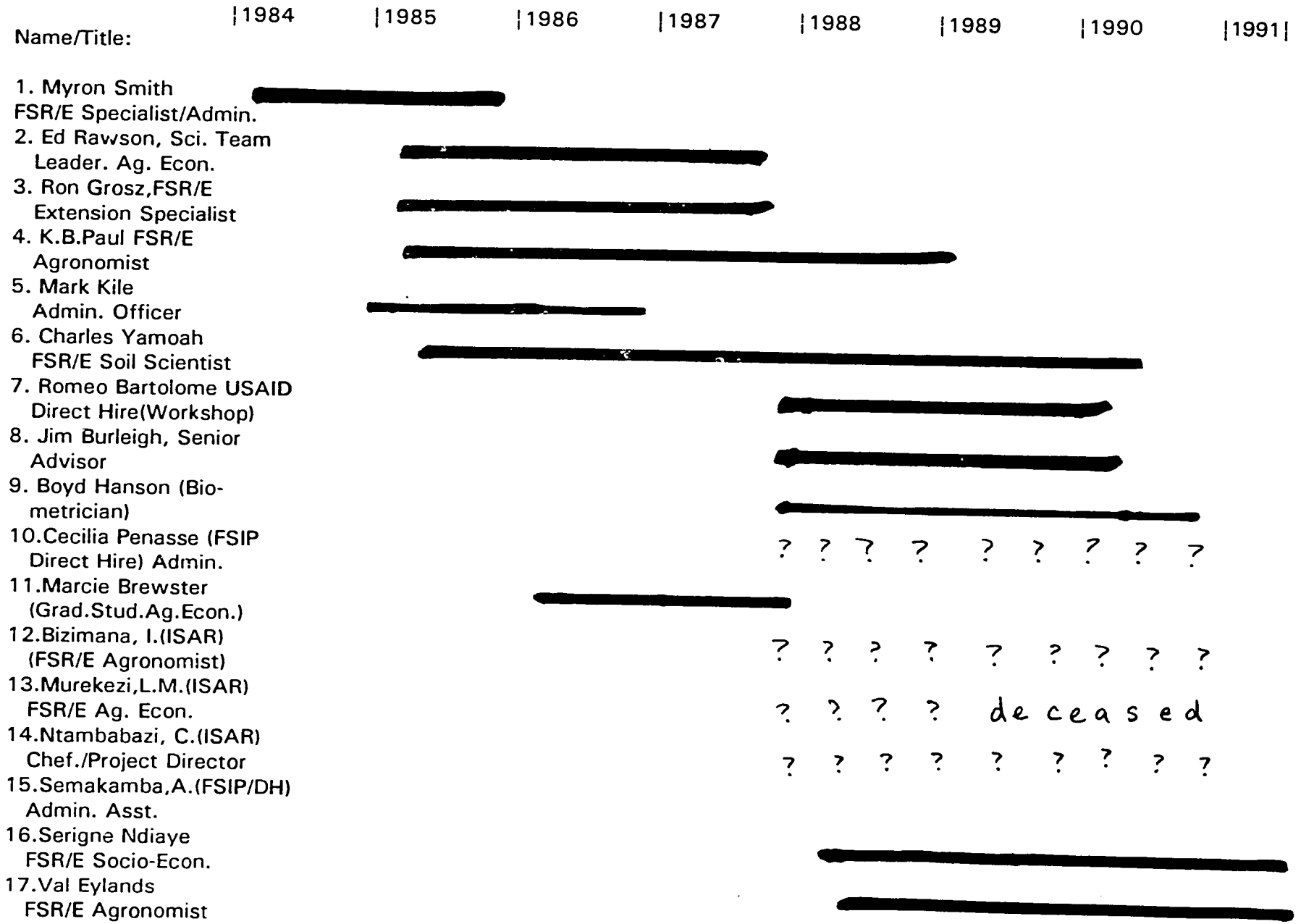
FSRP staffing and period of service for personnel



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Name/Title:	1984	1985	1986	1987	1988	1989	1990	1991
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19.Ukiriho, B.(ISAR) Chef./Project Director					? ?	? ? ? ?	? ? ? ?	? ?
20. Juanita Eylands(FSRP/DH) (Train./Admin./Coord.)						———	———	———
21. Arvid Rimkus (FSR/E Res. Exten.Lias.Officer)							———	———
22. Munyemana,A.(ISAR) FSR/E Socio-Econ.						? ? ? ?	? ? ? ?	? ?
23. Kayihura, F.(ISAR) Extension Agron.						? ? ? ?	? ? ? ?	? ?
24. Nizeyimana,E.(ISAR) Chef./Soil Scientist								? ?
25. Nyirandege,P.(ISAR) Agronomist								? ?
26. Mbarushimana,T.(ISAR) Animal Scientist								? ?
27. Nkusi,J.B.(ISAR) Agronomist								? ?

Memoranda noting changes in evaluation work schedules

Appendix

MEMORANDUM

DATE : September 4, 1992

TO : Alex Cunard, Team Leader, FSRP Final Evaluation

FROM : PDO, Claudia Cantell

SUBJ : Modification to Evaluation Schedule

REF : Meeting, September 4, 1992

As a result of the referenced meeting, the following modification to the FSRP Evaluation was agreed upon, and the workplan for your stay.

September 4 - 7	:	Meet with USAID officials and read the project documents. Develop the draft workplan.
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September 28	:	Submit reports to USAID PDO at 7:30 a.m.
October 1	:	Meet with USAID PDO and ADO representatives at 7:30 a.m. to obtain USAID's written comments on reports.
	:	Meet with USAID PDO and ADP representatives at 1:30 p.m. to discuss comments.
October 7	:	Submit final reports to USAID.

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MEMORANDUM

DATE : September 28, 1992

TO : FSRP Evaluation Team, Alex Cunard and Millie Gadbois

THRU : ADO, Kurt Fuller

FROM : PDO, Claudia Cantell

SUBJ : Change in Workplan

REF : Cunard/Cantell telecon, 9/28/92

A one day extension in the due date for the draft FSRP final evaluation being submitted to me is granted. This is based on our discussion today in which you informed me of the continuing problems with the computers and transformers resulting in the draft not being quite finished by 7:30 a.m. today.

We expect the draft evaluation by noon, September 29, and we will then continue with the agreed upon workplan schedule.

Cleared:ADO:PBartholomew: PWB Date: 9/28/92
ADO:ETwagirumukiza: ET Date: 9/28/92

MEMORANDUM

DATE : October 7, 1992

TO : TR&D, Cynthia Purdy-Bertelson

FROM : PDO, Claudia Cantell

SUBJ : FSRP Final Evaluation

REF : Cantell/Cunard Discussion, 10/7/92

Per the referenced discussion, USAID notes that, as a result of computer inadequacies, the numbers of reports called for in the delivery order will not be provided at this time. Instead, Dr. Cunard will provide three copies of the English version by close of business 10/7/92; the remaining seven English copies will be made by TR&D and pouched to ADO Kurt Fuller, Dept of State/Kigali, Washington, D.C. 20521-2210; and, the ten French copies will be submitted directly to USAID by AGINCO, the Rwandan firm Dr. Cunard subcontracted with to produce the French. The English diskette was given to Dr. Bartholomew. ADO, and AGINCO will supply the French diskette when it turns over the hard copies. The French diskette, if AGINCO is unable to supply it in IBM DOS compatible form, will be supplied by TR&D.

ADO:PBartholomew: Pbto Date: 10/7/92

ADO: K. Fuller 10/07/92

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MEMORANDUM

DATE : September 28, 1992

TO : FSRP Evaluation Team, Alex Cunard and Millie Gadbois

THRU : ADO, Kurt Fuller

FROM : PDO, Claudia Cantell

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ADO: ETwagirumukiza: _____ Date: 9/28/92

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ADO:PBartholomew: PBto Date: 10/7/92

ADO: K. Fuller 10/07/92

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MEMORANDUM

DATE : September 4, 1992

TO : Alex Cunard, Team Leader. FSRP Final Evaluation

FROM : PDO, Claudia Cantell

SUBJ : Modification to Evaluation Schedule

REF : Meeting, September 4, 1992

As a result of the referenced meeting, the following modification to the FSRP Evaluation was agreed upon, and the workplan for your stay.

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Rapid reconnaissance survey

GWBASIC programs used in selecting farmers for the survey

The first program, "Sample," was used to determine the size of the sample of farmers needed in order to verify an estimated percentage of technology transmission. The two parameters needed, a) the margin of error and b) the confidence level, was decided by the surveyors and Casley & Lurey's formula was applied:

$$n = K^2 R(100 - R)/D^2$$

where:

- n = number of farmers
- R = estimate of variance where $v^2 = R(100-R)$
- K = Normal Deviate from tables for a two-sided or one-sided interval
- D = margin of error

References:

Scott, C. 1985. Sampling for Monitoring and Evaluation, Technical Supplement to Monitoring and Evaluation of Agriculture and Rural Development Projects by D.J. Casley & D.A. Lury. The World Bank.

Poate, C.D. & D.J. Casley, 1985. Estimating Crop Production in Development Projects: Methods and Their Limitations. The World Bank.

Casley, D.J. & K. Kuman, 1987. Project Monitoring and Evaluation in Agriculture. IFAD/FAO/UN/ The World Bank.

Smith, K.F., 1980. Design & Evaluation of AID-Assisted Projects, Training and Development Division OPM. USAID, Washington, D.C.

The second program is a random number generator that uses a seed number to select a required set of random numbers from a field.

