PRODUCTIVE LAND USE SYSTEMS PROJECT

Haiti

USAID/Haiti Economic Growth Office

SOUTH-EAST CONSORTIUM FOR INTERNATIONAL DEVELOPMENT
AND
AUBURN UNIVERSITY

May 2001

TECHNICAL ASSISTANCE TO THE PLUS PROJECT:
Final Report of the
South-East Consortium for International Development (SECID)
and Auburn University

Dennis A. Shannon, J.D. (Zach) Lea, Lionel Isaac and Sarah Belfort

This work was performed under USAID/Haiti Contract No. 521-0217-C-00-5031-00. The views expressed herein are those of the contractor consultants and not necessarily those of SECID or the U. S. Agency for International Development.

TABLE OF CONTENTS

List of Acronyms vi

PLUS Project Principle Staff Roster vii

Executive Summary x

I. Introduction 1
SECID's Role 1
Preliminary Activities 2

II. Success and Impact of Technical Assistance to PLUS 3
Preliminary Reviews 3
Farmer Needs Assessment Surveys 3
PDAI & ADS II Project Technologies 4

A. Crop Production, Protection and Management 5
On-farm Agronomic Research 5
Crop Variety Selection 6
Beans (*Phaseolus vulgaris*) 6
Cowpea (*Vigna unguiculata*) 7
Peanut (*Arachis hypogea*) 7
Maize (*Zea mays*) 8
Sweet Potato (*Ipomea batata*) 8
Cassava (*Manihot esculenta*) 8
Pest and Disease Control and Production Studies 9
Yam Tuber Rot Control 9
Yam Production Surveys in Grande Anse 9
Soil Conservation Case Studies and Trials 10
Consultancies 11
Crop Variety Inventory 11
Pest Management 12
Banana and Plantain Diseases 12
Cacao Yield Improvement 13
Coffee 14

B. Agroforestry and Soil Conservation 14
Agroforestry Adaptive Research Program 15
Soils at Research Sites 15
Choice among soil conservation practices 16
Adoption and Management of Soil Conservation Practices 19
Choice of Hedgerow Species 21

Hedgerow Establishment....21
Biomass Production....22
Assessing Hedgerow Species as Source of Nitrogen....22
Effect of Hedgerow Species on Soil C and N....23
Best Choices for Hedgerow Species....23
Hedgerow Pruning Management....25
Effects on Maize Grain and Hedgerow Biomass Yields....26
Effects on Soil Carbon and Nitrogen....28
Effects on Nitrogen Recovery by Maize....28
Summary of Hedgerow Management Research....28
Consultancies in Support of Soil and Water Conservation....28
Water Harvesting in Small Scale Irrigation....28
Irrigation Systems and Watershed Management....29

C. Tree Germplasm Improvement....30
Genotype assessment (by species)....31
Cedrela odorata....31
Cordia alliodora....32
Enterolobium cyclocarpum....34
Senna siamea....34
Casuarina spp.....35
Pinus spp.....35
Gliricidia sepium....36
Neem (*Azadirchta indica*)....37
Mahogany (*Swietenia*)....38
Haitian Oak (*Catalpa longissima*)....39
Reference book on Haitian Trees....40
Impact of Tree Planting....40
Conclusion....41

D. Information Clearinghouse....43
Introduction....43
Accomplishments....43

E. Market research and marketing support....44
Introduction....44
Background....45
SECID Marketing Programs....47
Program Overview....47
Program Activities and Results for Manioc (*Manihot esculenta*)....48
Program Activities and Results for Plantain (*Musa paradisiaca*)....50
Program Activities and Results for Handicrafts....51
Program Activities and Results for Dried Immature
Sour Orange (*Citrus aurantium*)....52

Program Activities and Results for Mango (*Mangifera indica*) 52
Program Activities and Results for Breadfruit (*Artocarpus incisa*) 55
Program Activities and Results for Kenep (*Melicocca bijuga*) 56
Program Activities and Results for Igname (*Dioscorea* spp.) 56
Program Activities and Results for Malanga (*Xanthosoma* spp.) 58
Program Activities and Results for Pumpkin (*Cucurbita moschata*) 59
Program Activities and Results for Cacao (*Theobroma cacao*) 60
Program Activities and Results for Cacao Yield Improvement Program 61
Program Activities and Results for Greenhouse Drying Facilities 63
Program Activities and Results for Quality Control Training 65
Program Activities and Results for Coffee (*Coffea arabica*) 66
Marketing Credit for Farm Groups 66
Organic Certification Activities 67
Other Activities at Don Don 68
Activities at Baptiste 69
Other Marketing Programs 70
Okra (*Hibiscus esculentus*) 70
Hot Pepper (*Capsicum annuum*) 71
Pigeon Pea (*Cajanus cajan*) 72
Dried Beans (*Phaseolus vulgaris*) 72
ServiCoop 73
Introduction 73
ServiCoop Activities and Results for Cacao 75
ServiCoop Activities and Results for Coffee 76
Coffee Processing Consultancies 78
Initial Consultancy with Enterprise Works Worldwide (EWW) 78
Background 79
Results 80
Institutional Strengthening Activities 82
Training for PLUS Project Partners 82
Training for Farm Groups 82
Ongoing Support 83
Formation of a Marketing Cooperative at Gros Morne 83
Concluding Remarks on Marketing 84

F. Monitoring and Evaluation 86
A Resume of M&E System Design and Evolution 87
Initial Design 87
First Modification of the M&E System 87
Second Modification of the M&E System 88
USAID Mandated Modifications to the M&E System 89
Developing the M&E System 90
Refining the PLUS M&E System: Phase I 91
Refining the PLUS M&E System: Phase II 93

Refining the PLUS M&E System: Phase III 93
The M&E System as of 21 September 1995 contained the following nine components 94
M&E System Outputs: Reports 98
M&E System Outputs: Reported Results 98

G. Hillside Agriculture Assessment 99
Introduction 99
Principal Findings 100
Principal Conclusions 100
Principal Recommendations 101

III. Lessons Learned 103
A. Contribution of Technical Assistance to PLUS 103
Technical Lessons 103
Tree Improvement 103
On-farm Adaptive Research 104
Agroforestry and Soil and Water Conservation 104
Marketing 104
Conditions for a Successful Marketing Program 106
Development of a Successful Marketing Program 107

B. Programmatic and Institutional Lessons 108
Continuity of Effort 108
Adequate Staffing 109
Institutional Structures fostering Collaboration and Complementarity 110
Information Clearinghouse 111
Lessons Learned from the PLUS M&E Experience 111

IV. Conclusions and Recommendations 113
Crop Production, Protection and Management 113
Tree Improvement 113
Agroforestry and Soil Conservation 114
Information Clearinghouse 114
Marketing 114
Recommendations for Designing and Implementing Future M&E Programs 115

Appendices

Appendix A. SECID/Auburn Formal M&E System Reports.
Appendix B. SECID/Auburn Informal M&E System Reports Prior to September 1998.
Appendix C. SECID/Auburn Strategic Objectives Reports After September 1998
Appendix D. SECID/Auburn Publications.

List of Acronyms

AFII	Agroforestry II Project
AOP	Agriculture Outreach Project
ASSET	Agriculturally Sustainable Systems and Environmental Transformations
ATPPF	Assistance Technique pour la Protection des Parcs Nationaux et Forêts
AU	Auburn University
BIG	Bio-Intensive Garden
CARDI	The Caribbean Research and Development Institute
CARE	Cooperative for American Relief Everywhere
CATIE	Centro Agronónomico Tropicale de Investigación y Enseñaza (Tropical Agriculture Research and Higher Education Center)
CBO	Community and Church Based Organizations
CGIAR	Consultative Group for International Agricultural Research
CIAT	Centro International de Agricultura Tropical
CIDA	Canadian International Development Agency
CIP	Centro International de Papa
COP	Chief of Party
CRP	Conservation Research Program
CRDA	Centre de Recherche et de Documentation Agricole
CRSP	Collaborative Research Support Program
DDA	Directions departementales de l'agriculture
EG	USAID Office of Economic Growth
EU	European Union
EWW	EnterpriseWorks Worldwide
FACN	Fédération des Associations Caféières Natives (Federation of Native Coffee Associations)
FAES	Fond d'Assistance Economique et Social
FAO	Food and Agriculture Organization of the United Nations
GIS	Geographic Information System
GOH	Government of Haiti
GPS	Global Positioning System
HCC	Home Campus Coordinator
HEF	Haiti Environmental Foundation
HGRP	Hurricane Georges Recovery Project
IADB	Inter American Development Bank
ICO	International Coffee Organization
IFAD	International Fund for Agricultural Development
IICA	Institut Interamericaine de Cooperation pour l'Agriculture
INIBAP	International Network for the Improvement of Banana and Plantain
IPM CRSP	Integrated Pest Management CRSP
IR	Intermediate Result
IRR	Internal Rate of Return
MARNDR	Ministry of Agriculture, Natural Resources and Rural Development

MDE	Ministry of the Environment
M&E	Monitoring and Evaluation
NEAP	National Environmental Action Plan
NGO	Non-Governmental Organization
NTA	Non Traditional Agriculture
OCIA	Organic Crop Improvement Association
OPMAGAT	Coffee Cooperative in Les Cayes area
ORE	Organization for the Rehabilitation of the Environment
PADF	Pan American Development Foundation
PICV	Projet d'Intensification des Cultures Vivrières
PLUS	Productive Land Use Systems Project
PM	Project Manager
PRA	Participatory Rural Appraisal
PVO	Private Voluntary Organization
RRA	Rapid Rural Appraisal
SANREM CRSP	Sustainable Agriculture and Natural Resources Management CRSP
SCAA	Specialty Coffee Association of America
SDRT	Service de Defense et de Restauration des terres
SECID	South-East Consortium of International Development
ServiCoop	A Haitian agribusiness cooperative
SO	Strategic Objective
STABV	Secretariat Technique pour l'Amenagement des Bassins Versants
STABEX	European Community Export Stabilization Fund
UNDP	United Nations Development Program
USAID	US Agency for International Development
WB	World Bank

PLUS Project Principle Staff Roster

SECID Office/Haiti

Dr. Frank E. Brockman, Tropical Agronomist. Chief of Party (1993-1995)

Dr. J.D. (Zach) Lea, Agricultural Economist. Chief of Party (1996-2001)

Marion Ford, Institution Strengthening Specialist (1995-1996)

Marilyn Louis, Administrator (1992-1996)

Elda Lauredant, Administrator (1997-2001)

Lionel Isaac, Agronomist, Agroforestry Adaptive Research

Marguerite Blémur, Agronomist, Information Clearinghouse

Carmel Andre Béliard, Forester, Tree Germplasm Improvement Program

Yves Jean, Agronomist, On-farm Agronomic Research Program

Roosevelt Saint-Dic, Agricultural Economist, Monitoring and Evaluation

Frisner Pierre, Agricultural Economist, Monitoring and Evaluation and Marketing

Junior Paul, Marketing Specialist

Raymond Lerebours, Marketing Specialist

Carine Roche Bernard, Agronomist, Agroforestry Adaptive Research

Louis Verret, Agronomist, Tree Germplasm Improvement Program

Yvon Elie, Technician, Tree Germplasm Improvement Program

ServiCoop

Henri Bélizaire, Director, ServiCoop

SECID/Washington, DC

Harry H. Wheeler, Executive Director

Harry Sthother, Jr., Chief Financial Officer

Auburn University

Dr. Richard L. Guthrie, Associate Dean, International Agriculture

Dr. Dennis A. Shannon, Home Campus Coordinator

Executive Summary

SECID provided technical assistance to the Productive Land Use Project (PLUS) by various means, including a Tree Germplasm Improvement Program, an Agroforestry Research Program, an On-farm Agronomic Research Program, an Information Clearinghouse, a Marketing Program, a Hillside Agriculture Assessment and the creation and support of a Monitoring and Evaluation (M&E) System. It also conducted special studies using consultants and local staff and provided technical backstopping services. SECID's primary clients were the two implementing agencies of PLUS, CARE International and the Pan American Development Foundation (PADF), who were charged with working directly with farmers. Technical support and information were also supplied directly to USAID and to the "Haitian Bleu" Coffee Project of USAID, as well as to others seeking information and advice. Following is a summary of the major achievements of SECID.

Preliminary Studies

A review of prior USAID projects in Agriculture revealed mixed results for adoption of improved varieties and soil and water conservation practices tested and promoted by the predecessor projects, Integrated Agricultural Development Project (PDAI) and Agricultural Development (ADS) II Project. A long-term strategy was recommended for agricultural research and extension projects.

A series of Farmer Needs Assessment Surveys were conducted to identify priorities for PLUS in terms of technologies that would bring about sustainable increases in farmer income and crop production by hillside farmers. These surveys confirmed that past efforts in soil and water conservation had not led to long-term widespread adoption of these practices. Extension of these practices had not been accompanied by adequate research support. One of the innovations arising from this survey was the testing of contour barriers of perennial crops (*bann manje* in Creole), instead of multi-purpose trees. The roles of livestock should be considered when designing conservation interventions. A number of other interventions were recommended.

Crop Varieties

Between 1993 and 1996, on-farm trials were conducted in collaboration with CARE and PADF in different parts of Haiti. Variety trials with bean, cowpea, peanut, maize, sweet potato, cassava served to identify varieties with higher yield and/or other characteristics superior to local varieties. Bean varieties that performed well both in hot lowland conditions and the cool environment at high elevation allow seed exchange between farmers at low and high elevation. Sweet potato varieties introduced through these trials allow farmers to harvest tubers in two seasons per year rather than just one. The introduced cowpea varieties not only yield more than

local varieties, but have resistance to storage pests, resulting in greater shelf life for the grain. A survey of yam production areas in Grande Anse revealed a large number of varieties in at least 5 species of *Dioscorea*. An inventory of crop varieties in Haiti was also conducted.

Farmers are eager to obtain new and better crop varieties. Higher yields are readily obtained through selection. Variety testing and provision of improved crop varieties should be a part of future hillside agriculture projects.

Crop Management and Protection

An on-farm study was conducted to determine ways to reduce black rot (*Rosellinia bunodes*) in tubers of yam (*Dioscorea* spp.) grown as an understory in forest stands. Both pruning of forest canopy to allow more light penetration, or application of lime to the soil were effective in reducing the incidence of the disease and the percentage of unmarketable tubers. Canopy pruning also increased tuber yield by 3.4 metric tonnes per hectare. In a survey of yam production in the Grande Anse, the most important constraint cited by farmers was the insect larvae commonly referred to as *maroca*. Farmers believed that having pigs root in the fields after harvest helped to reduce *maroca* incidence. Several diseases and other pests were also cited by farmers.

Following a survey of banana and plantain diseases in Haiti by a specialist in banana diseases, SECID imported several disease-resistant varieties, which were multiplied and tested in on-farm trials. Information was provided on control of insect pests in vegetables and other crops. Consultancies on cocoa production problems led to the establishment of demonstrations for proper management of cocoa plantations. Consultants recommended improvements to coffee production and processing in order to increase quantity and quality of beans harvested and processed.

Agroforestry and Soil and Water Conservation

Research on hedgerow species for contour alley cropping revealed that *Leucaena leucocephala* produced the most biomass and was the best source of nitrogen at low elevations, while *Acacia angustissima* was the best at high elevations. *Delonix regia* provides an alternative at low elevation, where browsing by livestock results in destruction of leucaena hedgerows. Because *D. regia* is lower in N content, an alternate source of N should be supplied with this species.

Optimum management of leucaena hedgerows at low elevation for sustained maize production was obtained with three prunings per season, with prunings being applied to the soil. Soil application of prunings resulted in improved soil quality as indicated by higher contents of organic C and N. Alley cropping with leucaena trees gave higher and more stable maize yields over the long term than did rock walls, contour canals, grass rows or no conservation barriers. In

droughty seasons, yields of rock walls, contour canals and grass rows averaged lower than no-barrier control treatment. Lower yields were partly the result of loss in cropping area on a shallow soil.

Recommendations on water harvesting and on repairing and protecting an irrigation system at Marigot were made by a specialist in soil and water conservation and irrigation.

Future projects should continue to promote contour hedgerows for soil and water conservation and provide better training in management of hedgerows. This should be accompanied by promotion of alternate sources of livestock feed, such as feed gardens, so that hedgerows may be reserved for soil improvement. Future projects should put more effort into water harvesting as a means to improve farmer welfare and agricultural sustainability, particularly in drier areas of the country.

Trees and Tree Germplasm Improvement

Trials testing different genetic sources (provenances of introduced species and half-sib families of selected mother trees) of important indigenous and exotic tree species were conducted in different environments in Haiti. These trials identified tree varieties with superior growth and habit for planting by Haitian farmers. Trees of the best provenances or families grow faster and produce more wood than unselected sources of most species. Seed orchards established by SECID provide a valuable source of improved tree seed for increasing farm-level productivity and income and for maintaining genetic diversity in endangered species in Haiti. Continued maintenance and use of these orchards is being assured by PADF.