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```
HOW MANY RANDOMIZED NUMBERS ARE REQUIRED ?
 40


HOW MANY NUMBERS ARE THERE IN ALL ?
 450
 303  29  72  298  215  432  60  299  277  126  267  423  164  214  255  339  59  115
214  402  437  46  285  70  36  341  331  386  130  331  171  147  258  364  246  186
248  233  50  439
```


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```
4 REM RANDOM
5 REM THIS PROGRAM WAS WRITTEN BY DR. ALEX C. CUNARD, CPAg.
10 REM RANDOM NUMBER GENERATION
14 OPEN "OUTFILE.DAT" FOR OUTPUT AS #1
15 CLS
16 PRINT
17 PRINT #1, " "
18 PRINT
19 PRINT #1, " "
20 PRINT "HOW MANY RANDOMIZED NUMBERS ARE REQUIRED ?"
21 PRINT #1,"HOW MANY RANDOMIZED NUMBERS ARE REQUIRED ?"
30 INPUT X
31 PRINT #1, X
40 PRINT
41 PRINT #1, " "
50 PRINT
51 PRINT #1, " "
60 PRINT "HOW MANY NUMBERS ARE THERE IN ALL ?"
61 PRINT #1,"HOW MANY NUMBERS ARE THERE IN ALL ?"
70 INPUT Y
71 PRINT #1, Y
100 RANDOMIZE: FOR Z = 1 TO X
200 PRINT CINT(RND*Y);
201 PRINT #1,CINT(RND*Y);:NEXT
300 REM IF 10 NUMBERS ARE NEEDED THEN WRITE RANDOMIZE: FOR Z = 1 TO 10
400 REM IF THE POPULATION = 100 THEN WRITE PRINT CINT(RND*100);:NEXT
401 CLOSE #1
```


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HOW MANY NUMBERS ARE THERE IN YOUR UNIVERSE ?
150

WHAT IS THE PERCENTAGE OF THE MARGIN OF ERROR YOU HAVE CHOSEN ?
10

WHAT IS THE PERCENTAGE OF THE CONFIDENCE LEVEL YOU HAVE CHOSEN ?
90

FROM THE TABLE AT YOUR CONFIDENCE LEVEL AND AT A 1 OR 2-SIDED INTERVAL, WHAT IS THE NORMAL DEVIATE, K ?
1.28

R IS THE RATE BEING ESTIMATED. WHAT IS YOUR ROUGH GUESS FOR R SINCE THE FORMULA IS INSENSITIVE TO THE EXACT VALUE OF R.
50

THE SAMPLE NUMBER n SHOULD BE =; 40.96

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```
50  REM SAMPLE
55 REM THIS PROGRAM WAS WRITTEN BY DR. ALEX C. CUNARD, CPAg.
100 REM THIS IS A PROGRAM THAT EMPLOYS SAMPLING FROM A LIST
200 REM TO ESTIMATE AN INDICATOR.
300 REM ASSUMING THAT A COMPLETE LIST OF THE UNIVERSE ELEMENTS ARE
AVAILABLE
400 REM THE PURPOSE OF THE INQUIRY IS TO ESTIMATE THE VALUE OF A
500 REM SAMPLE INDICATOR.
600 REM A SAMPLE INDICATOR IS DEFINED AS THE PERCENTAGE OF THE LISTED
700 REM UNITS THAT HAVE A SPECIFIED CHARACTERISTIC.
710 PRINT
720 PRINT
800 REM "FOR A SAMPLING PROGRAM WHICH REQUIRES RANDOM NUMBERS REFER TO
900 REM "THE PROGRAM ENTITLED - RANDOM.
910 PRINT
920 REM TWO PARAMETERS MUST BE DECIDED UPON (1) THE MARGIN OF ERROR D
WHICH
925 REM IS EXPRESSED IN ABSOLUTE PERCENTAGE POINTS AND
930 REM (2) THE PERCENTAGE CONFIDENCE WITH WHICH IT IS REQUIRED THAT THESE
940 REM MARGINS WILL NOT BE EXCEEDED.
950 REM D REPRESENTS LARGEST ACCEPTABLE ERROR IN THE ESTIMATE AND MAY BE
960 REM TWO-SIDED OR ONE-SIDED.  IF IT IS TWO-SIDED, ONE GENERALLY ADOPTS
970 REM EQUAL VALUES ON EITHER SIDE SO THAT THE MARGINS ARE +/-D.  IF D IS
980 REM TAKEN AS ONE-SIDED THEN THE ESTIMATE IS -D.
990 REM THE LAST PARAMETER NEEDED IS THE VARIANCE OF THE QUANTITY OF
INTEREST
1000 REM AMONG THE POPULATION.  FOR A PERCENTAGE RATE R, AND ASSUMING
SIMPLE
1010 REM RANDOM SAMPLING, V2 = R(100 - R).
1011 REM
1015 OPEN "SAMPLE.DAT" FOR OUTPUT AS #1
1020 PRINT
1021 PRINT #1, " "
1030 REM THE SAMPLE SIZE IS NOW OBTAINED FROM THE FORMULA OF CASLEY&LUREY
1040 PRINT
1041 PRINT #1, " "
1050 REM        n = K(2)R(100 - R)/D(2)
1060 PRINT
1061 PRINT #1, " "
1070 REM TABLE: CONVERSION OF CONFIDENCE INTERVAL TO NORMAL DEVIATE
1080 REM ----------------------------------------------------------------
1090 REM          CONFIDENCE LEVEL
1100 REM               (%)                    Normal deviate
1110 REM ----------------------------------------  --------------
1120 REM  Two-sided interval   One-sided interval          K
1130 REM ----------------------------------------------------------------
1140 REM       80.0              90.0              1.28
```


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```
1150 REM      90.0          95.0          1.64
1160 REM      95.0          97.5          1.96
1170 REM      98.0          99.0          2.33
1180 REM      99.0          99.5          2.58
1190 REM ----------------------------------------------------------------
1200 PRINT
1201 PRINT #1, " "
1210 REM EXAMPLE FOR USING A ONE-SIDED INTERVAL WITH A CONFIDENCE LEVEL OF
1220 REM 90.0 %, THE NORMAL DEVIATE OR K TO BE USED IN THE FORMULA IS 1.28.
1225 PRINT
1226 PRINT #1, " "
1230 REM IN THE FORMULA V(2) AND D(2) MEAN V SQUARED AND D SQUARED.
2000 REM EXAMPLE: TO ESTIMATE THE ADOPTION RATE OF A CERTAIN PRACTICE
AMONG THE 2010 REM LISTED HOLDERS, WITH A 90% CONFIDENCE LEVEL THAT THE
RATE MAY NOT BE
2020 REM EXCEEDED BY 10 PERCENTAGE POINTS AND ASSUMING THAT THE RATE MAY
BE
2030 REM AROUND 40% WE PROCEED AS FOLLOWS:
2040 REM REFER TO THE TABLE TO OBTAIN K WITH A 90% CONFIDENCE LEVEL,
2050 REM UNDER A ONE-SIDED INTERVAL.  K = 1.28
2060 REM TAKE D AS EQUAL TO 10, WHICH IS AN ACCEPTABLE MARGIN OF ERROR
2070 REM THE GUESSED VALUE OF R IS 40.
2080 PRINT
2081 PRINT #1, " "
2090 REM THEREFORE n = 1.28(2) * 40(100 - 40)/10(2) = 39
3000 REM PROGRAM FOR ESTIMATING "n" OR SAMPLE SIZE FROM A TOTAL LIST.
3001 LET D = 0
3002 LET E = 0
3003 LET B = 0
3004 LET N = 0
3010 CLS
3020 PRINT
3021 PRINT #1, " "
3030 PRINT
3031 PRINT #1, " "
3040 PRINT "HOW MANY NUMBERS ARE THERE IN YOUR UNIVERSE ?"
3041 PRINT #1, "HOW MANY NUMBERS ARE THERE IN YOUR UNIVERSE ?"
3050 INPUT A
3051 PRINT #1, A
3060 PRINT
3061 PRINT #1, " "
3070 PRINT "WHAT IS THE PERCENTAGE OF THE MARGIN OF ERROR YOU HAVE CHOSEN
?"
3071 PRINT #1, "WHAT IS THE PERCENTAGE OF THE MARGIN OF ERROR YOU HAVE
CHOSEN ?"
3080 INPUT B
3081 PRINT #1, B
```

```
3090 PRINT
3091 PRINT #1, " "
3100 PRINT "WHAT IS THE PERCENTAGE OF THE CONFIDENCE LEVEL YOU HAVE CHOSEN
?"
3101 PRINT #1,"WHAT IS THE PERCENTAGE OF THE CONFIDENCE LEVEL YOU HAVE
CHOSEN ?"
3110 INPUT C
3111 PRINT #1, C
3120 PRINT
3121 PRINT #1, " "
3130 PRINT "FROM THE TABLE AT YOUR CONFIDENCE LEVEL AND AT A 1 OR 2-SIDED
3131 PRINT #1, "FROM THE TABLE AT YOUR CONFIDENCE LEVEL AND AT A 1 OR 2-SIDED
3140 PRINT "INTERVAL, WHAT IS THE NORMAL DEVIATE, K ?"
3141 PRINT #1, "INTERVAL, WHAT IS THE NORMAL DEVIATE, K ?"
3150 INPUT D
3151 PRINT #1, D
3155 PRINT
3156 PRINT #1, " "
3160 PRINT "R IS THE RATE BEING ESTIMATED.  WHAT IS YOUR ROUGH GUESS FOR R
SINCE
3161 PRINT #1, "R IS THE RATE BEING ESTIMATED.  WHAT IS YOUR ROUGH GUESS FOR
R SINCE
3170 PRINT "THE FORMULA IS INSENSITIVE TO THE EXACT VALUE OF R."
3171 PRINT #1, "THE FORMULA IS INSENSITIVE TO THE EXACT VALUE OF R."
3180 INPUT E
3181 PRINT #1, E
3191 LET X = (D*D)
3192 LET Y = (E*(100-E))
3193 LET Z = (B*B)
3195 N = X*Y/Z
3200 PRINT
3201 PRINT #1, " "
3210 PRINT
3211 PRINT #1, " "
3220 PRINT
3221 PRINT #1, " "
3230 PRINT    " THE SAMPLE NUMBER n SHOULD BE =;"N"
3231 PRINT #1, " THE SAMPLE NUMBER n SHOULD BE =;"N"
```