Under the project, SECID published a book, entitled *Bwa Yo - Important Trees of Haiti* provides valuable information on many trees of value in Haiti. A study of the impact of tree planting provides important information on farmer decision-making with regards to trees and confirms that tree planting projects have not only had an economic and environmental impact, but has changed farmer attitudes with respect to tree planting. They have also increased habitat diversity.

Tree planting by farmers should be continued. Greater effort should be placed on high value species. The seed orchards established by SECID should be developed by future projects into a seed industry to supply not only the local market but for export to other tropical countries.

Information Clearinghouse

The Information Clearinghouse of SECID enabled PLUS project staff to access information from previous projects, from the scientific literature and from other sources of technical information. Besides responding to individual requests for information, it also published a newsletter to provide project participants with technical information and to inform

them of project activities. Key to its success was a well-stocked and indexed library and a professional able to access and interpret technical information for the benefit of participants. Future projects will benefit greatly by having an Information Clearinghouse.

Market Research and Marketing Support

Marketing became the primary focus of SECID following the closing of Tree Germplasm Improvement, On-farm Agronomic Research Program, Agroforestry Adaptive Research and the Information Clearinghouse. In addition to market studies, marketing activities focused on increasing farmer income through changes in crop marketing channels to improve cost-effeciencies. The SECID approach was to organize farmers to market their products as groups rather than individuals and to market directly to large-scale buyers rather than through the more costly traditional channels. The more direct contact with the largest domestic buyers allowed farmers to capture a large proportion of the traditional marketing costs. Additionally, the more direct marketing channel allowed large scale buyers to better communicate quality requirements to farmers. This coupled with the increased farm-level price resulted in marketing systems that delivered higher quality product to large-scale buyers and rewarded farmers with increased revenue. For example, innovations in mango and cacao marketing have resulted in significant increases in farm-gate prices and are transforming the organization and efficiency of the associated marketing channels. Farmers now deal directly with exporters, rather than through middlemen, resulting in higher prices to farmers, as well as improvements in the quality of mangoes and cacao reaching exporters. A marketing cooperative, ServiCoop, was established to facilitate export of cacao, coffee and other products, and has played an important role in increasing farmer income. ServiCoop has become one of the major exporters of cacao, and has been instrumental in raising prices paid to farmers and cacao quality delivered to international buyers.

SECID and ServiCoop have been successful in targeting coffee to the European Fair Labeling Organization as well as the organic coffee market. Marketing and technical assistance was also provided to *Haitian Bleu* coffee, supported by USAID's Coffee Project. SECID also assisted farm groups apply the direct marketing approach (with similar results) to the export of non-traditional export crops such as dried immature sour orange, breadfruit, kenep, yam, malanga, and Haitian pumpkin. Marketing programs initiated but not yet successful were with okra, hot pepper, pigeon pea and dried beans.

SECID's greatest success in the domestic market resulted from a study in food technology, which determined that the flat-bread, *kassav*, could be made from dried meal rather than freshly harvested roots. This change in processing is transforming the *kassav* industry and increasing revenues for both farmers and processors, because of the reduced costs associated transporting dried meal, rather than of whole tubers and increased flexibility because the dried meal can be stored, whereas fresh roots cannot be stored. Another innovation, sun-dried plantain chips, was also successfully marketed. An important aspect of the marketing program has been

institutional strengthening. Training was given to staff of PADF and CARE as well as to farm groups. Topics included marketing, harvesting, product assembly, selection and processing, record keeping, accounting and management. Management skills are one of the most limiting factors for production in Haiti. SECID also facilitated the formation of cooperatives. Marketing should be a major component of future projects, because it has the potential to significantly and sustainably increase farmer income. It provides the incentive for improvements in crop management and land use husbandry that might be difficult to achieve on their own account. A successful marketing approach involves teaching farmers to organize group marketing enterprises. Farm groups must be trained to negotiate and successfully fulfill marketing agreements with large-scale buyers, with a special attention to quality control standards. Such training involves harvest management, quality assurance, and transfer of product to and payments from buyers on a timely basis.

Monitoring and Evaluation

A M&E System was designed for PLUS by SECID in collaboration with its partners, CARE, PADF and USAID. This system went through many modifications and refinements, as a result of conflicting interests including the alternate uses of funds for project implementation vs monitoring. The initial design of the system was too ambitious for the level of resources provided. Designs of the M&E system were further complicated by complexity of small-scale farming in Haiti, by the complexity of the technical packages provided by PLUS, changes in funding levels and reporting times. By the end of the project, the performance indicators were reduced to five:

1. Percent increase in agricultural income,
2. Percent increase in crop yields,
3. Percentage of improved agricultural practices being maintained,
4. Number of participants using sustainable practices,
5. Number of trees planted.

Data were obtained from an annual survey of farmers. This survey provided an indicator of farmer satisfaction with project activities, but its accuracy in measuring project impact is in doubt.

There is significant trade-off between M&E System quality and level of funding. Future M&E systems should be designed more systematically, with review and approval of both methodology and funding by project implementors and by all levels within USAID with authority to do so. Modest goals should be set and more than one method should be used to obtain acceptable M&E results.

Hillside Agricultural Assessment

In its efforts to address agricultural production and environmental degradation problems in Haiti, USAID has assisted the hillside agriculture sector through various initiatives. These initiatives have evolved over the years from simple agro-forestry and small holder agricultural efforts to the current focus upon community based development and marketing of its natural resources, on a sustainable basis. A number of other donors and international Non-Governmental Organizations have joined USAID in this approach. In the spring of 1999, USAID/Haiti commissioned SECID to perform an assessment of Haiti's hillside agricultural sector. The Assessment, supported by all agencies and donors throughout the country, sought what effective progress had been made to increase hillside farmer revenues and to preserve the hillside environment. The purpose of the report, which was translated into French and widely distributed within Haiti, was to offer some preliminary findings, conclusions and recommendations, to assist USAID and its development partners to better assist Haitian hillside farmers break the cycle of their environmental and employment problems and their dependency upon outside assistance.

I. INTRODUCTION

The purpose of the Productive Land Use Systems (PLUS) Project was to bring about sustainable increases in agricultural production and income of hillside farmers through ecologically and economically sound agricultural practices that conserve the fragile environment of Haitian hillsides. PLUS began in October 1992 as a follow-on to Agroforestry II (AF II) Project, which was suspended in September 1991 due to political events. AF II focused a major part of its resources on tree planting on agricultural land, while at the same time encouraging soil and water conservation through establishment of tree hedgerows and other conservation barriers. Under PLUS, less emphasis was placed on tree planting, as attention was shifted to agricultural production and marketing. Over the course of the project, the focus on marketing increased, while emphasis on agricultural production decreased.

SECID's Role

The role of SECID in PLUS grew out of a recognized need in the predecessor Agroforestry Outreach Project (AOP) for research and technical support to the agencies conducting extension and support to farmers in order to address technical problems encountered by the implementing agencies. Under PLUS, SECID was contracted to provide technical and marketing support to CARE International and the Pan American Development Foundation (PADF), who in turn provided technical support and training to farmers. SECID supported CARE and PADF by conducting applied research, developing and supervising a Monitoring and Evaluation (M&E) System and providing marketing support. It also recruited consultants and sought out technical information to address needs as they were identified by the Grantees (PADF, CARE) or SECID. As the PLUS Project's role evolved over time, so did SECID's role.

In 1993, SECID established the following programs:

- Tree Germplasm Improvement
- Agroforestry Adaptive Research
- On-farm Agronomic Research (later referred to as On-farm Adaptive Research)
- Information Clearinghouse
- Monitoring and Evaluation
- Marketing

The SECID technical assistance team was led by a Tropical Agronomist/Chief of Party, who was responsible for the first four areas, listed above, and an Agricultural Economist, who was responsible for M&E and Marketing. Both held doctoral degrees and were based in Haiti. Each of the six sections was headed by a Haitian professional holding a MS degree. The Tree Germplasm Improvement Program was a continuation of tree germplasm conservation and selection begun under AOP. Agroforestry Adaptive Research continued trials begun in 1991 under AF II. The remainder of the programs were created to reflect the new orientation of USAID's agricultural program. At the end of 1995, the Tropical Agronomist position was replaced by an Institutional Building Specialist. This position was discontinued following the resignation of the Specialist in May 1995. The Agricultural Economist became Team Leader,

and, following the departure of the Tropical Agronomist and Institutional Building Specialist, he became the sole long-term expatriate under the contract.

The Tree Improvement Program was also discontinued in 1995, followed by the On-farm Adaptive Research, the Information Clearinghouse and the Agroforestry Adaptive Research Programs in 1996. From 1997 until its closing in February 2001, market support has comprised the major focus of SECID's work, together with oversight of ongoing M & E activities.

After a hiatus of some years, the responsibility for the orchards, arboreta and trials established under AOP were assumed by PADF. The trials initiated under Agroforestry Adaptive Research Program were continued under the auspices of the Soil Management Collaborative Research Support Program project, ***Soil Management Practices for Sustainable Production on Densely Populated Tropical Steeplands.*** SECID provided administrative and logistical support, while PADF assisted in accessing farmers and some support to on-farm trials and surveys. Some of these research results are reported here.

Preliminary Activities

As part of the initial efforts to orient the activities of PLUS and SECID, several consultancies were initiated at the start of the project. These included:

- A review of technologies introduced to farmers by two preceding agricultural projects and an assessment of their long-term impact by Dr. Marianito Villanueva (SECID/Auburn PLUS Report No. 2)
- A review of status of seed orchards and tree improvement trials by Joel C. Timyan, with recommendations for continuing the most promising work (SECID/Auburn PLUS Report No. 1)
- Development of a M & E System for PLUS by Dr. Angelos Pagoulatos, in collaboration with representatives, of CARE, PADF and SECID (SECID/Auburn PLUS Report No. 3)
- Farmer Needs assessment Surveys, by a multi-disciplinary team led by Anthropologist, Richard Swanson (SECID/Auburn PLUS Report No. 7-13)

These investigations, which are described in Chapter II, provided a rationale for many of the activities carried out under PLUS.

II. SUCCESS AND IMPACT OF TECHNICAL ASSISTANCE TO PLUS

The principal role of SECID in PLUS was to provide information that helped project leaders to better orient project activities to achieve greater economic and environmental impact and to provide information to improve farmers productivity through more productive tree and crop varieties or improved farming practices. This report synthesizes and summarizes the results of the technical assistance and highlights important accomplishments.

Preliminary Reviews

Farmer Needs Assessment Surveys

Early in the project, SECID conducted a series of exploratory surveys to orient the project towards activities that can bring about sustainable increases in income and crop production for hillside farmers, while addressing the project's conservation objectives of preserving soil and protecting watersheds. The team sought to determine what farmers wanted from the PLUS Project and how some of their stated needs or demands could be met through project interventions. These surveys provided baseline information on farming systems in watersheds in each of five regions of PLUS interventions. They also identified constraints to production and opportunities for PLUS to achieve sustainable increases in production and farmer income. The recommendations and summary provided in the reports helped to draw PLUS project attention to areas of particular strength on which to built, and to areas of possible weakness, which needed improvement.

The team observed that past hillside soil and water conservation programs, in general, have not had the results hoped for. Short-term "success" in implementing conservation practices have not generally translated into long-term adoption of these practices. The team also noted that extension of conservation practices had taken place without adequate applied research to support the technologies being extended.

Soil and water loss and deforestation continued to pose serious problems in many areas. However, some hillside cropping systems remained productive, particularly in the Cap Haïtien, Jacmel, and Mirebalais regions. These fields in most cases still did not have adequate soil conservation measures in place and were therefore at risk. Thus continued focus on improving appropriate production systems, including conservation measures for these and other regions was highly justified.

Past experience with hedgerows as a soil conservation measure had not been satisfactory. The team suggested that greater attention be placed on the possibility of using perennial crop species and crop management techniques already used by farmers. Based on discussions with farmers, the survey team felt that what might be needed was not a row but a vegetative band or barrier. This vegetative band must be composed largely of crops of high economic importance to the farmers, both for household consumption and for commercialization. A new structure called

"*bann manje*" in Haitian Creole, which consisted of an earthen ridge of long-cycle horticultural crops of high economic value, was developed under PLUS following these recommendations.

Rock terraces are another option for soil conservation on farmers' fields where the material is available. However, the problem with rock terraces was the motivation to create such structures. The team suggested that appropriate productive vegetative barriers be created along rock terraces for long-term soil conservation purposes and as a further incentive to maintain an repair rock walls.

Farm animals play an important role in the agricultural economy, throughout Haiti, and should be taken into consideration when designing pragmatic conservation interventions. Perennial species planted on the contour of hillsides should be monitored for their value and use in animal production.

Pigs are greatly valued in many areas in Haiti. They are often tied under a tree where they are fed forage and excess fruit gathered by the farmer for this purpose. Pig manures in these areas are important for soil fertility. The presence of pigs could serve as an incentive to increase the number of fruit trees on their land and to reduce cutting of existing fruit trees for charcoal production.

Other recommendations included the establishment of grain and seed banks to help farmers obtain seed at planting time, seed multiplication of high yielding and disease resistant crop varieties, improvement of rural road, promotion of vegetable production through bio-intensive gardens, value-added product transformation, especially of fruits, and implementation of on-farm farmer managed trial activities. (SECID/Auburn PLUS Reports No. 7-13)

PDAI & ADS II Project Technologies

A review of technologies tested or developed under the Integrated Agricultural Development Project (PDAI) and Agricultural Development Support II (ADS II) was conducted in January 1993 to see what interventions endured after the departure of the projects and to obtain background information to base farming systems and crop production under the PLUS Project. Successes and failure of the previous projects were reviewed in terms of technology development, socio-economics and research and extension efforts. The major technologies addressed under PDAI and ADS II projects were varietal improvement, cultural management and soil conservation.

Agronomically superior cultivar of cereals, legumes, root and tuber crops were identified under PDAI and ADS II. However, among the varieties recommended by PDAI and promoted by ADS II in two regions of Haiti, only TAMAZULAPA, a black bean variety, was adopted and extensively grown by the farmers. This implied that most of the introduced crop varieties did not meet all the requirements of the farmer. Therefore more on-farm testing was needed. Tamazulapa, introduced into Haiti from the International Center for Tropical Agriculture (CIAT), Colombia, out-yielded the local variety by 20-50 % in areas tested. The recommended

varieties for the other food crops had not undergone extensive testing, but initial reactions of the farmers were negative.

In terms of soil conservation efforts, the ADS II focus was to identify sustainable methods of continued soil conservation. In the Les Cayes region, living hedgerows of *Leucaena* and grasses were adopted by farmers in the hillside fields. However since the project closure, many of the hedgerows have disappeared, primarily due to overgrazing by animals. Also, farmers interviewed recognized that *Leucaena* was good for the soil, but claimed that it was difficult to manage. In Haut Cap Rouge, Jacmel, rock terraces were the focus of the intervention under ADS II. These structures were introduced in combination with vegetative strips and fruit trees. A major portion of several watersheds were covered and maintained with a combination of rocks walls, vegetative strips, and fruit trees. Less than satisfactory adoption of soil and water conservation practices was attributed in part to the premature suspension of the projects. The need for long-term strategies to address these problems were emphasized.

Recommended interventions for PLUS were the introduction of improved crop varieties, creation of a functional seed production program, adoption of sound research and extension strategies, credit assistance to farmers and linkages with external sources of technology. Research will be needed to adapt technology obtained from outside sources to local conditions and to address local problems encountered by the project. There is a need for continuity between projects and for a long-term strategy for agricultural research and extension. (SECID/Auburn PLUS Report No. 2).

A. Crop Production, Protection and Management

SECID made significant contributions to crop production through its on-farm agronomic research program, use of consultants and information services provided by the Information Clearinghouse and backup support from Auburn University.

On-Farm Agronomic Research

The On-Farm Agronomic Research under PLUS was a joint effort between SECID and PADF and CARE. The type of research undertaken in each region was determined based in part on knowledge of farmers' constraints and opportunities as gained by surveys, field agent/farmer interaction and feed back from the PLUS Monitoring and Evaluation (M&E) system, and also the priorities of the collaborating NGO. Trials in CARE areas were oriented towards crop variety improvement, which was seen as giving a rapid benefit, while trials in PADF areas focused on more long-term solutions such as soil conservation and disease management. SECID designed the trials in consultation with the project partner, prepared a protocol for operational procedures, provided instruction on trial management and data collection and was responsible for data analysis and interpretation of results. CARE and PADF were responsible for the actual management of the trials and recording of data.