Appendix

Questionnaire - Evaluation du Projet de Recherche sur les Systemes de Production, Rwanda FSRP.	Totals & Means	n
Village:		
Secteur:		
Nom du Paysan:		
Sexe:		
Male:	18	18
Female:	3	3
I. CARACTERISTIQUES DU SYSTEME DE PRODUCTION:		
1.-ZONE:		
1a a. Moyenne Alt:(1700-2000)	9	9
1b b. Haute Alt:(2000-2400)	12	12
2a. POPULATION TOTALE DE LA FAMILLE:	6.380952	21
2b. POPULATION ACTIVE DE LA FAMILLE:	2.714285	21
3. SUPERFICIE TOTALE DES CHAMPS:	1.564285	21
4. NOMBRE D'ANIMAUX:		
4a a. boeufs		0
4b b. vaches	1.5	12
4c c. moutons	1.846153	13
4d d. chevres	3	11
4e e. poulets	2.25	8
4f f. autres(lapins)	3	1
5. SOURCES DE REVENUS:(y compris agric./non-agricole)		
5a a. Travail Salarie:		5
5b b. Vente de Produits Agric.	20	20
5c c. Vente de Betail	3	3
5d d. Travail d'occasion/metier	6	6
5e e. Vente de biere de banane/sorgho	2	2
6. REVENU TOTAL:		
6a a. Par Saison		0
6b b. Par An	20476.19	21
7. NOMBRE D'ANNEES DE PARTICIPATION DANS LE PROJECT:	2.333333	21
8. CONTRAINES:		
8a a. Manque de Fumier	16	16
8b b. Manque de Fertilite des Sols	11	11
8c c. Insuffisance de terres	7	7
8d d. Manque de Main d'Oeuvre	3	3
8e e. Insectes/Pestes	12	12
8f f. Inondations/Secheresse	9	9
8g g. Manque de Moyens a investir	2	2
8h h. Problemes de Transport/Commercialisation	1	1
8i i. Autres(a preciser)		0
9. Quelles sont les cultures principales que vous cultivez?		
9a a. Haricot Volubiles	21	21
9b b. Pomme de terre	18	18
9c c. Patate Douce	10	10
9d d. Bananes	5	5
9e e. Mais	11	11
9f f. Petits Pois	8	8
9g g. Ble	14	14
9h h. Sorgho	10	10
9i i. Legumes	2	2
9j j. Tabac	1	1

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10. Quelle est la frequence des visites des monagris ?			
10.1	.1 Moins d'une fois par semaine	1.45	4
10a	a. Une fois par semaine	8	8
10b	b. Deux fois par semaine	8	8
10ba	ba. Trois fois par semaine	1	1
10c. Est-ce que c'etait suffisant?			
10ca	a. Oui	16	16
10cb	b. Non	4	4
11. Avez-vous montre ces nouvelles technologies/ techniques a vos voisins ?			
11a	a. Oui	15	15
11b	b. Non	6	6
11c. Indiquez le nombre		7.466666	15
11d. Ont-ils adoptes ces techniques?			6
11da	a. Oui	14	14
11db	b. Non	0	0
11e. Lesquels ?			
11ea	a. Semis en ligne	12	12
11eb	b. Application du fumier/engrais chimique	6	6
11ec	c. Application de la chaux	3	3
11ed	d. Utilisation du compost	2	2
11ee	e. Semences ameliorees	6	6
11ef	f. Tuteurage	5	5
11eg	g. Entretien des cultures	2	2
II. TECHNOLOGIE:			
A. LES HARICOTS:			
A1	1. Est-ce que vous-avez essaye dc cultiver les haricots volubiles recommandes par le projet?		
A1a	a. Oui	21	21
A1b	b. Non	0	0
A2	2. Est-ce que les nouvelles varietes ont donnees les rendements mieux que:		
A2a	a. Vos Haricots Volubiles?		
A2a1	1. Oui	19	19
A2a2	2. Non	2	2
A2b	b. Vos Haricots Nains?		
A2b1	1. Oui	10	10
A2b2	2. Non	0	0
A3	3. Par combien est-ce que les rendements etaient augmente?		
A3a	b. Quantite	3.029411	17
A3b			
A4	4. Est-ce que cela necessitait main d'oeuvre supplementaire?		2
A4a	a. Oui	16	16
A4b	b. Non	4	4
A5	5. Si non, pourquoi pas?		17
A5a	a. Manque des moyens financiers	1	1
A5b	b. Mn d'oeuvre familiale suffisante	3	3
A5c	c. Travail communautaire	1	1
A6	6. Si oui, est-ce que cela necessitait un cout additionnel?		6
A6a	a. Oui	14	14
A6b	b. Non	0	0
A7	7. Est-ce que l'augmentation du rendement etait suffisant de couvrir les couts additionnel?		4

A7a	a. Oui	14	14
A7b	b. Non	3	3
A8	8. Est-ce que vous cultivez toujours ces nouvelles varietes?		
A8a	a. Oui	19	19
A8b	b. Non	2	2
A9	9. Est-ce que les nouvelles varietes continuent a donner des meilleurs rendements ?		4
A9a	a. Oui	17	17
A9b	b. Non	0	0
A10	10. Ou est-ce vous obtenez les semences ?		
A10a	a. Conservation	13	13
A10b	b. Achete\marche\voisins	8	8
A10c	c. Projet	10	10
B. TUTEURS:			
B1	1. Quels types de tuteurs utilisez-vous?		
B1a	a. Pennisetum	19	19
B1b	b. Eucalyptus	18	18
B1c	c. Verononia	1	1
B1d	d. Sesbania	3	3
B1e	e. Calliandra		2
B2	2. Est-ce que le tuteur vous-preferez celui qui a ete recommande par le projet?		6
B2a	a. Oui	3	3
B2b	b. Non	12	12
B3	3. Si non, pourquoi est-ce que vous ne le preferez pas?		17
B3a	a. N'a pas recu materiel.	1	1
B3b	b. Croit amener a la degradation	2	2
B3c	c. Pas de preference	1	1
B4	4. Est-ce que vous avez besoin d'acheter vos tuteurs?		1
B4a	a. Oui	9	9
B4b	b. Non	11	11
B5	5. Si oui, combien coutent-ils?		12
B5a	a. Montant	1022.222	9
B6	6. Est-ce que l'augmentation du rendement etait suffisant de couvrir les couts additionnel?		10
B6a	a. Oui	8	8
B6b	b. Non	2	2
C. LA CHAUX			
C1	1. Est-ce que vous avez jamais utilise la chaux dans vos champs?		1
C1a	a. Oui	13	13
C1b	b. Non	7	7
C2	2. Est-ce que la chaux a provoque une des rendements?		8
C2a	a. Oui	13	13
C2b	b. Non	0	0
C3	3. Sur quelles cultures?		8
C3a	a. Haricots	10	10
C3b	b. Pommes de terre	1	1
C3c	c. Patate douce	1	1
C3d	d. ble	8	8
C3e	e.		
C4	4. Est-ce que vous avez achete la chaux		8

	vous-meme?		
C4a	a. Oui	0	0
C4b	b. Non	12	12
C5	5. Comment est-ce que vous l'avez obtenu?		8
C5a	a. Du projet		12
C6	6. Est-ce que vous continuez d'appliquer la chaux maintenant?		9
C6a	a. Oui	0	0
C6b	b. Non	12	12
C7	7. Si non, pourquoi pas?		8
C7a	a. Non-disponible	12	12
C7b	b. Manque de moyens financiers	1	1
D. LES HAIES VIVES.			
D1	1. Quelle espece preferez-vous pour les haies vives?		
D1a	a. Pennisetum	13	13
D1b	b. Eucalyptus	1	1
D1c	c. Calliandra	6	6
D1d	d. Setaria	3	3
D1e	e. Sesbania	2	2
D2	2. Pourquoi preferez-vous cette espece?		
D2a	a. Raison 1 Tuteurage	14	14
D2b	b. Raison 2 Construction	6	6
D2c	c. Raison 3 Aliment betail	8	8
D2d	d. Raison 4 Lutte Anti Eros	4	4
D2e	e. Raison 5 Compost	6	6
D2f	f. Recommande par MINAGRI pour LAE	4	4
G2g	g. Vente	1	1
D3	3. Est-ce que vous avez plante haies vives?		0
D3a	a. Oui	21	21
D3b	b. Non	0	0
D4	4. Est-que cela necessitait une main d'oeuvre supplementaire?		1
D4a	a. Oui	7	7
D4b	b. Non	13	13
D5	5. Si non, pourquoi pas?		8
D5a	a. Main d'oeuvre familiale suffisant	13	13
	b.		
D6	6. Si oui, quels etaient couts additionnels?		16
D6a	a. Montant	710	5
D7	7. Est-ce que vous avez remarque une benefice de ces haies vives?		
D7c	c. Oui	18	18
D7d	d. Non	0	0
D7e	7e. Si oui, quelles benefices?		0
D7ea	a. Tuteurage	14	14
D7eb	b. Construction	9	9
D7ec	c. Aliment betail	14	14
D7ed	d. Lutte anit-erosive	13	13
D7ee	e. Compost	1	1
D8	8. Est-ce que les haies vives que vous avez plante encore sur vos champs?		
D8a	a. Oui	21	21
D8b	b. Non	0	0
D9	9. Si non, pourquoi pas?		21