Crop Variety Selection

Varieties superior in quality and yield to local varieties under prevalent farmer conditions of low-fertility soils and drought stress were identified for beans, cowpea, peanut, maize, sweet potato and cassava crops. Many of the varieties tested came from a crop variety inventory made by SECID (SECID/Auburn PLUS Report No. 20). These varieties consistently out-yielded the local varieties by about 20 % to more than 100 % under the growing conditions of the sites where they were evaluated. For information on detailed results of variety trials conducted under the On-farm Research, readers are referred to SECID/Auburn PLUS Reports No. 42 (yam), 43 (bean), 44 (sweet potato), 45 (cassava), 46 (peanut) and 51 (cowpea). Although future testing is needed, initial reactions of the farmers were positive. These findings demonstrate the benefits of variety testing in future projects. It may be interesting for future projects to continue with farmer-managed demonstration trials for some crop varieties to better assess the acceptance by the farmers.

Beans (Phaseolus vulgaris)

Nineteen bean varieties, selected in Puerto Rico for resistance to Golden Mosaic Virus and heat tolerance and one from the Organization for Rehabilitation of the Environment (ORE), were tested in low and mid-elevation sites in Haiti together with three local varieties. One of the objectives was to identify varieties that would tolerate production conditions at both low and high elevation areas. Because of the lack of a regular seed supply during the planting period, beans harvested in the plains are exchanged as seeds in the mountains and vice versa. However, the differences in growing conditions at low and high elevation are such that varieties that do best at one location are not necessarily the most suited for the other. Therefore it was necessary to look for varieties with very wide adaptation in addition to high yield potential and tolerance to pests and diseases.

Yields were low at low elevations, in large part because the varieties were grown during the hot time of the year, but introduced varieties gave consistently the highest yields. Across sites, DOR 557 and MD30-75 were the highest yielding varieties at both low and mid-elevation sites. These varieties yielded 260 and 160 kg ha^{-1} at low elevations and 755 and 817 kg ha^{-1} at mid-elevation, respectively. These experiments made it possible to identify bean varieties superior to local varieties during the hot cropping season. Those varieties of wide adaptation could solve the problem of seed exchange between plain and mountain farmers. The variety DOR 557 showed few symptoms of golden Mosaic Virus (BGMV). However, MD30-75 appeared sensitive to golden mosaic virus but it was little affected by ashy stem blight caused by *Macrophomina phaseoli*, an important disease during the hot season.

These varieties should also be tested during the cooler period of February to April, which is the normal growing period at low elevation. This research was conducted in collaboration with Agronomist Emmanuel Prophete of the Center for Agricultural Research and Documentation, Ministry of Agriculture, Natural Resources and Rural Development (CRDA / MARNDR). (SECID/Auburn PLUS Report No. 43)

Cowpea (Vigna unguiculata)

Cowpea, known locally as *pois inconnu*, is an important crop in drier areas of Haiti. One of the major problems with this crop is its susceptibility to insect pests, among them, weevils that destroy the seed during storage. Twenty-three cowpea varieties obtained from the International Institute of Tropical Agriculture (IITA) were tested in field trials in Northwest Haiti, together with local cowpea varieties. Out of 10 trials, IITA varieties gave yields testing superior to those of the local varieties in five trials. In no case did the local variety yield significantly higher than the introduced varieties. In seed storage tests, the local variety had the highest percent seed damage and greatest weight loss. Based upon the criteria as yield, resistance to storage pest and farmer preference, the best performing introduced varieties were IT87D-885 and IT87D-879-1 for the extra early group and IT86D-444 and IT87D-670-2 for the early varieties (See Table 1 of PLUS Report No. 51, referenced below).

Varieties with host plant resistance to storage weevils offer a low-cost, safe solution to Haitian farmers who cannot afford the cost of pesticides. Farmers can substantially increase cowpea yields and shelf life without use of insecticide by adopting high-yielding varieties with resistance to seed storage pests. The USAID/Haiti mission and other donors can make a significant contribution to sustainable agriculture in cowpea-growing areas of Haiti by supporting the multiplication and distribution of seed of selected cowpea varieties, and by supporting cowpea variety testing and studies to address insect pest problems. (SECID/Auburn PLUS Report No. 51)

Peanut (Arachis hypogea)

In the northwest peninsula of Haiti, farmers wanted peanut varieties that are higher yielding and earlier in maturity, to enable them to harvest twice a year. In the Grand-Anse CARE/PLUS areas, farmers appreciate running varieties that produce more pods. Introduced varieties were tested against the best local varieties in the northwest and in the Grand-Anse regions. Trials were conducted both at CARE training centers and on farmers' fields. In the northwest, farmers reported that Valencia was the earliest variety, allowing two croppings a year, as compared with one annual harvest for the local varieties. Valencia yielded more than the local variety in two out of five trials. The variety, Marc1, yielded higher on average, than the local variety in 10 trials. In the Grand-Anse region, ICGS 76 yielded more than the local variety at one trial site. Because of poor stands obtained in the introduced varieties, the yield advantage of these improved varieties was not adequately demonstrated. However, per plant yield was higher for the ICGS 76 than for the local variety. We were unable to repeat these trials with fresh seed because of the termination of the program.

These experiments enabled the identification of peanut varieties with potential to increase farmers' production in the Northwest and Grand-Anse areas. However, more variety testing is needed to identify the best peanut varieties under different soil and climatic conditions in Haiti. (SECID/Auburn PLUS Report No. 46)

Maize (Zea mays)

Two maize varieties from the Dominican Republic, Unphu 301 and Unphu 304, and Comayagua from Honduras, Central America, were tested against the local varieties in the Northwest regions of Haiti. Results from a trial in Passe Catabois (Northwest) showed that introduced varieties Unphu 301 and Comayagua produced better yields than the local varieties.

Sweet Potato (Ipomea batata)

Yield of sweet potato in CARE areas in Northwest Haiti is limited by soil and rainfall conditions and by the photoperiod sensitivity of local varieties that only allow them to produce tuber in the second cropping season (September-December through February-April). Two sweet potato varieties, Tapato and Toguecita, obtained from the Organization for Rehabilitation of the Environment, were tested against the best local varieties under farmers' field conditions and at CARE training centers. These introduced varieties generally yielded higher than local varieties when planted in the first season in spite of their low survival rates. The lower survival rates for the introduced varieties were in large measure due to deterioration of the cuttings owing to the long distance that the cuttings had to be transported and the unpredictability of rainfall in the Northwest. This adversely affected the performance of the introduced varieties in the test. When planted in second season, it appeared that the introduced varieties also yielded higher, rather than in first season, but data available was inadequate to be sure, given the trials were not planted in both seasons at all locations. These trials confirm the limitations reported by farmers with respect to planting of local sweet potato varieties in the first season. The introduced varieties provided farmers with more options, by making it possible to plant sweet potato in first season, with the expectation of somewhat higher yields.

Farmers reported that they attach importance to obtaining improved sweet potato varieties, having themselves introduced varieties obtained in other parts of Haiti. The varieties, Tapato and Toguecita, are appreciated by the farmers who participated in the trials due to their ability to yield tubers in first season, when the price of sweet potato is 2.5 times the price in the second season. Farmers like Tapato for its high yield and large tubers, while they like Toguecita because its tubers are formed in clusters near the crown, thus facilitating harvest. Farmers who participated in the trials are now growing Tapato and Toguecita in their fields. Further work is needed to increase sweet potato yields in first season. (SECID/Auburn PLUS Report No. 44)

Cassava (Manihot esculenta)

Cassava is an important crop for semiarid areas. However, cassava yields in CARE areas in the Northwest can be very low due to drought conditions. Two varieties, CMC40, a bitter variety from the North of Haiti, and Maliyo, a sweet variety from the South, were tested against the best local varieties in CARE areas in the Northwest to find ways to improve cassava yields. The variety CMC40 yielded highest in trials at different sites and appeared to withstand well the

drought conditions that characterize the Northwest. However, the variety Maliyo yielded low in the trials due to stealing of cuttings out of the trials. The theft of Maliyo from the trials is evidence of the value farmers attach to this variety. Additional research is required in order to properly assess the yield potential of this variety. However, these experiences demonstrate that it is possible to increase cassava yields in the drought-prone conditions of the Northwest region through the selection of improved varieties. (SECID/Auburn PLUS Report No. 45)

Pest and Disease Control and Production Studies

Yam Tuber Rot Control

Yam (*Dioscorea sp*) is a major crop in certain areas of Haiti where it is adapted and plays an important role in the economy of Haitian farmers. It is a high value staple crop that brings a high price locally and has export potential. In the North region, it is grown in a traditional agroforestry system as understory in dense forest. However, production is severely limited by a rot affecting tubers in the field caused by the fungus, *Rosellinia bunodes*. The fungus also attacks and kills several tree species associated with yam in agroforestry systems. Following a review of literature, SECID designed a trial to assess cultural practices that might limit impact of the fungus on yam tubers in the field. A yellow yam (*D. cayenensis*) was used in the trial. Highest disease incidence occurred on plots where the traditional cultural practices were followed. Both pruning of upper canopy and lime application drastically reduced the percentage of tubers affected by the disease and the quantity of unmarketable tubers in comparison to traditional practices. In addition to reducing the incidence of the disease, pruning also increased yam yield by 3.4 Mg (metric tonnes) per hectare. However, combination of pruning and liming did not produce more effect on the disease than produced by the two factors applied separately. Mounding had no effect on the disease.

Rosellinia bunodes is an economically important disease. In 1999, a shipment of yam from Grande Anse was rejected for export to the United States because of the presence of tuber rot. *Rosellinia bunodes* is the most likely causal agent. The disease is most prevalent in shady moist conditions. To rid the soil of the disease, it is recommended to clear the land of trees, which, on steep slopes expose the soil to a high risk of erosion. This study suggests that by pruning the trees, it may be possible to control the disease and avoid the negative environmental impacts associated with clearing the forest. (SECID/Auburn PLUS Report No. 42)

Yam Production Surveys in Grande Anse

The Grande Anse Department is one of the major yam (*Dioscorea sp.*) growing areas of Haiti, where it is an important source of revenue to farmers, and an important part of their diet. Knowledge of the yam production system, the varieties and species grown, and the principal constraints are important to any attempt to increase the production of this high value crop. These surveys were conducted at Moron and Dame-Marie regions by two students at the Faculty of Agriculture and Veterinary Medicine (FAMV), National University of Haiti, with support from CARE and assistance from SECID. Publication of the results of these surveys for the PLUS

Project was in conformity with a memorandum of agreement between SECID, CARE and FAMV.

These surveys revealed the richness in germplasm available to farmers in these areas and the importance given to the crop by the farmers. Twenty-nine varieties were reported across the two regions with a large number of varieties common in both regions. These varieties are of diverse characteristics and genetic background from at least five species of *Dioscorea*. The varieties Ginen and Jon (Fran) were the most cultivated in Moron region while Jon (Bangoule) was the most commonly grown in the four localities in Dame-Marie. These three varieties were judged to be from the complex *D. rotundata - D. cayenensis*. Other commonly-grown varieties were Bakala, Keston, Plenbit and Toro. These varieties are widely grown either because of the availability of their seed (heads or crowns) at reasonable price, their high market price or their resistance to drought and diseases.

In both, Moron and Dame-Marie regions, most yams are planted during February and March, but some varieties are planted all year long. The field preparation consisted in clearing the land followed by mounding. Whole yam tubers or tuber cuttings, usually from the upper crown area of the tuber, are used as seed. Yam is often grown in association with other crops, such as common bean, peas and maize, on the top of the mound, cassava and sweet potato on the sides, and malanga and taro at the bottom of the mounds. Harvest is generally spread over time, but traditionally yam harvest begins on Christmas day.

The most frequently mentioned constraint to yam production was the insect larvae commonly referred to as *maroca*. Other constraints of secondary importance included "scab" (flesh eventually turn black), *pian* (a rotting spot), birds, anthracnose disease and high cost of planting material. The *maroca* can cause extensive losses but certain varieties are more susceptible than others. Yams affected by *maroca* had tubers filled with holes (*galeries*) containing a yellow substance which become brown. Such tubers are not edible. The methods utilized by farmers to control *maroca* involved the utilization of chemicals, pigs, mechanical destruction of the larvae and burning. However, only the use of pigs had some effect at reducing *maroca* infestation. The failure of these traditional methods of maroca control demonstrated the need for research to identify ways to effectively control the *maroca* larvae in yam.

Yam is a crop with great economic potential both as a high-value staple crop and as an export crop for the ethnic market in the United States. Further effort to develop this crop is warranted in order to obtain high yields of high quality tubers, free of damage by *maroca* and free of insect pests and diseases. The PLUS Report No. 52 provides a larger picture of the diversity and importance of yam in the Grande Anse.

Soil Conservation Case Studies and Trials

The farmer needs assessment surveys conducted at the beginning of the PLUS project emphasized both the importance and difficulties associated with implementation of soil and water conservation (SECID/Auburn PLUS Reports 7-13). In 1993, the PLUS M&E program

instituted a series of case studies to assess the economic impact of various soil and water conservation options. Among the technologies tested were rock walls, hedgerows and checkdams in ravines and other areas of concentrated runoff flow. Different technologies were tested in different parts of the country. For rock walls and hedgerows, participating farmers agreed to establish the intervention in one half of a field and were to leave the other half unchanged, in order to serve as control. Initial results were positive (see discussion of M&E Program), but approximately two years after initiation, the program had to be abandoned, because farmers continued the rocks walls or hedgerows across the entire fields, leaving no control with which to assess the technology. Preliminary results showed higher yields with the interventions than without, but there were reports that farmers applied a higher level of management to plots protected by soil conservation practices than in the control plots.

The need to obtain unbiased comparisons to traditional practice, as well as among soil conservation options led to the decision to replace the case studies with replicated trials on land that was rented from the farmers, to ensure that there were valid controls. These trials were conducted only in PADF regions. Trials were designed comparing 2-3 conservation alternatives with traditional practice without soil conservation. The choice of soil conservation options was determined in consultation with the PADF regional staff.

Trials were set in each PADF region and managed by the PADF staff. Each trial had a replication of the "*bann manje*" structures, a traditional practice without conservation, and a third plot under either hedgerows or rock walls. The "*bann manje*" consisted of an earthen ridge on which were planted long-cycle horticultural crops of relatively high economic value. This type of research required several years of implementation before the confidence to make extension decision is developed. Unfortunately, the termination of the On-Farm Agronomic Research Program prevented these activities from being completed. Also, trial results did not get reported due to incomplete information provided by collaborators. (SECID/Auburn PLUS Semi-Annual Reports).

Consultancies

Several consultancies were carried out in support of crop production activities by farmers.

Crop Variety Inventory

Information was compiled on crop genetic resources available in Haiti including staple food, vegetables and fruit crops. Approximately eighty-four varieties of twenty-six crops are described with information on agroclimatic adaptation, yields, pest and disease considerations and seed sources. Information contained in this report was used to identify varieties to include in on-farm trials. (SECID/Auburn PLUS report No. 20)

Pest Management

Insect pests were identified as a major problem in vegetable gardens. An entomologist was hired to advise on Integrated Pest Management for the control of insect pests in vegetable gardens in Haiti. The main crops affected were cabbage, plantain, tomato, yam, sweet potato, beans and maize. Information on a list of insect pests, damage caused to these crops and current methods of control were reported. This report also emphasizes the importance of diseases, nematodes and weeds as a major constraint to crop production. In plantain, the Panama disease is believed to be the main cause limiting plantain production. Localized problems of tomato disease and golden mosaic virus infecting beans were also causing significant losses. Whitegrub attack to sweet potato and yam was said by local agronomists to be a serious problem. Description of the former fit that of the sweet potato weevil, *Rhysomatus subcostatus*. Continued manual control of weevils should be encouraged at the time of land preparation. With regard to the sweet potato weevil in particular, this is generally only a serious pest when crop practices are bad. Recommended practices are not leaving tubers in the soil too long, removal of old tubers, crop residues and volunteer plants, weed control, crop rotation, replanting in gaps left by dead or weak plants. Appendices include information on insecticidal plants and other common products that may be used at village level to control insects, various control measures to control common pests of vegetable gardens and experimental techniques to study insect pests and their control in hedgerows (SECID/Auburn PLUS Report No. 21).

Banana and Plantain Diseases

An assessment of disease problems in banana/plantain in Haiti was conducted by a plant pathologist specialized in banana. Diseases caused by fungi and nematodes were observed on the four main banana/plantain varieties grown in Haiti: Plantains (Musque), Cavendish (Figue), Silk (Figue bayonner) and Bluggoe (Poban). Panama disease, caused by *Fusarium oxysporum*, was found on Bluggoe (Poban) and was most destructive and in epidemic form in the Central zone around Mirebalais. The nematode root and rhizome rot (*Radopholus similis*) was most severe in some fields in the plains near Cap Haïtien on Plantains (Musque). The Sigatoka Leaf Spot caused by *Mycosphaerella musicola* was responsible for severe defoliation on Cavendish and Silk (Figue) varieties everywhere. The incidence of this latter disease is related to rainfall and damage is greatest as the rainfall seasons progress. The Banana Steak Virus was detected in the Arcahaie and Cap Haitien but was not common. Some disorders related to nutrient deficiencies are also reported.