D9a	a. Raison		
E. COMPOSTAGE.			
E1	1. Est-ce que vous avez etabli une fosse de compostage?		
E1a	a. Oui	21	21
E1b	b. Non	0	0
E2	2. Est-ce que vous avez utilise ce compost dans vos champs?		
E2a	a. Oui	21	21
E2b	b. Non	0	0
E3	3. Est-ce que cela necessitait main d'oeuvre supplementaire?		
E3a	a. Oui	16	16
E3b	b. Non	5	5
E4	4. Est-ce que cela necessitait les couts additionnels?		2
E4a	a. Oui	15	15
E4b	b. Non	4	4
E5	5. Lesquels?		10
E5a	a. Montant		8
E6	6. Sur quelles cultures avez-vous utilise le compost?		
E6a	a. Haricots	19	19
E6b	b. Mais	12	12
E6c	c. Pomme de terre	15	15
E6d	d. Banane	3	3
E6e	e. Ble	11	11
E6f	f. Sorgho	5	5
E6g	g. Patate douce	2	2
E6h	h. Legumes	3	3
E6i	i. Tabac	1	1
E7	7. Est-ce qu'il y avait une augmentation du rendement a cause de ce traitement?		
E7a	a. Oui	21	21
E7b	b. Non	0	0
E8	8. Si oui, est-que l'augmentation rendement		3
etait suffisant de couvrir les couts additionnels?			
E8a	a. Oui	18	18
E8b	b. Non	0	0
E9	9. Est-ce que vous continuez de pratiquer le compostage?		
E9a	a. Oui	21	21
E9b	b. Non	0	0
E10	10. Si non. pourquoi pas?		21
	a.		0
F. CULTURES: BLE			
F1	1. Est-ce que vous cultivez les nouvelles varietes de ble?		7
F1a	a. Oui	12	12
F1b	b. Non	2	2
F2	2. Quelle est la source de vos semences?		9
F2a	a. Conservation	8	8
F2b	b. Projet	7	7
F2c	c. Voisin/achete	4	4
F3	3. Est-ce que vous achetez les semences?		8

F3a	a. Oui		6
F3b	b. Non		7
F4	4. Est-ce que l'augmentation du rendement etait suffisant pour couvrir les couts additionnel?		14
F4a	a. Oui	7	7
F4b	b. Non	0	0
G. CULTURES: POMMES DE TERRE			
G1	1. Est-ce que vous cultivez les nouvelles varietes de pommes de terre ?		2
G1a	a. Oui	17	17
G1b	b. Non	2	2
G2	2. Combien de sacs recoltez-vous du champ?		3
G2a	a. Quantite	3.558823	17
G3	3. Est-ce que cette recolte etait plus que ce que vous avez recolte de vos varietes locales?		5
G3a	a. Oui	16	16
G3b	b. Non	0	0
G4	4. Est-ce que la cultivation des nouvelles varietes necessitait une main d'oeuvre additionnel?		4
G4a	a. Oui	16	16
G4b	b. Non	1	1
G5	5. Si non. pourquoi pas?		20
G5a	a. Manque des moyens financiers	1	1
G6	6. Est-ce qu'il y avait couts additionnels?		5
G6a	a. Oui	15	15
G6b	b. Non	1	2
G7	7. Lesquels ?		11
G7a	a. Montant	950	9
G8	8. Est-ce l'augmentation en rendement etait suffisant pour couvrir couts additionnels?		6
G8a	a. Oui	15	15
G8b	b. Non	0	0
G9	9. D'ou achetez-vous vos semences?		6
G9a	a. Conservation	8	8
G9b	b. Marche/voisins	8	8
G9c	c. Projet	4	4
H. GENERAL:			
H1	1. Est-ce que vous aviez des problemes avec le projet?		1
H1a	a. Oui	6	6
H1b	b. Non	12	12
H1c	c. Non/avec reservations	1	1
H2	2. Quelle est votre opinion de ce projet?		2
H2a	a. Bonne	14	14
H2b	b. Bonne/avec reservations	3	3
H2c	c. Pauvre	1	1

Fin[illegible]gs of the rapid reconnaissance survey
FSRP Evaluation September 1992

Comments:

Characteristics of the Production System:

Only about 14 percent of the 21 farmers interviewed were female. Fifty seven percent of them lived and worked their farms in the altitude range of 2,000m -2,400m while the rest were located between 1,700m - 2,400m. The average family population was 6.4 members while the active working proportion constituted 2.7 members. Each family farmed an average surface area of 1.56 ha.

Average family livestock ownership was as follows: for cows, 1.5 (n=12); for sheep, 1.85 (n=13); for goats, three (n=11); and for chickens, 2.25 (n=8). Only one farmer raised rabbits. The majority of the farmers (n=20) earned revenue by the sale of agricultural produce while only three farmers sold livestock. Twenty four percent of the farmers had an assured salary income. One female farmer earned 6,000 FRw per month (72,000 FRw/yr) by tailoring. Women also earned revenue by brewing and selling banana and sorghum beer. Mean total revenue per farm family was around 20,500 FRw (n=21).

Average duration of participation in the project was 2.33 years although at least half of the farmers complained that they had participated little in the project because it had arrived too late in their commune of Cyeru.

Farmer identification of major constraints:

From the table it will be seen that 16 farmers (76 percent) identified the lack of manure as a major constraint while 11 farmers (52 percent) gave the lack of soil fertility as another major constraint. Twelve farmers (57 percent) mentioned drought or flooding as another important constraint. Only seven farmers (33 percent) claimed that insufficiency of land was a problem.

All the farmers interviewed had grown the varieties of beans (100 percent; n=21), Irish potatoes (86 percent; n=18), wheat (67 percent; n=14) and sweet peas (38 percent; n=8) distributed by the project.

Extension statistics:

Four farmers reported that the *moniteurs agricoles* visited them less than once per week. Eight farmers reported that they received one visit per week, another eight reported two visits per week, and one farmer reported three visits per week. This data seems to confirm the doubt placed upon the claim that more than 12,000 farmers were regularly visited by the *moniteurs agricoles* (see Section 3.5.1).

Sixteen farmers (76 percent) acknowledged that the frequency with which they were visited was sufficient.

Secondary transmission of technology:

Fifteen farmers (71 percent) claimed that they had demonstrated their newly learned technologies/techniques to their neighbors while six replied that they had not done so. An average number of 7.5 technologies/techniques were demonstrated by these farmers, and 14 farmers (67 percent) claimed that

their neighbors had adopted the techniques. The most popular of these technologies was in-line sowing, the importance of which under Rwandan conditions has already been mentioned in the body of the report. Other technologies were application of manure/fertilizers, seeds of improved varieties and bean poles.

TECHNOLOGIES:

BEANS:

The farmers surveyed stated that they had grown the bean varieties distributed by the project. They (90.5 percent; n=19) claimed that the improved varieties gave, on an average, three times more yield than their own varieties. Sixteen farmers (76 percent) claimed that the cultivation of the new varieties necessitated the hiring of supplementary labor while four stated that it had not. One of these claimed that he had to resort to "communal labor" because of lack of financial resources while three claimed that they had sufficient family labor to cope.

Fourteen farmers (67 percent) claimed that the cultivation of the new varieties entailed additional cost but that additional revenue generated by the mean three-fold increase in production was sufficient to cover the additional expense. The majority of the farmers continued to cultivate the new bean varieties, which continued to give them improved yields. The majority of the farmers conserved their seed for planting in the next season while the rest obtained the seeds by purchase from the market or from neighbors.

In the commune of Cyeru, almost every farmer interviewed stated that vermin consumed the new bean variety G2333 even before it was harvested. (ISAR has distributed a circular letter concerning a root disease afflicting it.)

Bean poles (tuteurs):

The majority of farmers (88 percent; n=18.5) claimed that the bean poles they used were of the species Pennisetum and/or Eucalyptus. Only three used Sesbania, and two used Calliandra. To the question "Is the species of tuteur that you prefer that recommended by the project?" a total of 12 farmers (57 percent) replied in the negative while three farmers gave positive replies. However, the large negative response was due to the fact that the leguminous tree species that were being distributed by the project had not reached these farmers or were too small to be comparatively evaluated (Question B3 "If not, why do you not prefer it?") had no less than 17 "Not applicable" responses. One of the farmers who said he did not prefer the recommendations stated that he believed the use of them exacerbated environmental degradation, and one said that he simply did not like them.

Nine farmers (43 percent) claimed that it was necessary for them to buy tuteurs every year, and, that on the average, it cost them about a 1,000 FRw. These farmers also stated that the increase in production of beans brought about by the use of tuteurs was sufficient to cover the extra cost. Other farmers who did not buy their tuteurs ostensibly had their own hedges of Pennisetum or were able to obtain Eucalyptus tuteurs at no cost.

LIME:

Thirteen farmers (62 percent) applied lime and NPK package to their fields for the production of beans. Each of the participants was given 1kg. of improved bean seeds together with 25 kg. of lime and a

specified amount of NPK with the proviso that at harvest 5kg. of bean seed should be returned to the project. Seven farmers did not apply the package. Those who applied the package acknowledged that the package gave an increase of production in beans of 48 percent (n=10) of farmers; and of wheat of 38 percent (n=8) of farmers. One farmer used it on Irish potatoes, and another used it on sweet potatoes.

When the farmers, seeing the crops' remarkable response to lime, requested more of the material, they were told that there was no more to be had. Those who used it once do not use it any more because it is unavailable.