Cultural practices, such as removing the roots and peeling the infected rhizome, were recommended to control Nematode Root Rot. Introduction of resistant varieties was recommended to maintain low incidence of the Panama Disease and Sigatoka Leaf Spot. In order to obtain nematode free plants it is necessary to utilize small meristem plantlets obtained from meristem tissue. The plantlets are grown to field planting size in a nursery. (SECID/Auburn PLUS Report No. 26)

As a result of this consultancy, disease-resistant varieties of plantain were introduced in Haiti. Three varieties of plantain from Honduras, FHIA-03 (Poban), FHIA-01 (Banana) and FHIA-23 (Banana), were tested on farmers' plots in the Grande Anse. Varieties FHIA-03 and FHIA-23 had resistance to "Panama Disease," while FHIA-01 was resistant to "Moko Disease." Additional orders of approximately 3,000 individual plants of FHIA-01, FHIA-03 and FHIA-21 (plantain resistant to Panama Disease and Black Sigatoka) were imported from the Honduran production firm. The variety FHIA-21 was found to carry the Banana Streak Virus (BSV). The BSV disease had already been found in the North and in Arcahaie. All plants of the variety FHIA-21 were given to Operation Double Harvest for field planting to observe the development of the Banana Streak Virus in cooperation with the Ministry of Agriculture. However, variety testing never completed or reported due to termination of the On-farm Agronomic Research Program.

Cacao Yield Improvement

Cacao specialists were hired to assist PLUS to increase the quantity and quality of cacao production for export through ServiCoop. Initial surveys reported excess shading, inadequate drying and storage conditions, low yielding and unproductive cacao trees, pests (rats) and disease as major constraints to cacao production in Grand Anse and Northern region. Recommended implementation activities included the use of demonstration plot, training in pest and disease (Fan Gall caused by *Fusarium decemcellulare*) control and harvest processing and improvement in sun drying capacity. The goal was to demonstrate to farmers how to manage existing cacao plantations to improve production and quality of the cacao produced with a relatively small increase in investment.

Preliminary curricula were established for demonstration plot training in upgrading of fields, including tree selection, grafting, pruning and shade adjustment. Improved prices and production translate into the higher profits that in turn encourage the farmers to continue to grow cacao. The focus of this program was on teaching the appropriate method of pruning of the cacao, grafting and shade adjustment (thinning out the branches of overgrown shade trees to reduce shading from over 50 % total shade to the desired range of 35 % - 50 %). In most plots, there were good and low producing trees. Better producing trees (50 to more than 100 pods) can be used as mother trees to provide bud or vegetative material for grafting onto less productive trees. To assist the cacao program, SECID prepared a set of sheets to be used specifically for harvest data collection. Also, a training manual for improving Cacao production published as SECID / Auburn PLUS Report No 50 contains a list of training activities and sheets to better manage and improve Cacao plantations in Haiti. This latter report compiles technical sheets with detailed information on training curricula for demonstration plots, tree pruning technique, grafting, nursery management, cacao planting technique and field design guide for new plantings. Cacao production increased for the demonstration plots as compared to the control plots. (SECID/Auburn PLUS Reports No. 48 and 50)

A Creole-language production booklet "*Annou Plante Kakao Byen*" which is a revised edition of a booklet by MEDA in 1985 was produced. Copies of this booklet were distributed to

cacao farmers and cooperatives by PADF and CARE as a training aid or a cacao production guide. (See also section on Marketing)

Coffee

Coffee plays an important role in the trade and monetary exchanges between developed and developing countries. Haiti depends to some degrees on coffee exports for foreign exchange to import capital and consumer goods. A consultancy was carried out to identify means to improve farm management practices and coffee processing technology to increase small-scale coffee farms productivity and to implement a marketing strategy for coffee cooperatives and producer associations. The report summarized the situation of coffee production on existing farms. The common denominator was the state of neglect of the farms, cultivated under poor management with trees that are very old, weak and prone to disease and low productivity. This situation has led many farmers to abandon coffee and switch to annual crops on the hillsides, which are becoming severely degraded. Recommendations are made to increase production and to help regain Haitian's coffee market share and raise the income in rural areas in the North (Dondon) and in the Southeast (Thiotte) regions. These included (a) the development of pilot areas through the application of a new technology package based on the production of *Typica*, which would allow the transfer of technology in these two major regions, (b) training of technicians to facilitate the transfer of technology to farmers, (c) the improvement of the existing processing technology while maintaining control at every stage of the process to ensure quality and (d) setting up adequate quality control mechanisms. This report also contains valuable information to those implementing coffee projects in Haiti, including management strategy and renovation for coffee production, processing and marketing. (SECID/Auburn PLUS Report No. 49. See also section on Marketing)

B. Agroforestry and Soil Conservation

Soil erosion and associated runoff is understood by most observers to be a major threat to the Haitian environment and agriculture. USAID's response to this concern has evolved over the years. During the 1960's and 1970's construction of rock walls was the primary means used to combat it. In the 1980's the use of tree hedgerows as a barrier to soil erosion began to take hold and gradually began to replace rock wall construction as the primary means for soil and water conservation on cropped land. Under PLUS, a number of soil practices were promoted for soil conservation, but tree hedgerows became a dominant practice in the areas covered by PADF. Also promoted by PADF were hedgerows of perennial crops, known as *bann manje* and first recommended by the team that conducted the Farmer Needs Assessment Survey. CARE chose in the early years of PLUS to de-emphasize soil and water conservation in open fields in Northwest Haiti, and what promotion of conservation practices did take place in open fields was focused on trash barriers or *ramp paille amelioré*.

The primary role of SECID in soil and water conservation was to conduct research on alley cropping, under the Agroforestry Adaptive Research Program. Other activities included case studies, consultancies on water harvesting and protection of irrigation systems, and economic analyses.

Agroforestry Adaptive Research Program

The Agroforestry Adaptive Research Program continued research trials begun in 1991 under AFII. The research studies were designed to address specific concerns expressed by PADF and CARE regarding hedgerow technology. These questions related to choices among soil conservation practices including hedgerows, choice of species under different soil and climatic conditions, questions about how to manage the hedgerows, and particularly the biomass harvested from the hedgerows. Farmers used the biomass from hedgerows primarily as fodder for livestock and questions of trade-offs between using the biomass as fodder or as soil amendment was and remains an issue of major importance. Three sets of trials were developed, one on hedgerow species, one on choice of conservation practices and one on hedgerow management. In support of this research, soils at all the research sites were described, classified and analyzed for major nutrient characteristics.

Support to the Agroforestry research program was discontinued by the USAID/Haiti Mission at the end of 1996, but the research was continued with support from the Soil Management CRSP. PLUS continued to provide logistical and administrative support through the SECID office. The results presented here synthesize findings of research from PLUS and the Soil Management CRSP Steeplands Project.

Soils at Research Sites

The research program was carried out in five locations in Haiti. All were very low in phosphorus, but differed in other characteristics. The soil at Bergeau (South region) and Pernier (East of Petion-Ville) are shallow soils over limestone parent material, with a pH of 8.0 in the upper horizon. These calcareous soils are characteristic of a large portion of soils at low elevation. The high pH and calcium in the profile make them poorly responsive to fertilizers, and likely to be deficient in micronutrients. On the other hand, the high organic matter content and cation exchange capacity make them more fertile without fertilizer than some other soils. At Titanyen, North of Port-au-Prince, a calcareous semi-arid site, the problem of nutrient imbalance is compounded by inadequate moisture.

The Saint Georges site (South region), is a shallow soil over basalt parent material, the second most common type of soil found at low elevation. The soils are low in native fertility, poor water holding capacity, and are prone to erosion and sloughing. The soil has a neutral pH and responds well to fertilization. In fertilizer trials conducted by the Soil Management CRSP, when phosphorus and potassium fertilizer were applied, maize yields were among the highest at this site.

At Fort Jacques, 1150 - 1200 m elevation, the red soil, formed over colluvium of limestone and shales, has a neutral pH, high cation exchange capacity and organic matter. It has good nutrient balance and is likely to respond well to phosphorus fertilizer and less likely to have micronutrient deficiencies. The soils at all of these sites had low available phosphorus. (SECID/Auburn PLUS Report No. 29).

Choice Among Soil Conservation Practices

Soil conservation practices are usually assessed primarily for their effects on reducing runoff and only secondarily for their effects on crop yield. It is widely assumed that the installation of soil conservation structures in farmers' fields will increase crop yields and that farmers should therefore be willing to invest in soil conservation practices because of the financial rewards from the ensuing higher yields. However, past experiences in Steeplands in some East African countries revealed that significant increases in crop yield were not frequently observed in trials of soil conservation measures (Herwig and Ludi, 1999). Hence, it was important to test the long-term impact of soil conservation practices on crop production before choosing among soil conservation practices.

Under the AOP and AF2 project over a period of three years SECID conducted a series of on-farm evaluation studies on PADF and CARE farmers to assess the impact of hedgerow on crop production and on soil conservation. Soil characteristics and farm practices (mixed cropping) on the hillside are highly variable, hence the variability of crop yields was extremely high. While the variability of on-farm data cannot be controlled, using carefully selected covariates that are quasi independent from one another (orthogonal), can account for it. Using sorghum as the indicator crop, and plugging four independent covariates to account for field variability due to soil fertility and farming practices, results from 24 farms in the South West, Central Plateau and Northwest provinces, 7 of which were control farmers without hedgerows, showed significant yield increase compared to the no hedgerow controls (Rosseau, 1995). Indeed, results adjusted for the presence of hedgerows, are showing that the average sorghum yields in farmers' fields where hedgerows are planted 8 meters apart is 361 kg/ha, while average yields in the control is only 214 kg/ha.

In order to have a better understanding of the benefits of agroforestry in Haiti, a study was begun in 1991 at Pernier, Haiti, to compare contour alley cropping with other soil conservation practices currently being promoted in Haiti. Treatments consisted of 1.) alley cropping with *Leucaena* hedgerows, 2.) barriers of *Panicum maximum* grass 3.) rock walls, 4.) contour canals, 5.) alley cropping with *Leucaena* and grass rows, 6.) alley cropping with moderate N-P-K fertilizer, 7.) control with no conservation practices. Since 1993, a local maize variety was planted twice yearly. Eight rows of maize were planted in the alley plots with *Leucaena* or grass (4 in each alley) and ten rows in the stone wall, contour canal and control plots, respectively. Hedgerows were pruned two to three times per season, grass as needed, and biomass was applied to the plots. Root pruning was performed yearly to eliminate penetration of roots laterally from alley cropped plots into plots without hedgerows.

Yields fluctuated greatly between seasons, largely due to seasonal differences in total rainfall and rainfall distribution. (Figure 1). Alley cropping with *Leucaena* hedgerows sustained yields over time while yields declined in control, contour canal, stone walls and grass rows treatments. In the first season, highest yields were recorded for the stone wall, the control treatment without conservation practices, and contour canal treatments. This was due in large part to the 20 % loss in cropping area in plots with vegetative barriers and probably to the competition from the trees. However, yields in these plots declined, whereas maize yields in the three alley cropping treatments containing *Leucaena* trees appeared to increase slightly over the first four seasons and remain stable through the remainder of the trial due to the beneficial effects of biomass applications to the soil. Combining the *Panicum* grass with *Leucaena* trees gave a slight advantage over trees alone in the first five cropping seasons, but there was no advantage in later seasons, due to the suppression of grass by the trees. The alley cropping treatment receiving a moderate rate of fertilizer yielded highest from the third season onward.

Different trends emerge when compared under good and bad seasons (Figure 2). In seasons where drought stress was most limiting, alley cropping with *Leucaena* gave yields equivalent to that of the control, whereas the other conservation practices gave yields inferior to the control. In seasons where rainfall was least limiting, alley cropping with *Leucaena* was clearly superior to rock, canal or grass barriers, as well as to the no-barrier control. Hence, at sites less drought prone than Pernier, even better results may be anticipated with alley cropping. Contour alley cropping with N fixing trees appeared to be the best option among soil conservation barriers in terms of crop yield.

Rock walls and contour canals gave higher yields than the control during good seasons, but poorer yields during droughty seasons. The poor performance of rock walls during drought may be attributed to loss of rooting area below rock walls due to tillage and water erosion. Poor results with contour canals is attributed to the exposure of maize roots to greater drying in rows adjacent to the canals.

Generally, maize yields with grass barriers were lower than with the no-barrier control, and were lower, on average, than with the other barrier treatments. The 20 % loss in area available to the maize crop explains much of this difference. Competition from this grass appeared to be low.

The lack of yield advantages from soil conservation structures during seasons when yields were low may help to explain why farmers do not readily adopt soil conservation practices without outside assistance. Application of a low amount of compound fertilizer in presence of fresh prunings of *Leucaena* gave greater yield increases than did soil conservation practices. Interventions that increase the economic value of output from protected fields may be needed to enhance adoption and economic sustainability. The economic feasibility of combining fertilization with hedgerow promotion need further research. The use of stone walls, contour canal, and grass rows as barriers may reduce erosion but, to provide maximum benefits to crops, should be combined with practices that enhance soil fertility.

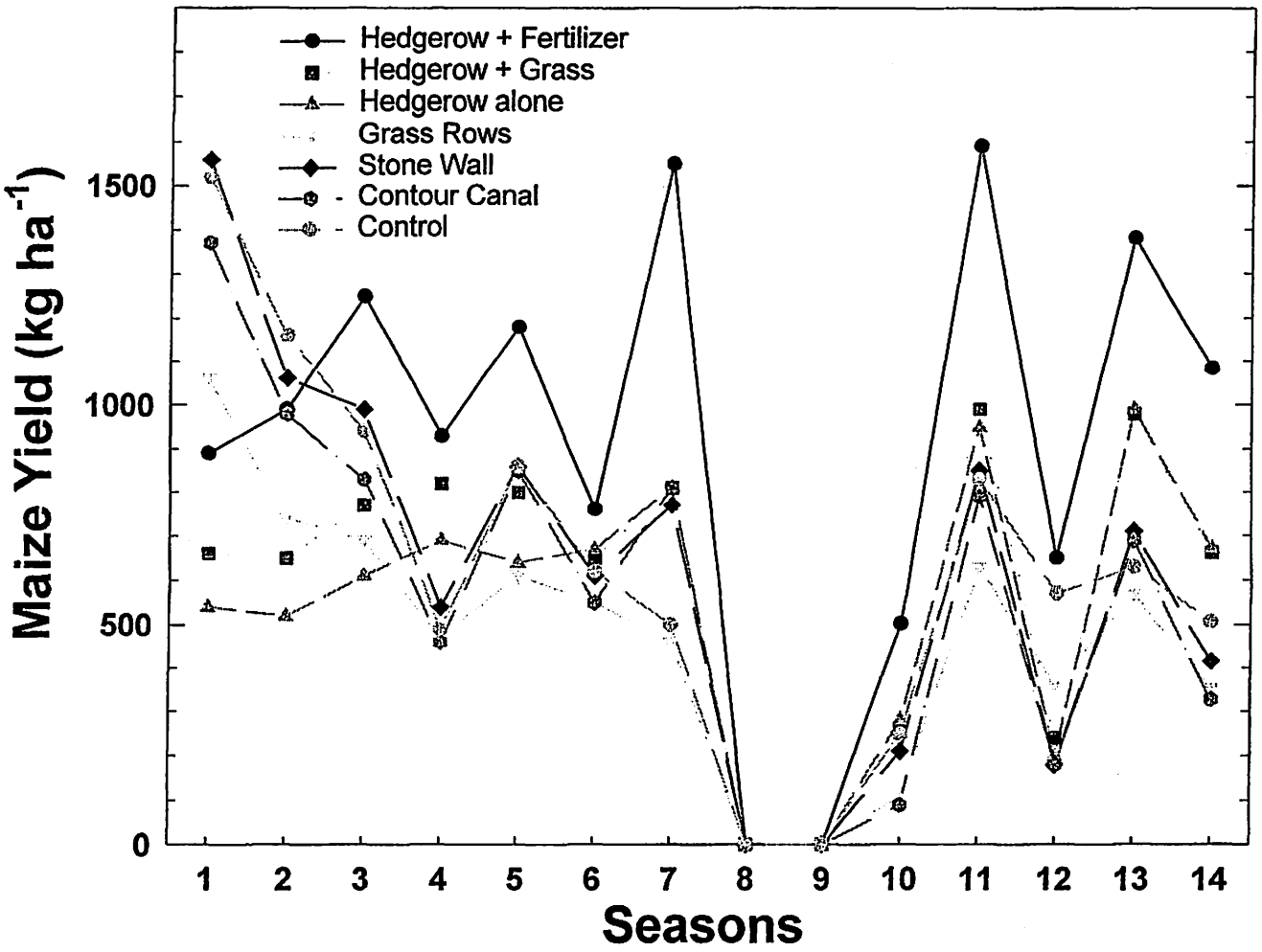

Figure 1. The effect of soil conservation practices on maize yield over 14 seasons. Pernier, Haiti. 1993 – 1999.