LIVING HEDGES:

When asked the question, "Which living hedge species do you prefer?", 13 farmers (62 percent) replied that their species of preference was Pennisetum because of its multiple uses as tuteurs, for construction, fodder for livestock, soil conservation and compost. Four farmers (19 percent) flatly stated that they preferred it because MINAGRI recommended it for living hedges. Six farmers (29 percent) preferred Calliandra; three liked Setaria; two opted for Sesbania, and one chose Eucalyptus.

All the farmers interviewed reported that the living hedges that they had planted continued to grow on their fields.

COMPOST:

All the farmers interviewed reported that they had established compost pits on their farms. But they already had the pits before the project was implemented. The project *moniteurs agricoles* instructed them on how to make the compost pits larger in order to produce more organic manure for their crops. All of the farmers interviewed reported that they applied the compost to their crops, to beans (90 percent of farmers; n=19), to Irish potatoes (71 percent; n=15), to maize (57 percent; n=12) and wheat (52 percent; n=11). Smaller percentages of farmers applied them to bananas, sorghum, sweet potatoes, vegetables and tobacco. All the farmers surveyed reported an increase in yields because of the compost application. Additional costs involved in applying the compost were compensated for through the increase in production. All the farmers surveyed reported that they continued to practice composting.

CROPS: WHEAT

Twelve farmers (57 percent) cultivated the improved wheat varieties. Eight farmers (38 percent) reported that they conserved their own seeds and four (19 percent) bought their seed from either the market or their neighbors while eight farmers (38 percent) reported that they obtained it from the project. These latter are probably those in the areas where the project had arrived late.

IRISH POTATOES:

Seventeen farmers (81 percent) planted the new varieties of potatoes distributed by the project, each harvesting an average of 3.5 sacks of potatoes from their fields. They reported that this amount was greater than the production of their traditional varieties. The cultivation of these new varieties necessitated the hiring of additional labor although the increase in production compensated for the additional costs.

GENERAL:

Twelve farmers (57 percent) stated that they had had no problems with the project. Six of them (29 percent) said that they had problems, but their problems were related to the fact that the project was late in arriving to their area.

Fourteen farmers (67 percent) had a good opinion of the project. Three farmers (14 percent) had a good opinion but with reservations, and only one farmer (5 percent) had a poor opinion of the project.

Extension circular:
Fletrissement fusarien du haricot volubile var. umubano au stade de floraison

INSTITUT DES SCIENCES
AGRONOMIQUES DU RWANDA

DIRECTION GENERALE
B. P. 138 BUTARE
REPUBLIQUE RWANDAISE

/N°1042/91/CIAT/

Messieurs,

J'ai le plaisir de vous envoyer ci-joint de l'information récente sur un nouveau problème du haricot volubile, surtout la variété Umubano.

En effet, nous craignons que pendant la saisons en cours, vous ne verriez les plantes de Umubano sécher prématurément, surtout dans des parcelles où cette variété a déjà été cultivée plusieurs fois. L'information ci-jointe vous aidera à mieux comprendre ce nouveau phénomène qui a fait l'objet d'une recherche intensive par l'ISAR, dès qu'il a été porté à sa connaissance, il y a moins d'une année.

Nous espérons qu'avec cette information, nous rendons un service utile à tous les Agents qui sont en contact quotidien avec les agriculteurs et leurs problèmes.

Veuillez agréer, Messieurs, l'assurance de notre parfaite collaboration.

Le Directeur de l'ISAR
Léopold GAHAMANYI

c.p.i.: - Dr. Pierre Nyabyenda,
Chef du Département Productions
Végétales à l'ISAR.

- MINAGRI

Nous vous prions d'adresser votre correspondance à ISAR et non personnellement à nos Chefs de Service.

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FLETRISSEMENT FUSARIEN DU HARICOT VOLUBILE var. UMUBANO AU STADE DE FLORAISON

Dans la saison 1991A, les chercheurs de l'ISAR et du CIAT ont observé pour la première fois un problème de flétrissement sur la variété volubile Umubano (G2333) dans les champs des paysans des préfectures de Butare et Gikongoro: Toute la tige d'une plante affectée se désèche ainsi que les feuilles; ce phénomène se manifesta au stade de formation des gousses; les plantes affectées ne remplirent donc pas les gousses, et ne donnèrent que peu de rendement. Souvent, sur un tuteur, une plante fut affectée pendant que les 2 ou 3 autres se développèrent normalement.

Agent pathogène: *Fusarium oxysporum f.sp.phaseoli* fut isolé des plantes affectées. Des cultures monosporiques de ces isolats étaient utilisées pour inoculer de jeunes plantes de la variété Umubano en serre et produisaient sur ces plantes des symptômes identiques à ceux observés dans le champs. L'agent causal de ce flétrissement est donc *Fusarium oxysporum f.sp.phaseoli.*

Description des symptômes: Les symptômes sont apparus dans les saisons 1991A et B entre l'étape R6 (floraison) et R8 (remplissage des gousses). Cette saison (1992A), il parait que la maladie se manifeste dans certains champs déjà en R5 (début floraison).

Les premiers symptômes sont: un jaunissement prématuré des feuilles qui commence dans les parties inférieures de la tige et s'étend vers en haut, ou bien, une nécrose des bords des feuilles, les feuilles restant petites. Ensuite les feuilles commencent à flétrir et bientôt toute la partie aérienne de la plante se sèche et meurt (voir photo 1). La maladie affecte le remplissage des gousses: dépend du moment de l'infection, les gousses peuvent ne pas se former (infection précoce, rendement nul), peuvent être mal remplies ou, les gousses inférieures peuvent être bien remplies pendant que les gousses supérieures sont mal remplies (infection tardive).

Au moment des premiers symptômes foliaires, la partie basale (juste au dessus du niveau du sol) de la tige ne montre pas de symptômes extérieurs (voir photo 2, tige entière). En coupant longitudinalement la tige, on peut observer que le tissu vasculaire montre une décoloration brun-foncée et le tissu central paraît aqueux. Plus tard des spores rougeâtres se développent dans la tige basale qui donne au tissu central un aspect brun-rougeâtre (voir photo 2, tige coupée) qui peut s'étendre vers le haut dans la tige. Le tissu central de la racine pivotante peut être affecté de la même façon, mais normalement cette racine reste ferme, même si elle est attaquée.

Distribution géographique: Le pathogène *F.oxysporum* a été trouvé sur les mélanges locaux (surtout nain) dans tout le pays dans une prospection faite dans le cadre du Programme Régional Haricot des Pays des Grands Lacs (sous-projet des maladies racinaires, conduit par l'Université Nationale du Rwanda) en 1990A et B.

Pourtant on n'a jamais observé le problème décrit ci-haut sur la variété Umubano pendant les nombreux essais en milieu réel conduit avec cette variété entre 1987 et 1990.

Actuellement, nous avons observé le flétrissement fusarien sur la variété Umubano dans beaucoup de champs d'agriculteurs des préfectures Butare, Gikongoro, Kibuye, Gisenyi et dans le Sud-Kivu mais pas dans la région de Kigali-Nord, où cette variété est cultivée par beaucoup d'agriculteurs. Dans les champs expérimentaux de l'ISAR à Rubona, le problème n'a pas été observé jusqu'à présent.

La maladie est plus grave si après l'infection il y a des conditions chaudes et sèches.

Qu'est-ce qu'on peut faire? Dès que l'agent causal fut identifié, nous avons commencé à cribler les variétés volubiles en diffusion pour leur sensibilité à cette maladie.

Variété résistantes:

Flora	Urunyumba-3	Decelaya	Gisenyi 2 bis	59/1-2

Variétés moyennement sensibles:

Vuninkingi	Puebla	AFR-13	AND-10

Variétés très sensibles:

Umubano	G-2331	Muhondo-6

Jusqu'à présent, la plupart des agriculteurs ont carrément refusé de cultiver d'autres variétés volubiles que Umubano (parce que Umubano est tellement supérieur en beaucoup de caractéristique aux autres volubiles). Maintenant nous avons observé dans les zones où les agriculteurs ont déjà subi le problème du flétrissement fusarien sur Umubano un intérêt fort pour essayer d'autres volubiles. C'est donc maintenant le moment et l'opportunité de diffuser ces autres volubiles (résistantes à *F.oxysporum*) et de cette façon élargir la base génétique des haricots volubiles cultivés au Rwanda. C'est donc recommandé de faire tous les éfforts possibles pour disponibiliser des semences des variétés résistantes au flétrissement fusarien aux agriculteurs pour la prochaine saison.

Fusarium oxysporum étant un pathogène du sol, il peut y survivre plusieurs saisons. Il faudrait donc cultiver des variétés résistantes de haricot ou d'autres cultures pendant au moins 6 ou 8 saisons pour réduire sensiblement le niveau d'inoculum dans un sol qui a déjà des problèmes.

Recherche: Actuellement, plusieurs activités de recherche sont en cours pour mieux comprendre ce nouveau phénomène et en trouver des solutions: Une caractérisation des races de *Fusarium oxysporum* dans tout le pays; le croisement de Umubano avec des sources de résistance à *F.oxysporum*; des études sur l'épidémiologie de ce pathogène. L'ISAR a établi le criblage avec inoculation artificielle pour tout le processus de sélection des volubiles.

En même temps, on demande la collaboration des Projets de Développement et Unités Opérationnelles pour pouvoir mieux délimiter la distribution géographique du flétrissement fusarien. A cette fin, nous envoyons le questionnaire en annexe. Ce dernier peut être completé juste en observant les champs de Umubano pendant les visites normales sur terrain.

On s'engage à vous informer périodiquement des résultats de cette recherche et d'autres nouvelles sur le flétrissement fusarien.