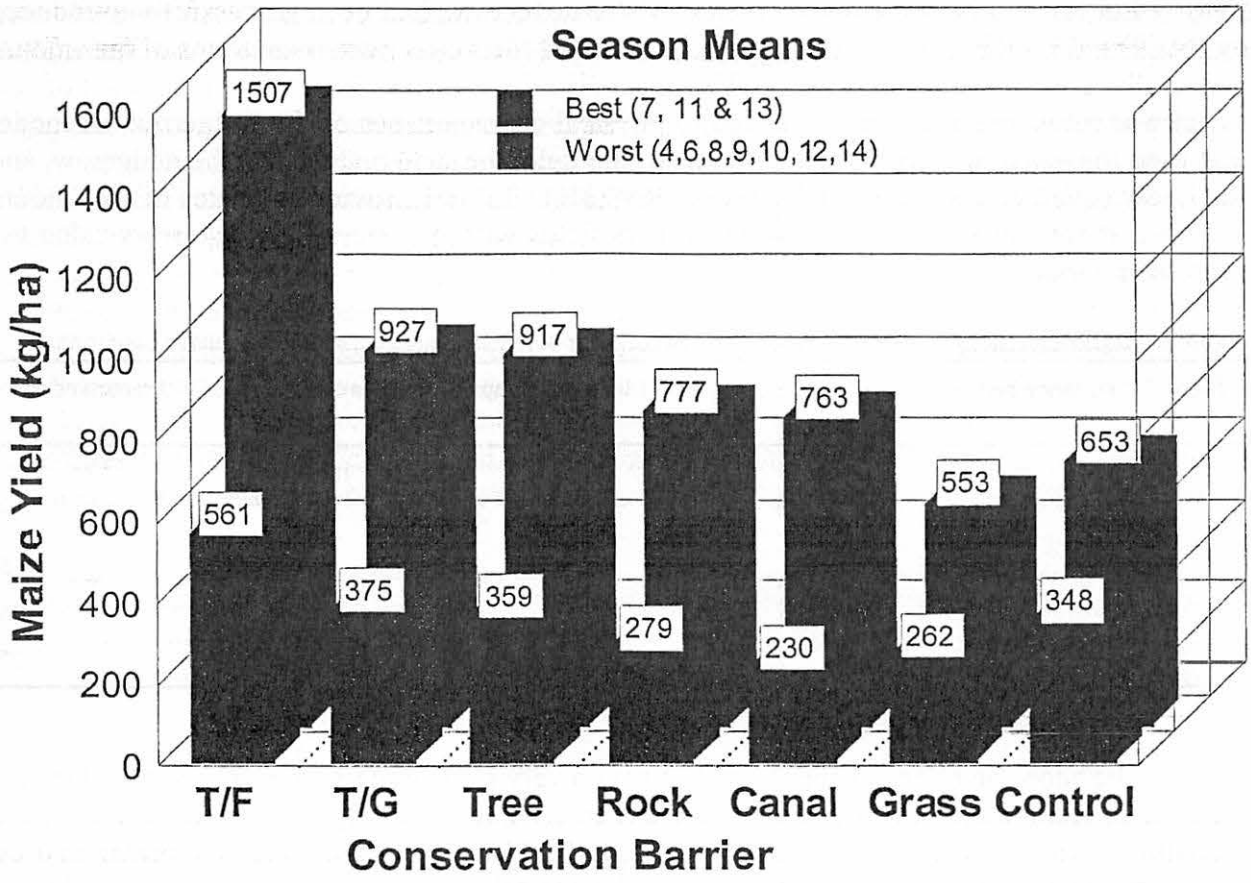

Figure 2. The long-term effects of soil conservation barriers on average maize yield during seasons with severe drought stress and seasons with most favorable rainfall pattern. (First three seasons have been eliminated from analysis. Seasons 8 and 9 had zero yield)
Legend: T/F=Leucaena and NPK fertilizer T/G= :eicaema amd grass rows (*P. Maximum*)

Preliminary measurements taken in September and October 2000 on soil erosion from the contour alley cropping, rock wall and control treatments show alley cropping and rock walls were both effective and reducing erosion in the plots. (SECID/Auburn PLUS Report No. 30; Interim and Annual Reports of the Soil Management CRSP Steeplands Project).

Adoption and Management of Soil Conservation Practices

Farmers have observed declining yields in their fields and are aware of the need to preserve the soil on the hillside. They are conscious of the devastating effect of erosion, not only depleting the yields in their field, but also the degradation of water quality in the catchment areas. The primary reason for introducing hedgerows is to save soil and slow the erosion on the hillside. There are some additional benefits that will be discussed later.

Under the AOP and AF2 projects, SECID dis an assessment of the impact of hedgerows on soil conservation. Using hedgerows in nine farmers fields, three in each of the South West, Central Plateau and North West provinces, where hedgerows had been successfully introduced by PADF and CARE, Rosseau (1989, 1995) evaluated their effectiveness in terms of the amount of soil that was saved on the hillside. Using simple trigonometry (Figure 1) the amount of soil saved was measured and then correlated to physical characteristics of the hedgerow. A model that used the age of the hedgerow, the slope of the field, the stem diameter of the hedgerow, and the linear coverage was successfully tested (R^2=72%). Table 1 provide estimates of the amount of soil that we can anticipate saving in farmers fields with 4½ years old hedgerows using the regression model.

Table 1. Illustrative sample of the anticipated soil savings for 4½ years hedgerows under specified conditions.

Slope	Distance between hedgerows	# of hedgerows per ha	Linear Coverage	Maximum hedgerow diameter	Amount of soil saved
%	m		%	mm	t/ha
35	5	20	40	67	570
35	6	16	40	67	456
50	5	20	40	44	348
50	6	16	40	44	279

The adoption of new technology is always a very slow process for resource poor farmers, such as in Haiti where hillside farmers are extremely poor and very much risk averse. In the decision making process at the farm level, risk acts as a friction to technology adoption. In order to determine potential adoption of recommendations related to cropping practices a hedgerow management, Rosseau (1995) used the stochastic dominance analysis. Using data from 24 farmers in the South West, the Central Plateau and the Northwest provinces, the study showed that through increased yields farm income increased dramatically (first degree stochastic dominance) and that their risk for lower income (second degree stochastic dominance) was greatly reduced by the adoption of the hedgerow technology. This gives the scientific and analytical basis to explain why farmers are adopting soil conservation practices and hedgerows in particular. In on-farm studies that are assessing several crop management alternatives, this tool provides researchers and field practitioners with tools to "sift" through a large number of practices and select those that are the most viable.

A survey with support of Soil Management CRSP Steeplands Project was conducted at Fort Jacques (near Kenscoff, west region) and in Les Cayes (south region) to identify factors likely to influence farmers' decision to adopt soil conservation practices such as contour hedgerows and rock walls. Farmer's income, sex, size of farms and previous training in soil conservation practices had significant impact on both the management and adoption of these techniques. Farmers who received training in soil conservation practices were 5 times more likely to adopt contour hedgerows in alley cropping. Membership in a local group increased a farmer's chance to adopt contour hedgerows in Les Cayes region while reduced adoption of rock

walls in Fort Jacques. It is also noted that probability of adoption of contour hedgerows increases when the farmer is female, while adoption of rock walls increases when the farmer is male. By considering the positive results with alley cropping under the PLUS Project, extension efforts need to focus on new strategies to pass on the alley cropping techniques to farmers.

Choice of Hedgerow Species

Having established that contour alley cropping provides the best choice among soil conservation barriers, questions arise as to how it can best be implemented. In this section, we address what species is most appropriate under different circumstances.

The most widely-used species for hedgerows in Haiti is *Leucaena leucocephala* (Lam.) de Wit. This species grows rapidly, fixes N and produces seed readily. However, due to varying environmental conditions existing in Haiti, a single tree species is not the best choice for all locations. In 1991, 35 tree and shrub species were tested for biomass yield in trials at four locations in Haiti, differing in elevation, soil conditions and rainfall. Fort Jacques was chosen for its high elevation (1150 m) and cooler temperatures. Leucaena growth at high elevations is less vigorous, where it is attacked by the psyllid insect, *Heteropsylla cubana*. The soil was a clayey-skeletal, kaolinitic, isohyperthermic Typic Hapludalf. Bergeau and St. Georges are low elevation sites selected because of their contrasting soil types. The soil at Bergeau is a Lithic Haprendoll over limestone (referred as calcareous soil) whereas the soil at Saint Georges is a Typic Hapludalf over basalt parent material (referred as basaltic soil). Growth of leucaena on basaltic sites was much poorer than on calcareous sites, raising the question as to whether some other species might fare better. Titanyen was selected as a semi-arid site. Its gravelly soil is called a Lithic Petrocalcic Calciustoll and it is also high in lime. Sixteen species were planted in hedgerows at high elevation (1150 m) and at low elevation basaltic soil, respectively, 20 at low elevation calcareous soil and 18 at the semi-arid site. Hedgerows were pruned 3 to 4 times a year at 50 cm height. Species were evaluated for seedling establishment, survival and biomass production.

Hedgerow Establishment

Although satisfactory stands and survival were obtained with most species, many of the small seeded species appeared to be unsuitable for direct seeding in the field, which limits their usefulness as hedgerows for alley cropping. Dry conditions and irregular rainfall pattern at the semi-arid site were not conducive to direct seeding of trees, which raises the issue of whether alley cropping has any relevance to the hot, dry coastal areas represented by Titanyen. However, information gained on adaptation and growth of tree species at this site are invaluable in the selection of tree species for windbreaks in this area. This report also provides useful information like names of suppliers, seed lot numbers and seed source should future projects wish to utilize seed of the same or similar provenance. (SECID/Auburn PLUS Report No. 6)

Biomass Production

Leaf and stem biomass production is an important criteria in assessing hedgerow species for alley cropping. An initial evaluation of the first year of pruning is reported in SECID/Auburn PLUS Report No. 15. Large differences in annual biomass production were recorded among the species across the sites. Three years following this publication, the trend in species performance changed with *Delonix regia* (Bojer ex Hook) yielding similar leaf biomass as *L. leucocephala* at the low elevation, calcareous soil. After five years, highest biomass was obtained with hedgerows of *L. leucocephala* at all lowland locations, regardless of rainfall and soil type (Table 1). At low elevation, calcareous soils, *L. leucocephala* var. K636, *Leucaena* hybrid var. KX3 and *D. regia* were the best productive species while *L. leucocephala* var. K636, *Leucaena* hybrid var. KX3, and *Gliricidia sepium* (Jacq.) Walp. were the best at the low elevation, basaltic soils (Table 2). At the high elevation site, *Acacia angustissima* (Mill.) Kuntze gave the highest biomass yield followed by *Leucaena* hybrid var KX3 and *L. diversifolia* var. K156. On average, the highest performing species yielded a total dry biomass of 13, 9 and 8.6 Mg ha^{-1} yr^{-1}, respectively, at the calcareous, basaltic and the high elevation site. These amounts of annual biomass were adequate to provide both N and organic materials in an alley cropping system. The low performance of *L. leucocephala* at high elevations was probably due to the presence of the psyllid insect on this species.

Assessing Hedgerow Species as Source of Nitrogen

Hedgerow prunings in alley cropping serve as a substitute for fertilizer nitrogen (N). Nitrogen is the nutrient element required in the greatest amount by plants. Amount and rate of N released are important criteria in selecting a hedgerow species for alley cropping. With help from SECID, the Soil Management CRSP studied decomposition and N release patterns from prunings of the five highest yielding hedgerow species at Bergeau (low elevation) and Fort Jacques (high elevation). Leaves harvested from 4-year old hedgerows were sealed in litter bags and placed on soil surface. The bags were removed at intervals and their contents analyzed for C and N concentration. The initial prunings were also analyzed for N and for compounds that slow decomposition. This provided a better idea of which species can be relied upon to provide timely release of N for the crop, as well as those that remain longer and contribute more to the organic matter buildup.

At both sites, leaf decomposition varied significantly among the species tested. At low elevation, leaf carbon (C) loss was highest (82 %) in *G. sepium* and lowest (42 %) in *D. regia* after 48 weeks. At the high elevation, C loss after 48 weeks was highest in *L. leucocephala* and in *A. angustissima*. Nitrogen release resembled C loss within each site. At the low elevation site, *G. sepium* and *L. leucocephala* released more than 50 kg N ha^{-1} during the first 4-6 weeks, whereas at the high elevation *A. angustissima* contributed to 40 kg N ha^{-1} during the same period (Figure 3). *L. leucocephala* and *A. angustissima* can be promoted as species for alley cropping at low and high elevations, respectively, to provide timely release of N for the associate crop. Because of the fast N release of leaf prunings of *G. sepium,* changes in hedgerow management may be necessary to prevent loss of the N before it can be taken up by the crop. *D. regia* is a

poor source of N, but may have potential for soil conservation and in areas where uncontrolled grazing prevents the successful use of leucaena (Isaac et al., 2000).

Effects of Hedgerow Species on Soil C and N

Five years after beginning the hedgerow species trials, we analyzed soils under the most productive hedgerow species and in plots without trees. Soils were collected at the surface (0-5 cm) and analyzed for C and N. At low elevation (calcareous site), cumulative application of *L. leucocephala* and *D. regia* prunings increased soil total N by 23 and 13 %, respectively, over the control soil without trees. No differences in soil N were found at the other sites but highest soil N was recorded under *Leucaena* KX3 hybrid (basaltic site) and *A. angustissima* (high elevation). Increases in soil C over the controls were observed for soils under *D. regia* (calcareous site) and *A. angustissima* (high elevation site).

In the laboratory, ground hedgerow prunings were mixed with soil and incubated to determine the effects of different pruning species on soil N and C mineralization. Nitrogen and C mineralization was highest in soils amended with leaves of *L. diversifolia* (low elevation sites) and *A. angustissima* (high elevation) and lowest in non-amended control soils. No differences in mineralization were found among treatment in soil amended with stem prunings. Greater mineralization of *L. diversifolia* and *A. angustissima* leaves suggests that more nutrients will be available to the companion crop during a cropping period.

Best Choices for Hedgerow Species

Acacia angustissima, an introduced tree species, may be promoted as the best hedgerow species for alley cropping in high elevations in Haiti. The *Leucaena* species, *L. leucocephala* and *Leucaena* hybrid KX3 provided greatest performance at low elevation sites. However, *D. regia*, a non-palatable species, may offer both a solution in areas where uncontrolled grazing by livestock is a major problem and as a means to reduce soil erosion. *D. regia*, is being used in On-farm comparison of non-palatable hedgerow species with *Leucaena* under the Soil Management CRSP Project. An alternate N source may be needed when cropping with this species.

Table 2. Summary of 5-year results for the best performing hedgerow species assessed for alley cropping and effects of their prunings on soil C and N. Agroforestry Adaptive Research.

Sites / Species	Survival	Total Dry Biomass	Leaf Biomass	Stem [1/] Biomass	Leaf N	Stem N	N [2/] Content	Soil Total N	Soil Organic C
Low Elevation - Calcareous Soil	%	$Mg\ ha^{-1}yr^{-1}$	$Mg\ ha^{-1}yr^{-1}$	$Mg\ ha^{-1}yr^{-1}$	$g\ kg^{-1}$	$g\ kg^{-1}$	$kg\ ha^{-1}yr^{-1}$	$g\ kg^{-1}$	$g\ kg^{-1}$
L. leucocephala var. K636	100	13.0	5.6	3.7	33.0	17.4	251.0	0.65	33.9
Leucaena hybrid var. KX3	94	12.4	5.5	3.1	32.2	18.0	233.0	0.58	31.3
Delonix regia	96	6.4	3.8	1.1	24.5	13.9	108.4	0.60	35.1
L. diversifolia var. K156	96	6.8	3.2	1.6	33.1	17.3	133.6	0.55	32.0
Gliricidia sepium	92	4.1	2.5	1.2	28.8	17.4	93.0	0.58	31.9
Control (Without hedgerows)	----	----	----	----	----	----	----	0.53	29.9
Low Elevation - Basaltic Soil									
L. leucocephala var. K636	96	9.0	3.3	2.7	23.5	15.3	119.0	0.25	16.2
Leucaena hybrid var. KX3	97	8.1	3.5	1.9	24.8	14.8	115.0	0.28	14.9
Gliricidia sepium	98	4.6	2.2	1.3	23.0	13.8	68.5	0.25	12.7
L. diversifolia var. K156	94	4.8	2.1	1.1	24.9	14.5	68.0	0.25	13.4
Delonix regia	69	1.6	0.9	0.4	22.1	14.7	26.0	0.23	12.1
Control (Without hedgerows)	----	----	----	----	----	----	----	0.25	12.3
High Elevation Site									
Acacia angustissima	96	8.6	5.2	2.1	41.2	15.1	246.0	0.55	30.1
Leucaena hybrid var. KX3	88	5.8	3.0	1.6	37.2	18.3	141.0	0.53	29.3
L. diversifolia var. K156	95	5.6	3.1	1.3	37.9	19.8	143.0	0.48	26.0
L. leucocephala var. K636	74	4.6	2.2	1.4	34.5	18.2	101.4	0.48	24.5
Flemingia macrophylla	96	2.9	1.9	1.0	30.9	14.6	73.0	0.48	24.3
Control (Without hedgerows)	----	----	----	----	----	----	----	0.48	22.1

[1/] Stem < 1 cm diameter; [2/] Sum of leaf + stems.