27/11/91 US,RB

Annexe: Questionnaire sur le flétrissement fusarien de Umubano

Instructions

Chaque fois que vous voyez une parcelle de Umubano au stade R5 ou après, estimez le pourcentage de plants attaqués par *Fusarium oxysporum* et faites une barre dans la case appropriée. Il est important d'indiquer aussi les parcelles de Umubano qui ne montrent pas de problème (dans la case"0").

A la fin de la saison 1992A, envoyez le questionnaire rempli à Dr. Robin Buruchara, ISAR, B.P. 138, Butare. Si vous avez des questions ou suggéstions concernant le flétrissement fusarien, n'hésitez pas de nous contacter, à l'ISAR même, ou par fax (30599) ou télephone (30446).

Indiquez le nombre de parcelles de Umubano trouvées dans chaque classe:

Préfecture:		Classe: Pourcentage de plants attaqués par F.oxysp.					
Commune	Secteur	0	1-10	11-25	26-50	51-75	76-100

Flétrissement fusarien (*Fusarium oxysporum* f. sp. *phaseoli*)

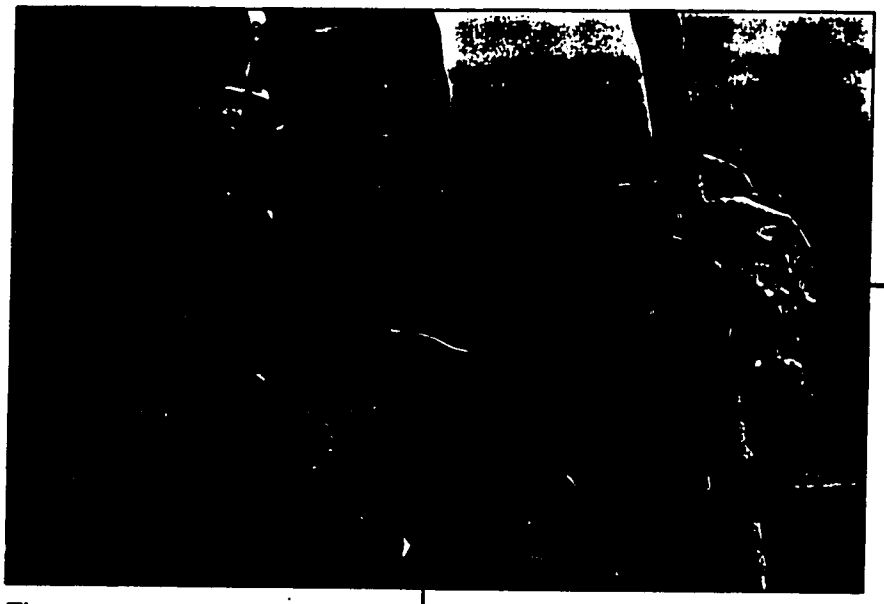

Figure 1

Figure 2

Figure 3

Figure 4

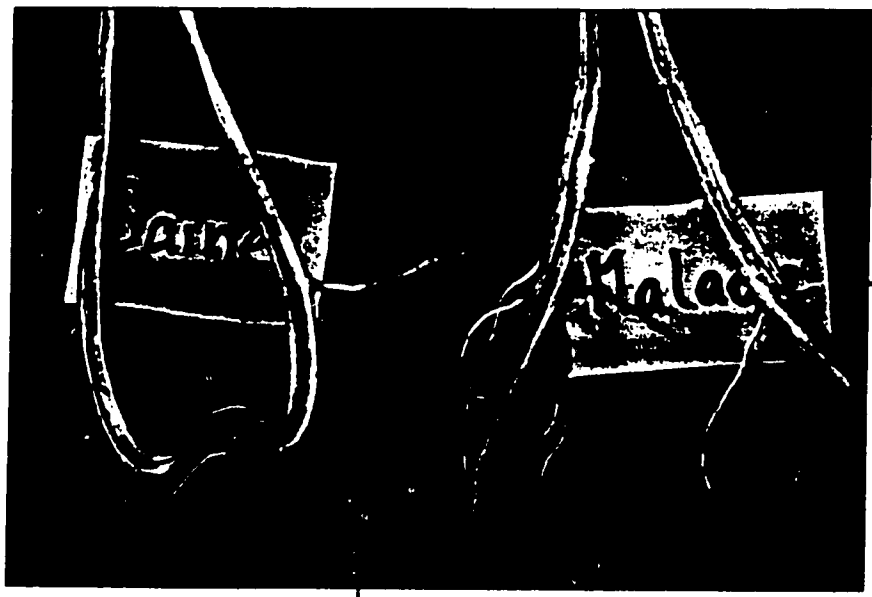

Figure 5

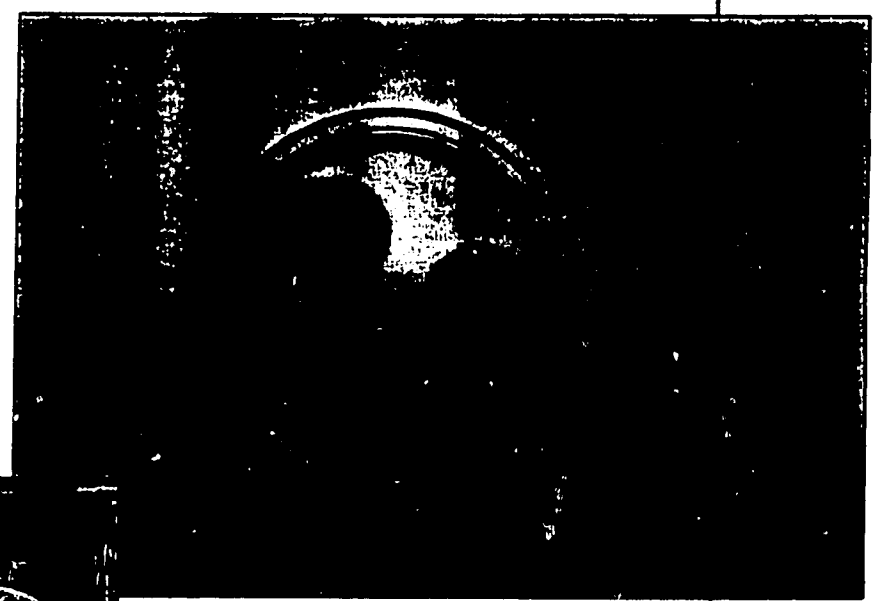

Figure 6

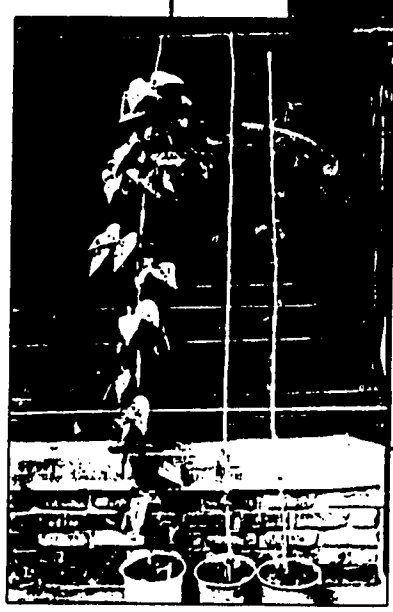

Figure 7

University of Arkansas response to evaluation team questions and evaluation team leader response

UNIVERSITY of ARKANSAS

300 Horn Hall • Fayetteville, Arkansas 72701-1201 • (501) 575-6857 • (501) 575-5055 (FAX)

College of Agriculture and Home Economics
International Agricultural Programs

October 1, 1992

TO: Dr. Alexander Cunard
Evaluation Team
USAID/Rwanda
Kigali, Rwanda
FAX (250) 74735

FROM: Dr. Tom Westing, Director
International Agricultural Programs
University of Arkansas
FAX (501) 575-5055

SUBJECT: Response to RWAFAX-92-0815
Request for Clarification/Questions for Dr. Tom Westing
re the FRSP Project in Rwanda

The University of Arkansas is pleased to assist USAID/Rwanda and the Evaluation Team in clarifying, to the best of our ability, the following questions, recapitulated verbatim from RWAFAX-92-0815.

1. According to the Project Paper, there should be at least 4 Data Bases established by the FSRP Team by EOPS. Where are they located?

UOA Response: The four data bases referred to in the Project Paper were included in the PP as a duty to be carried out by the FSR/E Advisor. A member of the original FSRP Design Team and a USAID (REDSO/ESA) employee, Mr. Bob McCullough, requested the inclusion of the four data bases which were intended to be GIS-type data bases. Dr. Don Voth, FSRP Design Team Leader, had suggested from the beginning of project design that this element be renegotiated because it had never been funded. Additionally, the UOA, having put forth a number of qualified candidates, was never permitted to fill the position of FSR/E Advisor, thus responsibility for follow-through with this un-funded activity remained undesignated. As a result of the 1989 evaluation, Boyd Hanson, UOA (Biometrics Unit) Advisor, was charged with developing at Rwerere a national research data base (please see FSRP PP Supplement, USAID/Kigali, March 19, 1990). However, when Dr. Hanson ended his contract with FSRP and left Rwanda 8/1/89, then ADO Paul Crawford decided not to pursue the creation of such

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a data base since it had never appeared in the FSRP budget and the FSRP team did not have the manpower--neither Rwandan nor expat--to accomplish it.

The UOA possesses copies on diskette of the data bases developed by FSR/E Socio-Economist Serigne N'diaye during his tenure: they are as follows:

- 36 Farm Survey (in-depth factors of production of, consumption of and expenditures for major crops [on-farm] 1989a and 1989b);

- 448 Farm Family Diagnostic Survey;

- An Agroforestry Data Base created by Dr. N'diaye in collaboration with AFRENA in regard to pole beans;

- A second Agroforestry Data Base initiated by Dr. N'diaye with AFRENA on the supply and utilization of bean poles (130 farm households in the project zone).