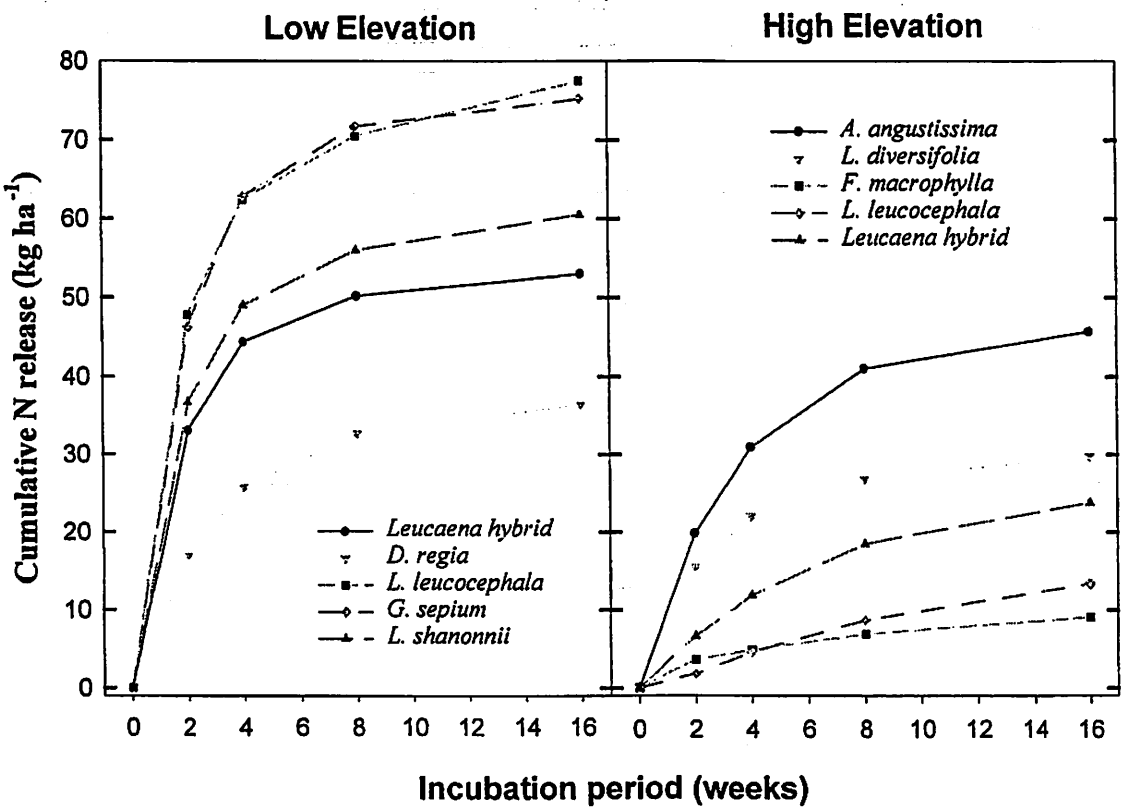

Figure 3. Cumulative N release from decomposing prunings of selected hedgerows species at low and high elevation sites.

Hedgerow Pruning Management

Management of hedgerows is key to success in alley cropping. Optimum management implies finding the right balance between production of N-rich biomass for the crop, and minimizing competition to the companion crop for light, nutrients and water. A trial was established in 1991 at Pernier, Haiti, testing combinations of *Leucaena* pruning utilization by pruning regimes. Treatments consisted of 3 *Pruning Uses* (removal, surface application and incorporation at maize planting followed by surface application) and 3 *Pruning Regimes* (at maize planting and 30 days after, DAP; at planting and 40 DAP; at planting, 30 and 60 DAP). A control treatment consisted of stone wall barriers in place of trees. Hedgerows were pruned at 50 cm height two to three times each season according to the treatment. Maize was planted twice a year beginning March 1993. Control plots were protected from penetration by *Leucaena* roots by annual root pruning.

Effects on Maize Grain and Hedgerow Biomass Yields

The first two-year evaluation of the effects of hedgerow pruning management on maize and biomass yields is reported in SECID/Auburn PLUS Report No. 27. During this period, maize yields declined over time in control plots but remained steady or slightly increased in best alley cropping treatments (Table 2). In the following seasons, effects of hedgerow management on maize yields were even more apparent. Application of *Leucaena* prunings increased maize yield over removal of prunings by at least 50 to more than 100 % depending on the season (Table 2 and Figure 4). The three pruning-regime nearly doubled the maize yield compared to pruning twice per season (Figure 4). When pruned twice per season with prunings applied to the soil, maize yields averaged higher when the second cut occurred at 30 rather than at 40 DAP. Highest yields for the control during the first two seasons was due in large part to a 20 % more plants. In the third season and from the fifth season onward, the combination of three prunings with prunings applied to the soil consistently gave higher yields than the control despite fewer rows of maize. The combination of three prunings per season with application of prunings to the soil resulted in relatively stable yields.

Hedgerow biomass production was higher when prunings were applied to the soil than when prunings were removed from the plots (Figure 4). Pruning twice, at planting and 40 DAP, gave consistently highest biomass yields whereas the three-pruning produced lowest biomass over seasons. There were no differences between prunings applied as mulch or incorporated at planting for both maize and hedgerow biomass yields over the seasons.

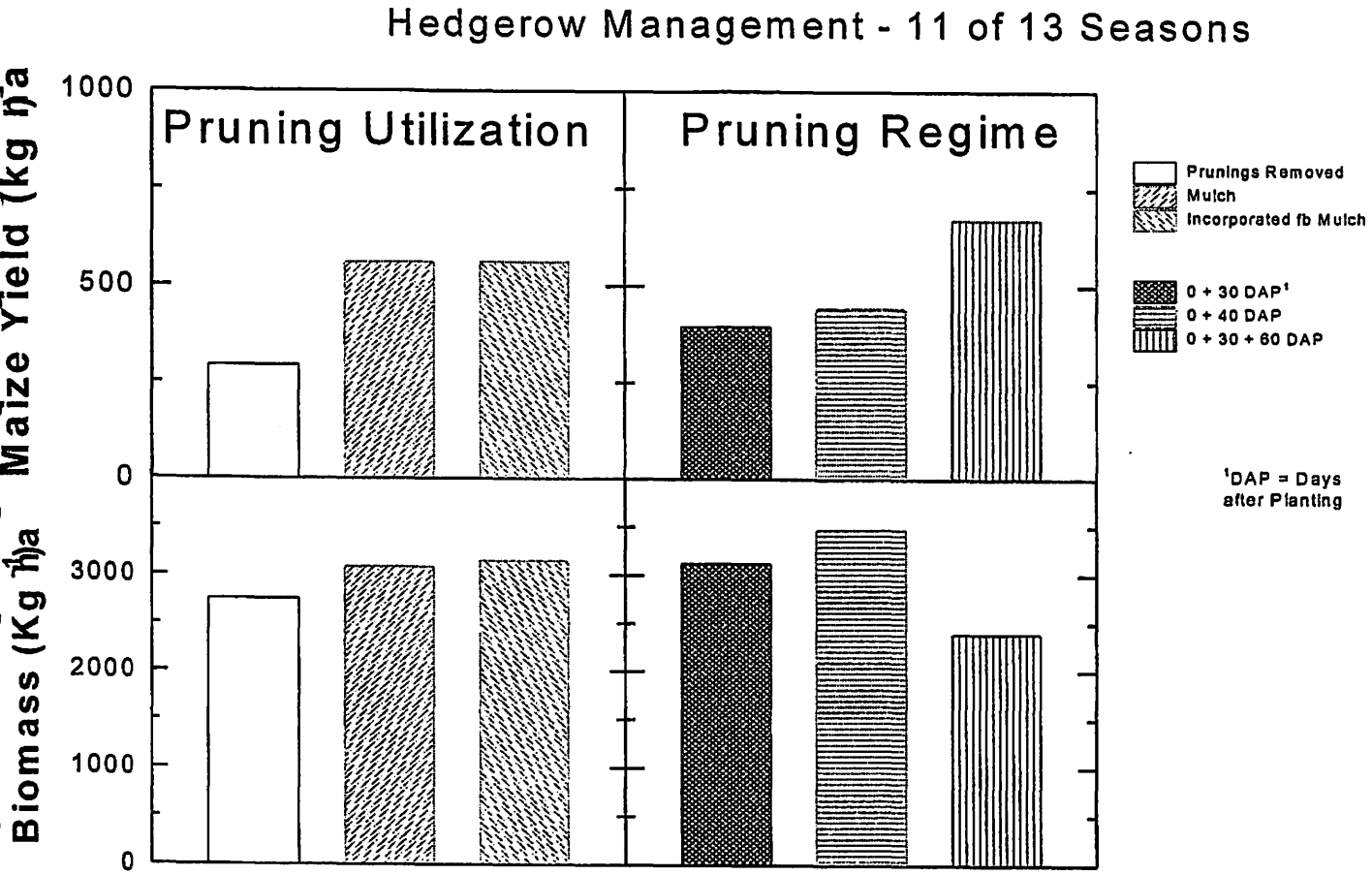

Figure 4. The effects of pruning use and timing of pruning application on maize and biomass yields. Pernier, Haiti. 1993-1999.

Effects on Soil Carbon and Nitrogen

Application of hedgerow biomass to the soil resulted in higher soil organic C and N and potential mineralization than in soils where prunings were removed and in the stone wall control. The use of low amount of compound fertilizer increased potential N mineralization but did not affect organic C and N significantly.

Effects on Nitrogen Recovery by Maize

Total N content in maize grain was greater when *Leucaena* prunings were applied to the soil than in the control treatment or where they were removed from alley plots. Incorporation of first prunings did not improve percent N-recovery as compared to surface applied prunings. The addition of low amount of inorganic fertilizer increased percent N recovered by the maize crop. Three-pruning regime had better % N-recovery than the two-cut regimes.

Summary of Hedgerow Management Research

These experiments illustrate the importance of applying hedgerow prunings to the soil and properly timed hedgerow pruning as a soil fertility improvement strategy under the Haitian conditions. The following conclusions may be drawn:

1. Application of hedgerow prunings to the soil sustains maize yields under continuous cropping.
2. Use of stone walls as a barrier to erosion is of itself inadequate to maintain crop yields over time,
3. Removal of hedgerow prunings to feed livestock can result in declining yields over time without other means of replenishing nutrients and organic matter in the soil.
4. Pruning three times per season, rather than twice, results in increased maize yields.

Consultancies in Support of Soil and Water Conservation

Water Harvesting in Small Scale Irrigation

The Northwest Region of Haiti, served by CARE, is an area that is prone to serious drought. A specialist in hydrology and water harvesting visited Northwest Haiti to study opportunities for water harvesting systems development in the Northwest Region of Haiti for the vegetal gardens, livestock watering and other agricultural purposes. A bio-intensive garden (BIG) project, promoted by CARE, would be able to produce good quality marketable vegetable if irrigation water was available. Water harvesting systems have the potential to provide water for irrigation, and other beneficial uses, reduce runoff and recharge aquifers in the region. A roof catchment system was proposed for the Northwest Region. In Bombardopolis and Passe Catabois regions, large-scale community-based water harvesting systems could be developed should pond sites be available. Any large-scale irrigation schemes in the area should be considered only after conservation measures show evidence of reduction of hillside erosion

sediment loads in the streams. Good maintenance of water harvesting systems is of utmost importance as well as design and construction of the systems.

Soil conservation and erosion control can be achieved by practices that reduce the erosive forces of runoff. Recommendations were made to improve performance and outcome of the BIG in the northwest region. These included field water harvesting systems with ponds, roof catchment systems and training in small scale irrigation for project participants. Rock walls and hedgerows were recommended for shallow ravines and check dams for gullies. The report contains drawings showing how various practices can be implemented. (SECID/Auburn PLUS Report No. 19)

Irrigation Systems And Watershed Management

This consultancy aimed to determine what was needed to rehabilitate the irrigation system located at Marigot damaged by flooding from Hurricane Georges and to protect it from damage from future storms. The site of a second irrigation system at Jacmel was also visited. Recommendations are made to restore the Marigot system and to prevent it from an irreversible damage. These included: a) relocate the intake for the Rodaille system upstream, b) build a new upper canal section to connect up the existing primary canal, c) install conservation structures to protect the primary canal from further erosion of the east bank of the river, d) divert the stream channel westward within the riverbed, e) clean the enclosed conduit and the canal between the syphon and the conduit, f) relocate the Belle Roche intake and the main canal and g) implement programs for irrigation system maintenance and water use management.

The extent of the damage as evidenced by deposition of large rocks and sediment loads on farmland and widening of streambeds at Marigot can be attributed in large part to erosion and runoff from the upper watershed. This suggested the needs for soil and water conservation in the upper part of the watershed to reduce soil erosion and flooding hazard with the loss of cropland and sections of primary canal. Degradation in the upper portion of the landscape is so extensive that a major effort is required in order to have significant impact in the lower part of the watershed. Among the conservation practices to be recommended to protect the upper part of the watershed are ravine stabilization, use of tree and grass plantings on contour, contour hedgerows, rock walls, alley cropping and improved soil fertility management.

Alley cropping with leguminous trees that supply N to the crop as well as hold the soil is a promising option, but research is needed to determine the appropriate species and management practices for this high elevation. Prior research conducted at mid elevations by PLUS at Fort Jacques and by the Soil Management CRSP at Salagnac point to *Acacia angustissima* as the species with most potential. Improvement of soil fertility through agroforestry and increased use of legume trees might stabilize production on the better agricultural sites and encourage farmers to better protect their soil resource. While technical solutions are apparent, these cannot be effective over the long term without addressing the underlying social, economic and political realities affecting the farmers of the upper watershed. Much of the upper watershed affecting the irrigation system at Marigot falls within the "buffer zone" of Parc La Visite. The USAID mission in Haiti could look for ways to enhance the effectiveness of the World Bank-sponsored

Technical Assistance for Protection of Parks and Forests Project (ATPPF), particularly in the area of soil and water conservation around Parc La Visite. (SECID/Auburn PLUS Report No. 47)

C. Tree Germplasm Improvement (1993 - 1995)

The over-exploitation of native forests and conversion of forests to agricultural lands has resulted in not only soil erosion, but also erosion of the genetic base of indigenous tree species. The Tree Germplasm Improvement Program had the dual objectives of conserving and enlarging the genetic base of important indigenous and exotic tree species, while increasing the productivity of trees planted by Haitian farmers for lumber and fuel. Selection of high yielding genotypes of tree species provides farmers with more wood in a shorter time, thus increasing the revenue of farmers. The Tree Germplasm Improvement Program continued tree germplasm conservation and improvement begun under PLUS predecessor projects, the Agroforestry Outreach Project (AOP) and the Agroforestry II (AF II) Project. This program supported CARE and PADF tree planting activities through conservation and genetic improvement of native and exotic tree species. Conserving improved locally adapted tree varieties is fundamental to sound natural resource management and critical to the future of a severely deforested landscape. Also, genetic improvement of economically important trees is uncommon in many developing countries, thus potential benefits of this project reach far beyond the bounds of Haiti.

The Tree Germplasm Improvement Program consisted in selecting mother trees of native species to establish progeny lines and in assessing provenances of exotic species. These progeny lines or provenances were planted in trials and also in seed orchards at different locations in Haiti. Growth measurements in trials were used to determine which progeny lines or provenances should be retained for seed production and distribution to farmers. Activities carried out under PLUS project began with an evaluation of the status of seed orchards and progeny/provenance trials established under the AOP and the subsequent AF II projects. This review provided the background information for activities to be implemented and to allow PLUS project to pass on the benefits of improved germplasm to Haitian farmers. Prior to PLUS, 660 superior trees representing 40 species were selected throughout Haiti. Sixteen species were established in 54 orchards. Fifty-two progeny and provenance trials were established for 28 species. In addition, arboreta were established in different sites, bringing the total number of tree species to close to 100.