Additional data base:

- An Agroforestry Data Base that Charles Yamoah initiated in collaboration with Lucas Parsch, Eric Wailes (a farm survey studying the location of trees on-farm and their benefits and disadvantages).

Dr. N'diaye said that these same data bases are on the hard disk of the Gateway 2000 that was moved back to Rwerere when the FSRP/ISAR Kigali office was closed. The last agroforestry data base listed above was on one of the Rwerere AT's. Then Chef de Station/Project Director Egide NIZEYIMANA took formal charge of all the computers, the data bases, and all hard copy and diskette files upon the closing of the Kigali office.

2. The planned training seminars for the FSRP Team at Nairobi were cancelled three times. Is there a reason why these cancellations took place?

UOA Response: In earlier years of the project, FSRP dialogued with Ananda of CIMMYT/Nairobi about arranging FSR training in French. At the time, CIMMYT had employed one French-speaking trainer who was subsequently injured seriously in an auto accident. Thereafter, CIMMYT could not produce a French-speaking trainer at the level required for the Rwandan agronomes. As a result, FRSP team members (e.g., Ron Grosz, Charles Yamoah) and later consultants (e.g., Tom Zalla) conducted in-country FSR training programs.

Per former COP Val Eylands, there was never any scheduled FSRP training in Nairobi during his tenure with the project. CIMMYT was slated to conduct training of FSRP team members in Rwanda but due to a lack of French-speaking CIMMYT trainers, they were never able to deliver such training. The FSRP team, under Val Eylands, then revamped the program and

allocated $40,000. to $50,000. to retain the services of FSSP out of the University of Florida, Gainesville. FSSP was to have conducted a training program in Rwanda sometime in November or December of 1990 but those plans were cancelled due to the October 1, 1990 rebel invasion and the ensuing civil strife. The money remained in the budget because it was the team's hope that the in-country situation would improve, allowing FSSP to eventually carry out the training, but such an opportunity never arose.

3. The Evaluation Team has discovered that the FSRP Team members did not attend the twice-yearly Technical Commission Meetings at ISAR over the LOP, except for the last one. Is there an adequate reason for this?

UOA Response: Dr. Val Eylands is unaware of a twice yearly ISAR meeting specifically entitled, "Technical Commission Meeting." However, he reports that the FSRP team (usually all Rwandan and expat team members, counterparts and some technicians) did attend technical reporting meetings and work plan meetings at Rubona. They attended other technical meetings (Technical Commission Meetings?) when they received written invitations. On many occasions ISAR did not invite the FSRP team or would invite them on very short notice. On other occasions, ISAR either didn't contact the Chef de Station or the Chef de Station didn't relay the message to FSRP team members. There were numerous instances of ISAR cancelling meetings after the FSRP team had arrived at Rubona.

4. Why were not Quarterly Reports done on a regular basis and where are the 1989, 1990 and 1991 Annual Reports?

UOA Response: The FSRP team was never required to furnish Quarterly Reports and there is no requirement for Quarterly Reports in the contract. The June/July 1989 mid-term evaluation of FSRP resulted in several major project modifications; among those was point ". . .4) Increasing the integration of the FSRP research team into ISAR's overall research management and administrative system." Dr. Eylands confirmed that beginning in 1989, FSRP team members submitted to the ISAR/Rwerere Chef de Station a section (in English and French) reporting on their respective research components that was to be included in the ISAR annual report. It was the responsibility of the Chef de Station/Project Director to then present these annual research summaries to ISAR for incorporation into ISAR's annual reports. Thus the FSRP annual reports for 1989, 1990, and 1991 are included in the 1989, 1990, and 1991 ISAR annual reports. Dr. Eylands is aware that one year the expat team members' contributions were not published although they had been turned in as scheduled to then Chef de Station Bonaventure UKIRIHO; only the contribution of one counterpart, Charles RUTAYISIRE, was included in the subject ISAR report of which Dr. Eylands is speaking. Please reference page 65 of the Rwanda FSRP Final Report, bottom of page-- "Note: Also available in USAID project files are the annual work plans, annual reports of ISAR, TDY reports, and the individual reports of departing team members." These reports are internal documents that should also be in the files turned over to Dr. Egide NIZEYIMANA and they should also be present in ISAR files.

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Regarding financial reportage, UOA Financial Officer Elizabeth Dombek reports that public vouchers for financial transactions of the FSRP were sent monthly and a financial statement was issued quarterly. Copies of same were sent to USAID/Rwanda (where they should be on file) and copies are on file at UOA.

5. Much of the economic impact analysis results were based on statistics contained in two J.P. Kajuga's reports (1. Rapport sur la récolte de la saison 1991 and 2. Résumé sur les activités du programme de vulgarisation). Where are these reports? It is imperative to have them in order to evaluate the economic analysis.

UOA Response: Per Arvid Rimkus, J. P. KAJUGA served as a technician with the Extension component of FSRP and on numerous occasions penned reports that he (KAJUGA) then submitted to ISAR/Rubona. Dr. Eylands suggested that J. P. KAJUGA may have left copies at ISAR/Rwerere as well; an inquiry with the current Chef de Station would be appropriate. Since both reports cited above were authored by an ISAR employee, initiating a request with ISAR on their whereabouts would be another avenue of inquiry. However, the economic impact analysis was not based primarily on reports penned by J.P. KAJUGA thus they should not be the only references considered in evaluating the economic analysis. Neither of these reports is listed in the FSRP Final Report Technical Paper Series.

The economic impact analysis was based primarily on RELO Arvid Rimkus' research data that was obtained from cooperating farmers in the normal mode of working with them through the FSRP extension component. The economic impact analysis was a special request from Mr. Kurt Fuller that Dr. Val Eylands complied with as a favor to USAID/Rwanda with a very short timeframe (several days). Such an analysis was never a responsibility of FSRP but was in fact a USAID/Rwanda responsibility. Coming as it did at the end of project, there was not adequate time or resources to conduct a comprehensive survey and ultimately, it was not FSRP's obligation to demonstrate the economic impact of the project.

The University of Arkansas is willing to assist in the clarification of any additional questions that may arise in the interest of assisting the Evaluation Team in its task. Please FAX or telephone (per the letterhead address) should you need additional information.

Regards,

Tom W. Westing
Director
International Agricultural Programs

/csr
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Comments on some of the responses from the UOA in reply to questions posed by the 1992 evaluation team.

1. It should have been the responsibility of the UOA to designate the FSRP team to undertake the task of establishing the databases in view of (a) the fact that the FSR/E Advisor position was never filled and (b) the extreme importance of databases to Farming Systems Research.

   Dr. Egide Nizeyimana of ISAR has only managed to locate one database (registered on SPSS) of Dr. Ndiaye's on the Gateway 2000 computer. This particular database is apparently related to his study "Facteurs de Production et du Revenu dans les Quatre Communes du FSRP, Saison 1990a," and has no connection whatever with the databases mentioned in Dr. Westing's fax, which still cannot be located.

   It is recommended that copies of the five databases mentioned by Dr. Westing be sent immediately to USAID for transmission to ISAR

2. The UOA has completely missed the point of this question. The FSRP team referred to in it was the expatriate team! In view of the serious lack of knowledge and experience of the majority of the members of farming systems methodology, the team would have benefited considerably from such training, and project performance would have improved.

3. The statements of the UOA in response to this question do not seem to agree with the findings of the 1992 evaluation team, which are that the FSRP team hardly ever attended the meeting at Rubona. Whenever they did, it seems they only stayed to present their papers and usually left immediately after, having very little interaction with other Rwandan scientists.

   On the many occasions that ISAR did not invite the FSRP team and cancelled scheduled meetings, one is constrained to ask whether there were any official, written complaints registered with ISAR and USAID by the FSRP team and particularly by the UOA!

   In several Francophone countries, the "technical reporting meeting" and the "work plan meeting" are referred to as Technical Commission Meetings or Commissions Techniques. The title is generic and self-explanatory. "Technique" indicates that the purpose of the meetings is technical review of either achieved or proposed research. "Commission" implies that it is a group of researchers who are making the reviews!

5. It is difficult to comprehend why an economic impact analysis (which should have been part and parcel of a Farming Systems Research Project) was written only after a special request had been made by Mr. Kurt Fuller. More obscure is the fact that its production should be regarded as a favor to USAID/Rwanda. This adds to the confirmation that the UOA really did not understand the nature of the farming system research they were ostensibly performing over 7+ years!

General Recommendation:

The 1992 evaluation team considers that the future of Farming Systems Research in Rwanda should not be compromised by the ineffectual performance of the UOA/FSRP team. Very little of the research they conducted can be classified as worthwhile farming systems research and extension because of the missing components of agricultural economics and, for a considerable while, extension itself. Although the perspective is gloomy and discouraging, there are several lessons that can be learned from this costly experience.

The training program has produced quite a number of qualified ISAR personnel with B.S., M.S. and Ph.D. degrees. It is recommended that these and other trained scientists from ISAR be provided with the kind of training they should have had from the project and never did; that is, courses in Farming Systems Research and Extension Methodology. The best venue for this is undoubtedly the University of Florida. A three- or six-month course of hands-on training should give the trainees an insight into what is involved when working with farmers. Those trained would become members of FSR/E teams located in ISAR's experiment stations, the state, management and operation of which will be rehabilitated and upgraded under a World Bank project.