In 1992, at the start of the PLUS Project, orchards and progeny/provenance trials were categorized according to the tree growth and development and the site conditions. Thirty-eight (approximately 70 % of those established during 1988-1991) progeny/provenance trials were recommended for continued measurements to enable PLUS to evaluate the genetic worth of economically important tree species and forty-six (80 % of those established during 1988-1991) orchards were recommended for continued supervision by SECID. The report (SECID/Auburn PLUS Report No. 1) also emphasized the need to establish a seed production system to ensure that seed of superior trees is made available to agricultural development projects and individual farmers.

Following is a list of tree species retained for research under PLUS:

- *Cedrela odorata*
- *Cordia alliodora*
- *Enterolobium cyclocarpum*
- *Senna siamea (Cassia siamea)*
- *Casuarina* spp.
- *Gliricidia sepium*
- *Pinus* spp.
- *Catalpa longissima*
- *Swietenia* spp.
- *Azadirachta indica*
- *Simauruba* spp.
- *Acacia auriculiformis*
- *Grevillea robusta*
- *Lysiloma sabicu*
- *Leucaena leucocephala*

Because of the early termination of the tree improvement program, it was not possible to analyze and report results for all of the species tested, nor was information on the arboreta published.

Genotype Assessment by Species

In light of the long growing cycle for trees, it was determined that a preliminary assessment of progeny and provenances contained in the trials could only be achieved after 5 years. The following reports were 5-year assessments, with the exception of *Gliricidia sepium.*

Cedrela odorata

Cedrela odorata is highly valued in Haiti for its lumber. Continuous exploitation of this species has resulted in severely reduced populations and possible genetic deterioration, including inbreeding depression. With the rapid loss of habitat conducive for natural regeneration and growth of *C. odorata* in Haiti, it was determined that a larger genetic base of *C. odorata* was needed to ensure the broad adaptability needed for a successful reforestation program. Ten provenances of *C. odorata* from Central America and two provenances from Haiti were tested to evaluate differences in survival and growth rates across five sites in Haiti. Five years after trial establishment, differences among provenances were observed for survival, height and stem diameter parameters, indicating that significant improvement for the species is possible in Haiti. The Haitian genotypes appear to be more site-sensitive and less broadly adapted than several of the Central American provenances. Evidence from other sites show that the Haitian provenances can perform as well as the best Central American provenances, but only under particular site conditions. PADF and CARE field records support the poor performance of *C. odorata* propagated from local sources.

A summary of the best performing provenances is presented in Table 4. The provenances from Honduras, 6888 and 52/79, exhibited survival and growth rates superior to the other provenances of Central America. The family accession from Haiti exhibited poor survival and

grew below average on the sites tested. Merchantable wood volume was greatest for the provenances from Honduras (6888 and 52/79), Nicaragua (14/75, 36/78) and Belize (23/77). Provenances from Honduras, Belize and Nicaragua were more broadly adapted than Haitian genotypes. These provenances are recommended as a seed source to increase the survival and growth performance of one of Haiti's most valued tree species.

Changing site conditions and the genetic deterioration of local populations indicate the need to shift to more hardy genotypes from Central America. However, in order to conserve the local provenances, regions where the species is still being harvested should be targeted for range-wide seed collections and reforestation with native genotypes. The propagation and spread of superior genotypes, both native and imported, should be implemented through vegetative propagation and use of seeds. Extension efforts should focus on multiplying superior genotypes through serious-minded farmers with a vested interest in *C. odorata* lumber and value-added wood products as a livelihood. (SECID/Auburn PLUS Report No. 31)

Cordia alliodora

This species known in Haiti as "*Bwa Soumi*" is widely used in Central America as a shade tree for coffee. It is found in Haiti as an occasional species, notably in the southern peninsula, becoming more abundant toward the southwest from Port-Salut to Tiburon.

Five provenances of *C. alliodora* from Central America were evaluated in the southern region of Haiti to broaden the genetic base of the species used in Haitian agroforestry systems. Differences in survival rates were observed among provenances across sites, though the provenance effect is weak. The site with the highest survival was Roche Blanche with 77.2 %. The highest survival of any provenance and site was 92.3 % for 7488 from Cofradia, Honduras, established at Berault. Across sites, the best survivors were 4140 and 7488 from Costa Rica and Honduras, respectively. Those two provenances maintained their superiority in terms of height and diameter growth across sites. Maximum height was 10.5 m for 7488 and the largest diameter was 10.8 cm for 4140 after 5 years. The mean annual increments of 2 m in height and 2 cm in diameter were an excellent growth rate for a wood species of high quality. Differences in merchantable wood volume were also observed; provenances with the fastest growth yielded the highest wood volume.

These results revealed the adaptability of the provenances to climatic and soil conditions of low elevations in Haiti. However, additional testing is needed on a wider range of sites, particularly in the major coffee producing zones of Haiti's mountains. Pilot plantations should also be established with the superior provenances to test optimum sylvicultural practices and to

Table 3. Summary of 5-year results of effects of hedgerow pruning management on maize and hedgerow biomass yields. Agroforestry Adaptive Research.

Treatment Factors	Annual [1] Dry Biomass	N [2] Content	Maize Yields / Cropping Seasons [3]							
			1 93 - A	2 93 - B	3 94 - A	4 94 - B	5 95 - A	6 95 - B	7 96 - A	10 97 - B
	Mg ha^{-1}	kg ha^{-1}	--------	kg ha^{-1}	--------	kg ha^{-1}	--------	kg ha^{-1}	--------	kg ha^{-1}
Pruning Utilization										
Removed	5.94	168	610	570	520	430	370	240	270	168
Mulch	6.25	195	870	690	790	850	610	630	770	428
Incorporated / Mulch [4]	6.36	208	860	740	830	820	670	530	690	388
Pruning Regime										
Planting + 30 DAP [5]	6.06	185	680	540	600	620	430	480	410	318
Planting + 40 DAP	7.00	196	600	650	600	600	500	330	440	293
Planting + 30 + 60 DAP	5.40	188	1050	800	940	890	720	580	880	365
Best Alley cropping Treatments vs Control (Stone walls)										
3 Prunings / Mulch	----	----	1.2e+11	870	1.2e+11	1080	740	7.6e+08	1160	3.1e+08
3 Prunings / Incorp. - Mulch	----	----		870		1020	890		1040	
Control (Stone walls)	----	----		1130		930	1090		730	

[1] Mean dry weight (leaf + small stem) biomass - Data are means of 5 years; [2] Mean annual (leaves + small stems) - Data calculated with a mean N concentration over 4 cropping seasons; [3] Cropping seasons / year (A = 1st rainy season, March - July; B = 2nd rainy season, August - December); [4] Prunings incorporated at planting and used as mulch after; [5] Days after planting.

evaluate the species under Haitian growing conditions and economic constraints. (SECID/Auburn PLUS Report No. 33)

Enterolobium cyclocarpum

Enterolobium cyclocarpum, a large, spreading tree from Central America, was introduced to Haiti for its adaptability to a wide range of site conditions and its potential to provide goods and services to Haitian farmers. Effects of four provenances from Central America and a commercial seed lot from COHDEFOR on survival and growth rates and on biomass production were studied at two sites in Haiti with varying climatic and soil conditions. One site (Cayes Plain) was characterized by moist conditions and deep alluvial soils whereas the other site was in the Central Plateau with much drier conditions and shallow soils overlaying calcareous tuff.

No statistical differences in survival among provenances were observed at either site. Differences in height growth were significant at the Cayes Plain, with an average height of 8.5 m after five years. Highest stem diameter and wood yield were recorded for the provenance 792 from Costa Rica and 1667 from Honduras averaging stem diameter increments of 3.0 cm yr^{-1} and an annual wood production of 8 kg $tree^{-1}$ at the Cayes Plain (Table 4). The slower growing provenances, 1371 (Nicaragua) and 2464 (Costa Rica), averaged stem diameter increments of 2.3 cm yr^{-1} and an annual wood production of 8 kg $tree^{-1}$.

The two provenances, 792 and 1667, are recommended in regions of Haiti where *E. cyclocarpum* is most likely to have an impact as shade and fodder tree. It was also recommended that trials be converted to an improved in-country seed source of *E. cyclocarpum* by eliminating the inferior provenances. Similar trials need to be established on a wider range of sites with a larger genetic base. Pilot plantations can also be established to test appropriate sylvicultural practices and to evaluate economic constraints to growing the species. (SECID/Auburn PLUS Report No. 34)

Senna siamea

Senna siamea (syn. *Cassia siamea*), the most widely planted tree in Haiti, is primarily used as a source of wood for charcoal and construction wood combined with shade and beauty. During the period 1981-1991, approximately 12 million *S. siamea* trees were distributed under the USAID-funded Agroforestry Outreach and Agroforestry II projects. The objectives of *S. siamea* trials were (a) to broaden and improve the genetic base of *S. siamea* in Haiti and (b) to identify provenances of *S. siamea* that exhibit broad adaptability in Haiti in terms of survival, height growth and wood productivity. Trials were established to compare locally selected *S. siamea* genotypes with seed originating from Central American and African sources. This report summarizes the performance of the earliest trials established in 1989 at five sites in Haiti.

Sites conditions had a far greater impact than seed source for *S. siamea* in terms of survival, wood yield and harvest value. The species did not perform well on semi-arid, alkaline sites or sites with extremely shallow and rocky soils. The highest growth rates were exhibited at Roche Blanche, (deep, valley bottom soils) averaging 11 m for all accessions after 5 years, over

2m yr^{-1}. The Haitian sources, represented by PADF bulked seed lots 1511 and 1501, showed greater diameter growth and wood yields than imported seed sources of *S. siamea* after five years at three sites (Table 3).

It is encouraging that Haitian seed sources were the top wood producers at three sites and at least performed adequately when not occupying the top rank. Locally adapted seed sources should be considered prior to purchasing and importing seed from other countries. However, seed from the native range of the species (SE Asia) should be introduced to broaden and invigorate the local genetic base, in particular resistance to diseases such as the widespread problem of leaf spot caused by *Cercospora*. It was recommended that the *S. siamea* trials be converted to in-country seed sources and research be continued to determine appropriate sylvicultural practices of this species for the major agroforestry models in Haiti. (SECID/Auburn PLUS Report No. 35)

Casuarina spp.

Casuarina equisetifolia is the most common and widespread species of the genus *Casuarina* in Haiti. It was introduced throughout Haiti in reforestation programs, in part because of its adaptation to a wide range of site conditions. This species is a valued source of wood for charcoal and beams for house construction. A study was conducted (a) to test the adaptability of different species of *Casuarina* at the Central Plateau in terms of survival rates, growth and wood production and (b) to broaden and to improve the genetic base of *Casuarina* in Haiti.

After five years, survival rates were significantly higher for *C. cristata* (88.5 %) and *C. equisetifolia* spp. *equisetifolia* (87.5 %) than for *C. equisetifolia* spp. *incana* with 64.6 %. The same two species grew faster and produced larger wood yield than the subspecies *C. equisetifolia* spp. *incana* after 5 years. The subspecies *equisetifolia* achieved the best average height (7.5 m) corresponding to an annual increment of 1.5 m.

This trial revealed that the subspecies *incana* is not a viable alternative to the more common subspecies *equisetifolia* in Haiti. However, the variability of *C. cristata* yields in the experiment support the conclusions that this species should be selected with caution because of its greater site sensitivity. (SECID/Auburn PLUS Report No. 36)

Pinus spp.

Pinus occidentalis is the only pine species native to Haiti. Past and current use of this species is primarily for lumber and kindling used in the urban areas for lighting charcoal stoves. However, the most serious threat to the species is the conversion of the fragile forest ecosystem to agriculture as a result of cultivating beans and vegetables for the urban market. Planting pine trees is one of many solutions to the deforestation in high-elevations in Haiti. In addition, the increasing needs of peasants merit the testing of improved pine provenances that can offer greater value and be more efficiently managed in the current agroforestry systems of high elevation mountains.

This trial was conducted to assess different species and provenances of *Pinus* for growth and wood production in areas near Kenscoff, Haiti. Twenty-nine seed lots, comprising twelve species of pine, were evaluated in a species/provenance trial at Viard (1500 m), near Kenscoff. After 5 years, no statistical differences among seed lots were reported for survival, height and stem diameter, but differences in merchantable wood volume were obtained after seven years. Seedlots of several pine species, notably *P. patula*, *P. oocarpa*, and *P. tecunumanii*, gave superior yields of merchantable wood volume compared to the local *P. occidentalis*. *P. patula* gave three times the volume as the local control. Poorest performers were *P. caribea caribea*, *P. elliotii*, and the *P. occidentalis* provenance from Cuba.

Height growth rate is a good indicator of vigor and site adaptability. The accession *P. oocarpa* 15319 from Zimbabwe was the top performer, averaging 5.9 m over five years, whereas the control *P. occidentalis* grew an average of 4.2 m and the mean height for the site was 3.8 m. The largest stem diameters at 1.3 m (DBH) after five years were recorded for *P. taeda* 496 (9.1 cm) and *P. oocarpa* 15319 (8.8 cm).

Considering the importance of pine trees to high elevation areas of Haiti, the trial has generated a valuable source of information, including the worth of testing alternative pine germplasm to increase productivity and economic value for farmers. It is recommended to establish seedlots and provenances of *P. patula* (15275), *P. oocarpa* (15319) and *P. tecunumanii* (7/77) due to their greatest potential of making an economic impact among farmers. However, long-term research is needed to better assess the potential of these tree species and provenances considering pest and disease resistance, wood quality, natural regeneration and hybridization characteristics. (SECID/ Auburn PLUS Report No. 37)

Gliricidia sepium

Gliricidia sepium is an economically important species in Central America where it is native. It is a nitrogen-fixing tree species easy to establish by stem cuttings, making it a valuable live fence species. Recent studies at Auburn show that *G. sepium* leaf mulch is a high quality N source, releasing its N at a faster rate than leucaena (Isaac et al., 2000). Grown as tree, it serves as shade for perennial crops and is easily lopped as a source of fuelwood. This study aimed at assessing provenances of *G. sepium* as hedgerows for alley cropping and for growth and wood production when established as seed orchards.

In 1988, twenty-three provenances of *G. sepium* from Oxford Forestry Institute collection were introduced and established in alley cropping trials at Bombardopolis and Bab Panyol in northwestern Haiti. The 100 most productive individuals at the Bab Panyol trial were vegetatively propagated and established in a seed orchard in the Central Plateau at Lapila. This report summarizes the 5-year results of *G. sepium* provenances testing at these sites.

Variations among *G. sepium* provenances in terms of dry biomass production managed in alley cropping were evident early during the evaluation period. The 62/87 hybrid, a composite of four Costa Rican provenances developed at IITA, Ibadan, Nigeria, was the most stable top biomass performer. The hybrid outyielded the site means by 36 % and 48 % and exceeded the

yields of the least productive provenances by 2 and 3.5 times at Bab Panyol and Bombardopolis, respectively. Other promising provenances were Laguna Tecomapa (13/82), Masaguara (25/84), Esteli (30/84) and Retalhuleu (60/87). Certain provenances were consistently poor performers at the 3 sites. It was also observed that several provenances exhibited good performance at one site while performing poorly at the other. It is important to point out that the variety distributed in the past by PADF turned out to be among the lowest yielding. This confirms the importance of provenance testing in any program to distribute seed to farmers.

The performance of the provenances at Lapila was similar in most case to the trends established in the alley-cropping trials. The wide variability among the *G. sepium* provenances and the relative stability of many of the most productive provenances indicates that significant improvements in the species can be achieved in Haiti. Those provenances that exhibit broad adaptability were recommended for multiplication in the PLUS extension program to increase the genetic base of a species that has been recently introduced to Haiti as a living fence and shade species. Efforts to multiply a larger genetic base, such as distributing seed from Lapila seed orchard, should be promoted to allow the greatest selection opportunity in regions of Haiti with varying environmental conditions. The report also provides recommendations to maintain the genetic gains and maximize the potential of the species in Haiti. (SECID/Auburn PLUS Report No. 38)

Neem (Azadirachta indica)

Neem (*Azadirachta indica* Adr. Juss) is a species that is attracting scientific and commercial interest around the world because of its content of the chemical azadirachtin, which is a natural insecticide and which also has fungicidal, anti-bacterial and anti-viral properties. This species, native to India, was introduced in Haiti in the 1960s, where it is planted for its hardiness and multiple purposes of shade, medicinal uses, wood, aesthetics and pest control. Efforts to enlarge the genetic base in Haiti have been unsuccessful due in part to seed germination problems, poor seed yield of imported provenances and project discontinuities.

A neem trial was established in October 1991 at Roche Blanche to examine the genetic base of *A. indica* for differences in survival, growth characteristics and azadirachtin production. The original objective was to examine differences in azadirachtin production of 14 seed sources originating in Africa and the Caribbean. It is unique because: a) it was the first trial in Haiti designed to optimize the production of neem fruit rather than wood, b) it was the only trial designed to study the genetic variation of neem, and c) it was the first time that neem was introduced and propagated vegetatively (by stumps) in Haiti.