With assistance and supervision from CIMMYT and perhaps SAFGRAD, the FSR/E teams will conduct farming systems research oriented towards solving farmers' problems in their vicinity. As they learn how to function as multidisciplinary teams, their contribution to the welfare of farmers will increase and improve with the passage of time and the gaining of experience. There can be no better or inexpensive way of reaching the farmer than by helping the nation help itself.

A.I.D. evaluation summary form

A.I.D. EVALUATION SUMMARY - PART I

1. BEFORE FILLING OUT THIS FORM, READ THE ATTACHED INSTRUCTIONS.
2. USE LETTER QUALITY TYPE, NOT DOT MATRIX TYPE.

IDENTIFICATION DATA

A. Reporting A.I.D. Unit:

Mission or AID/W Office _____
(ES# _____)

B. Was Evaluation Scheduled In Current FY Annual Evaluation Plan?

Yes ☐ Slipped ☐ Ad Hoc ☐

Evaluation Plan Submission Date: FY ____ Q ____

C. Evaluation Timing

Interim ☐ Final ☐ Ex Post ☐ Other ☐

D. Activity or Activities Evaluated (List the following information for project(s) or program(s) evaluated; if not applicable, list title and date of the evaluation report.)

Project No.	Project /Program Title	First PROAG or Equivalent (FY)	Most Recent PACD (Mo/Yr)	Planned LOP Cost (000)	Amount Obligated to Date (000)

ACTIONS

E. Action Decisions Approved By Mission or AID/W Office Director

Action(s) Required	Name of Officer Responsible for Action	Date Action to be Completed

(Attach extra sheet if necessary)

APPROVALS

F. Date Of Mission Or AID/W Office Review Of Evaluation: (Month) (Day) (Year)

G. Approvals of Evaluation Summary And Action Decisions:

	Project/Program Officer	Representative of Borrower/Grantee	Evaluation Officer	Mission or AID/W Office Director
Name (Typed)				
Signature				
Date				

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ABSTRACT

H. Evaluation Abstract (Do not exceed the space provided)

Project: Final evaluation: Farming Systems Research Program
Contract no.: PDC-1406-I-00-0073, D.O.# 14

Period: 9/92-11/92

Project officer: Claudia Cantell **Budget:** $56,905

Description: Tropical Research & Development, Inc. provided an agronomist and an agricultural economist to determine the extent to which the project had assisted the host-country government in developing a farming-systems approach for research and extension, including effective links between research and extension institutions. The evaluation team assessed economic impacts and sustainability of the project, as well as appropriateness of agricultural technologies developed to aid Rwandan farmers. And the team assessed the impact to the project from a civil war, including the 1990 evacuation of the project's long-term staff.

The final-evaluation team found the project's training efforts, improvements to infrastructure and work with women farmers were beneficial. A total of 22 Rwandans earned Ph.D., M.S. and B.S. degrees from U.S. universities, and more than half of these graduates were reemployed by Institut des Sciences Agronomiques du Rwanda (ISAR). AFRICARE, for a modest sum of $750,000, repaired roads, installed potable-water systems, built training centers and constructed storage hangars in the project area. These improvements will be of continuing value to the rural community. The FSRP team worked with women farmers, who composed an estimated 40 percent of total farmers; women were recruited as extension agents, and women were represented among Rwandan counterparts for long-term training.

However, the project suffered as a result of poor management and due to a lack of farming-systems expertise among the project-implementation team. Because farming-systems methodology was not implemented, few of the developed or proposed technologies were subjected to requisite socioeconomic analysis. As a result, sustainability of technologies tested among farmers was not fully assured. Although the higher-yielding varieties of beans, wheat and potatoes continued to be used by farmers, the value of the much preferred bean variety, G2333, was compromised by the onset of a fungal root disease. Other technologies, such as the Lime plus NPK treatment and the agroforestry species, *Sesbania*, were either abandoned or recognized as inappropriate.

Success of the project was also limited because recommendations from previous project evaluations were not followed. The 1986 evaluation led to the fourth project amendment, in which USAID unilaterally eliminated the extension component and the extension advisor's position, compromising the project's relevance to farming-systems research and extension. In 1988, the inspector eneral recommended an evaluation to determine the significance of extension for continued project implementation. The 1989 project evaluation that followed led to a fifth amendment, in which the extension component was reinstated and continued until the project agreement completion date.

I. Evaluation Costs

1. Evaluation Team Name	Affiliation	Contract Number OR TDY Person Days	Contract Cost OR TDY Cost (U.S. $)	Source of Funds

2. Mission/Office Professional Staff Person-Days (Estimate)	3. Borrower/Grantee Professional Staff Person-Days (Estimate)

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A.I.D. EVALUATION SUMMARY - PART II

SUMMARY

J. Summary of Evaluation Findings, Conclusions and Recommendations (Try not to exceed the three (3) pages provided)
Address the following items:

- Purpose of evaluation and methodology used
- Purpose of activity(ies) evaluated
- Findings and conclusions (relate to questions)
- Principal recommendations
- Lessons learned

Mission or Office:	Date This Summary Prepared:	Title And Date Of Full Evaluation Report:
	12/7/92	Final evaluation: FSRP 12/7/92

The Farming Systems Research Program (FSRP), USAID Contract # 696-0110-C-00-5016-00, began in 1984 with the launching of preliminary diagnostic survey during the project's design phase. The survey was implemented in four communes, Nyamugali, Nyarutovu, Cyeru and Butare in the Ruhengeri Prefecture.

The final evaluation team found the project's training efforts, improvements to infrastructure and work with women farmers were beneficial. However, the project suffered as a result of poor management, the implementation team's lack of expertise in farming-systems research and because recommendations from previous project evaluations were not followed.

Positive aspects of the project were the training program and AFRICARE's construction of infrastructure. A total of 22 Rwandans earned Ph.D., M.S. and B.S. degrees from U.S. universities, and more than half of these graduates were reemployed by Institut des Sciences Agronomiques du Rwanda (ISAR). However, because of GOR policy constraints, their future in ISAR is uncertain.

AFRICARE, for a modest sum of $750,000, repaired roads, installed potable water systems, built training centers and constructed storage hangars in the project area. These improvements will be of continuing value to the rural community.

The project had a significant impact upon women although women were not specifically targeted. The rapid reconnaissance survey (RRS) of the 1992 evaluation team revealed no difference between men and women's access to project personnel, resources or information. Unfortunately, FSRP's failure to collect data on the number of women participants rendered impossible any disaggregation of project impacts comparatively between women and men.

However, FSRP worked with women farmers, who composed an estimated 40 percent of total farmers; women were recruited as extension agents, and women were represented among Rwandan counterparts for long-term training.

One constraint to project success was that the FSR/Extension team that was to implement the project had no experienced leadership, nor were they adequately qualified to practice farming-systems research. They conducted no complementary diagnostic or verification surveys to explore further findings of the preliminary survey and, thus, failed to characterize recommendation domains or to identify and prioritize real constraints and problems of farmers. Since farming-systems methodology was not implemented, practically none of the developed or proposed technology were subjected to requisite socioeconomic analysis. Consequently, those technologies, such as the Lime and NPK treatment and the agroforestry species, *Sesbania*, were found to be unacceptable to farmers. Much on-station testing and even some on-farm trials conducted could be classified under upstream research; only a few on-farm trials fell under the category of down-stream research or research oriented towards solving problems and constraints of farmers.

A series of evaluations, internal and external, took place although most recommendations of the evaluating teams were not followed. The 1986 evaluation led to the fourth project amendment, in which, unfortunately, USAID unilaterally eliminated the extension component and the extension advisor's position, compromising the project's relevance to farming-systems research and extension. In 1988, the

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inspector general found the changes in the fourth amendment unacceptable and recommended an evaluation to determine the significance of extension for continued project implementation.

The 1989 project evaluation that followed led to a fifth amendment, in which the extension component was reinstated and continued until the project agreement completion date (PACD).

Project management by the University of Arkansas (UOA), USAID and ISAR was unsatisfactory throughout the project. With a few exceptions, the UOA was not able to provide a technical-assistance team that was adequately trained and experienced in farming-systems research and extension or with multidisciplinary capabilities. Nor were the TA teams representative of required disciplines, including agricultural economics. The team was unable to integrate itself fully with ISAR. Administrative and financial management problems plagued the UOA.

USAID management was poor throughout the project. Some salient management errors were use of project funds for USAID management costs that were not budgeted and for revision of the 1986 mid-term evaluation, with subsequent elimination of the extension component.

Effective implementation of the project was rendered extremely difficult by the advent of armed hostilities in October 1990. The hostilities led to the evacuation of the expatriate staff from the Rwerere Experiment Station in November 1990. Subsequent to that date, the expatriate staff made monthly or bimonthly visits to the stations from Kigali, which led to a commiserate reduction in levels of effort by research-station staff.

The station was directly attacked in June 1992 and activity at the station had ceased at the time of this final evaluation.

ISAR was unable to provide counterparts to the expatriate team. Those counterparts who were assigned were continually replaced, resulting in a lack of continuity and commitment to sustained research.

Because of the absence of an experienced farming-systems economist, the socioeconomic program was seriously compromised. The sociologist who was appointed as a socioeconomist was unable to fulfill the task of adequate economic analysis or even partial budgeting. This problem was likely the reason that the economic analysis contained in the final report for the FSRP was prepared without his knowledge and/or participation.

Because technologies tested among farmers did not undergo rigorous scrutiny of farming-systems methodology, their sustainability was not fully assured. Although the higher yielding varieties of beans, wheat and potatoes continued to be used by farmers, the value of the much preferred bean variety G2333 was compromised by the onset of a fungal root disease. Other technologies, such as the Lime + NPK treatment and the agroforestry species, *Sesbania*, were either abandoned or recognized as inappropriate.