This trial showed a remarkable uniformity among neem seed sources for survival, height and diameter growth and wood yields. There were no statistical differences in percent survival detected among seed sources after five years. Height growth followed the same pattern among seed sources with a site mean of 9.1 m after five years. The mean DBH of the site was 12.1 cm after five years, ranging from 10.9-13.1 cm among seed sources. Statistical differences were detected between the top four seed sources and the bottom one for basal or stump diameter. Wood yield averaged 34.1 kg tree^{-1} at the site, slightly less than the average of the control (34.7

kg tree^{-1}). Provenance means ranged from 28.1 kg tree^{-1} for the lot No. 2 from Puerto Rico to 40.8 kg tree^{-1} for the lot No. 10 from Burkina Faso.

Resource constraints did not allow the testing of azadirachtin yield in these trials before the Tree Improvement Program was terminated. Preliminary chemical analyses conducted by a commercial producer indicated the high quality of the seed (low hull content) and possible differences in azadirachtin content. However, these differences were not confirmed by systematic testing. The trial may still be utilize to make these determinations, provided that funding is available to carry out the analyses. The report contains recommendations for completing the work and for future research to increase the potential economic impact of the species to Haitian farmers. (SECID/Auburn PLUS Report No. 39)

Mahogany (Swietenia)

Swietenia mahogany, locally known as "*kajou*", is used in Haiti as a source of wood for souvenirs, turnery, and cabinetry, but also as an important medicinal plant and shade. *Swietenia macrophylla*, also occurring to a limited extent in Haiti, is known as "*kajou etranje*" to distinguish it from the local species. A review of both species is provided in "*Bwa Yo – Important Trees in Haiti*" by Timyan (1996).

Uncontrolled harvesting of the popular *S. mahogany* inevitably leads to genetic erosion resulting from the selective harvesting of most marketable individuals. Progeny of superior trees of *S. mahogany* and *S. macrophylla* were established in 2 seed orchards and 4 arboreta in Haiti between 1990-1991 and measured for survival, height and stem diameter parameters. Three seed lots of the *S. mahogany* x *S. macrophylla* hybrid imported from Puerto Rico and Saint Croix were also established to compare their survival and growth with selected progeny of the parent species. Provenances of *S. macrophylla* and *S. humilis* were introduced from Costa Rica and compared for survival and growth at 2 sites in the southwestern part of Haiti.

Survival and height were higher at Berault than at Labordette. Differences in soil depth and moisture largely accounted for faster growth at Berault. Though not statistically different, *S. humilis* showed a higher survival rate than *S. macrophylla* at both sites. The *S. mahogany* x *S. macrophylla* hybrid exhibited higher survival than either parent species at the Roche Blanche and Marmont seed orchards, but ranked the lowest at the Marmont arboretum. *S. mahogany* survived better than *S. macrophylla* at four of five trials. The *S. mahogany* x *S. macrophylla* hybrid showed no statistical differences from the families of either parent species at the Roche Blanche orchard. Significant differences in height growth between *S. mahogany* and *S. macrophylla* were observed at Fauche, the wettest site, throughout the period of 5 years. Trials established on much drier sites showed no differences between the two species but differences were detected between certain families of each species at Marmont and Paillant. In terms of diameter growth, differences were shown among *S. macrophylla* and *S. humilis* provenances, but not among species. On average, the Berault site produced 3 times the volume of lumber quality wood as Labordette.

These trials show that significant improvement and merchantable wood can be achieved through proper selection of the best adapted genotypes. Much needs to be done to protect Haiti's rich heritage of mahogany, and to restore the population of this valuable lumber source by making seed of selected genotypes available to farmers and land owners. Improvement in mahogany genotypes coupled with an increased efficiency in tree management at the farm level should result in enhanced economic opportunities that benefit both the farmer and his environment. Recommendations on managing *Swietenia* genetic resources in Haiti are included in SECID/Auburn PLUS Report No. 40.

Haitian oak (Catalpa longissima)

This oak is one of the most popular and expensive woods in Haiti. It is used for cabinetry, boat and house construction, and sculptures. The tree is managed by farmers in the rich alluvial plains and ravines, associated with food crops of plantain, fruit trees, sweet potatoes and beans. Because of its economic importance as a tree species and its demand by a large number of farmers, a total of 127 superior trees were selected under AOP for desirable characteristics such as stem form, size and wood merchantable volume. The progeny of 52 plus trees were established in seed orchards to produce improved seed for distribution to Haitian farmers. Progeny trials were established to examine the genetic variation among families for survival, height, stem diameter and merchantable wood volume.

Five-year survival rates of *C. longissima* in the orchard and progeny trials ranged from 60-98 % and averaged 85 % on six sites. These rates far exceeded the average performance for the species reported by PADF and CARE. Better seedling quality and more intensive site management were probably the reasons for these differences. Differences in height growth were revealed among sites rather than within sites, indicating that environmental differences caused most of the variation observed in height of *C. longissima*. Site means for height growth ranged from 1.5 to 6.1 m after five years, with highest and lowest means occurring on two sites in the Cayes Plain. Differences among families were observed at the Lapila progeny trial and the Terrier Rouge orchard after five years. The remaining sites showed either weak or no differences in height growth among families. Therefore, there was little evidence that significant gains in height growth could be achieved by selecting at the individual tree level. In terms of stem diameter growth, variation among family means for dbh (diameter at 1.3 m) was significant at all sites except Crocra. All three orchards showed statistical differences in dbh after five years, with Terrier Rouge exhibiting the greatest variation among families. The top family, 160, exhibited 60 % greater dbh than the site average. Differences in merchantable wood volume between the top three families, averaging 51 m^3 ha^{-1}, and the site mean of 36 m^3 ha^{-1}, ranged from 37 % to 44 %.

The seed orchards and trials reported here represent a valuable resource for perpetuating the species in Haiti and providing income to farmers. The orchards contain the broadest genetic base of the species in its native range and have the best chance of producing a seed mix that is broadly adapted for providing superior genetic material to small farmers. Both vegetative reproduction and recurrent selection should be used to improve the yield and profitability of this popular tree species. Efforts should be made to preserve past USAID accomplishments,

particularly in face of an ever-changing environment and economy. The species, *C. longissima*, is part of an exploited natural resource base that must be conserved through continued investment in both genetic conservation and improvement with seed orchards and progeny testing. (SECID/Auburn PLUS Report No. 41).

Reference Book on Haitian Trees

Bwa Yo – Important Trees of Haiti was published by SECID. This book, which draws on information gained from the Tree Improvement Program, is a useful manual for anyone working with trees in Haiti and other parts of the Caribbean. It covers a collection of native and exotic species that play an essential role in the agricultural landscape in Haiti. It contains much useful information on adaptation, uses and wood characteristics of a wider range of species. It also compiles information of a more technical nature and contains formulas useful to foresters to make estimates of wood productivity. This book should serve as a useful reference tool to professionals trained in both the basic and applied sciences.

Impact of Tree Planting

The importance and long-term environmental and socio-economic impacts of trees planted under the AOP and AFII projects since 1982 are reviewed in SECID/Auburn PLUS Report No. 23. This report revealed that site selection, land tenure and garden types are key elements of planter decision-making. Farmers tended to favor sites with greater land tenure security and proximity for closer surveillance. It also revealed discrete land use patterns on peasant gardens where trees were planted. In some cases, the introduction of trees has had only a limited impact. Some trees thrived for a time but seemed destined to disappear from the local landscape. However, in many other cases, the sudden introduction of large numbers of project trees actively precipitated distinct shifts in plot management.

A number of assumptions regarding farmer behavior on which the AOP project was initially based were shown to be incorrect. For example, it was assumed that farmers would not be willing to make long-term investments in the slower-growing, high value lumber trees. In fact, many farmers preferred high value trees as investments for later schooling and other needs. It was assumed that farmers would not plant trees on land without clear ownership. However, some farmers used trees to enhance their control over land for which they did not have title.

For a tree planting project is to have a lasting impact, trees must survive in sufficient numbers and reproduce. The tree sites averaged 12.3 years old and achieved a survival of 35%. This was likely an underestimate of the true survival, especially on the sites that were harvested earlier with a higher probability of missing an exact stump count. A third of the surviving project trees were still standing, dominated by *Senna siamea*, the most widely planted species, and other species such as *Casuarina equisetifolia* and *Catalpa longissima* valued for high value wood products. *Leucaena leucocephala* and *S. siamea* were the most heavily harvested trees and contributed over 80% of the wood volume. Some regeneration of trees was also observed. Farmers managed the regeneration of species valued highly as sources of wood such as *Simarouba glauca*, *Calophyllum calaba*, *Swietenia mahogani* and *Bumelia salicifolia*.

More AOP trees were harvested than left standing for all species except *C. equisetifolia*, *C. longissima*, *C. odorata* and *C. robusta*. Harvests represented a little more than half of the estimated wood yields. These harvests represent income benefits for farmers, one of the goal of the initial AOP project. The most important products were charcoal and construction wood for peasant houses. Charcoal, produced primarily for sale, comprised over 80% of the wood harvested and 31% of the monetary value. Construction wood made up of 155% of the harvest wood volume and 60% of its monetary value. In addition to wood products, AOP trees render a series of useful services to tree owners and surrounding communities. In many situations, the service role of trees may in fact be more important than the tree products. The farmers made extensive uses of project trees to improve soil quality, increase land value, enhance aesthetics, break wind and provide shade for mixed perennial gardens and other important services. Significant number of inventory farmers established enriched fallows on one or more sites, and shifted sites out of erosion intensive annual crops into permanent woodlots, charcoal gardens and mixed perennial gardens. Had the trees not been planted, the rate of site conversion to a useful, alternative land use would have been slower and perhaps less efficient. These types of land use benefits should be kept at the forefront of agroforestry research. In terms of quality of the environment, project trees had positive impacts by increasing habitat diversity and facilitating a shift toward soil conserving land use pattern. They are playing an important role as nurse trees that both attract seed dispersers and modify the microsite to favor regeneration.

Conclusion

USAID's tree planting program has had a positive impact on the environment and economy of Haiti's farmland. As a component of this activity, the Tree Improvement Program contributed in later years of the PLUS Project by contributing seed of higher genetic quality and yield potential than untested seed sources previously used for tree planting. However, some of the slower-maturing tree species have not yet begun bearing significant quantities of seed (M. Bannister, Personal communication, 2001). The arboreta, orchards and progeny and provenance tests are excellent examples of how genetic conservation can and should be integrated with the development goals of USAID. However, these accomplishments must be continued in order to win the struggle against the deterioration of Haiti's forest resources. Under normal circumstances, this requires long time periods to adequately assess genetic differences.

Table 4. Summary of 5-year results for the best performing species accessions tested under the Tree Germplasm Improvement. Data are means across sites.

Species	Accessions No.	Provenance or Progeny	Survival %	Height (m)	Wood/Tree (m^3)	Diameter (cm) at	
						0.1 m	1.3 m
Cedrela odorata	6888	Honduras	69	6.0	0.06	11.7	6.8
	52/79	Honduras	65	6.2	0.08	13.0	8.2
Cordia alliodora	7488	Honduras	80	9.3	0.08	13.0	10.0
	4140	Costa Rica	71	8.8	0.07	12.7	9.6
Enterolobium cyclocarpum [1]	792	Costa Rica	77	8.8	40.0 [2]	17.3	14.9
	1667	Honduras	75	8.8	45.0 [2]	17.2	14.9
Senna siamea	1511	Haiti	57	6.9	17.4 [2]	12.8	7.8
	1501	Haiti	53	6.9	28.0 [2]	11.9	7.6
	1365	Nicaragua	73	6.6	18.8 [2]	11.6	6.7
Casuarina cristata	1476	----------	89	6.9	11.6 [2]	6.9	5.0
C. equisetifolia spp. equisetifolia	70/85	----------	88	7.4	8.1 [2]	7.5	4.3
Gliricidia sepium	62/87	IITA - Nigeria	83.2	5.04	----	----	5.9
	30/84	Nicaragua	85.5	4.90	----	----	5.6
	25/84	Honduras	96.0	4.67	----	----	5.6
	60/87	Guatemala	82.3	4.62	----	----	5.8
Azadirachta indica	10	Burkina Faso	85.0	9.5	40.8 [2]	17.4	13.1
	7	Niger	100.0	9.7	38.2 [2]	16.7	12.8
	3	Dominican Rep.	95.0	9.0	37.1 [2]	16.4	12.5
	17	Haiti	95.0	9.1	34.7 [2]	15.6	12.1

[1] Data reported for one site. [2] Wood production in kg/tree.

D. Information Clearinghouse

Introduction

One of the problems common to international development agencies working in developing countries is poor access to technical information relevant to the country and the lack of information of what has been accomplished in other projects, or even what is being done by other groups within the same country. Part of this problem is the rapid turnover in personnel and the loss of institutional memory. The information Clearinghouse was conceived by USAID/Haiti for technical information and information on what has been learned from past USAID projects. Key elements to the Information Clearinghouse were 1.) the presence of a library housed at the SECID office, composed of both technical books and other documents, but also reports from both present and past USAID projects, 2.) an information retrieval system, covering not only the library of SECID, but also those of PADF and CARE, and 3.) staffing by a qualified agronomist, capable of not only retrieving information, but also having the ability to understand the technical information in order to summarize and interpret the information to the benefit of project implementors, as well as people outside of PLUS seeking technical information. This position was filled by an agronomist trained at the MS level who had extensive experience, not only with USAID-funded projects, but also the Ministry of Agriculture and the Agricultural Faculty of the National University of Haiti. This person was also supported by the SECID Home Campus Coordinator at Auburn, who responded to requests for information by consulting the Auburn University Library, faculty at Auburn and at other SECID institutions, as well as other sources in order to provide needed information. The Information Clearinghouse also served to promote communication among staff of the three participating institutions.

To accomplish these tasks, the Information Clearinghouse focused on:

1. Publication of the SECID/PLUS newsletter entitled INFO-PLUS.
2. Development and maintenance of PLUS Project library with its computerized inventory system, covering documents in the SECID, PADF and CARE libraries
3. Support to other SECID/PLUS programs with information searches and document translation
4. Public Relations

Accomplishments

Ten issues of Info-PLUS, written in English, were published and distributed to about one hundred institutions and more than 750 individuals of the public sector, NGOs, international organizations and ecological associations. Approximately 2000 documents were catalogued in the SECID/PLUS library in the CDS-ISIS computerized system. A collection of documents on processing and marketing of fruit, vegetables and other crops was also assembled to be used in SECID/PLUS marketing research and development activities. Upon recommendation of the M & E consultant team, documents on environmental M & E and participatory rural appraisal were obtained from different organizations, International Centers and Institutions. The Information

Clearinghouse also supported other SECID/PLUS programs by locating relevant documentation on specific crop and tree species and by assisting them to obtain seeds from international sources. This program contributed to PLUS public relations by preparing photo displays and illustrated guide to document Plus project activities. An illustrated guide on manioc processing was produced. When the funding ceased, the Information Clearinghouse library was transferred to Winrock's Asset Project and later transferred to DAI's Hillside Agriculture Project, where it currently rests.

E. Market Research and Marketing Support

Introduction

Under SECID leadership and guidance, USAID contractors and grantees initiated and then increased their use of marketing to achieve USAID goals relating to agriculture and the environment. Prior to SECID involvement, USAID contractors focused their activities on changing farm production activities under an assumption that more efficient production would lead to increased farm income. However, increased production by itself does not necessarily increase farm income, as the increased availability of the crop tends to drive down prices if not accompanied by efforts to change the marketing of the product. An additional assumption was that farmers' long-term concern for the state of natural resources under their control, coupled with technical assistance on how to conserve those resources, would lead to farmer adoption of conservation farming practices. However, project experience indicated that an extension focus on soil and water conservation technologies did not result in avid adoptions of the technologies by non-participating farmers. An economic explanation for this phenomenon is that increased production does not necessarily result in increased income if the increased production on a limited market drives down selling prices. Another explanation is that soil and water conservation does not consistently increase crop yields in the short or medium term, as shown by the experience of the Soil Management CRSP at Pernier.

SECID decided to reverse the accepted order of interventions and focus on marketing activities first. The marketing activities would increase prices for targeted crops and thereby provide the necessary financial incentive for farmers to increase production and also participate in associated soil and water conservation activities. For example, ServiCoop was created to increase competition in Haiti's cacao export market. This resulted in farmers receiving a greater percentage of the export price of cacao. The increased price at the farm level stimulated increased farmer interest in cultivating cacao. SECID's mango marketing program promotes more direct links between existing exporters and farmers; this too has resulted in a higher farm-level price for the product. Once farmers began receiving higher prices for their mangos, they demonstrated an interest in increasing mango production by protecting their existing mango trees and planting additional trees. The increase in their income gives farmers an incentive to practice conservation and improve cultural practices related to those crops. Both of USAID's goals of increased farm income and enhanced natural resource conservation are met in a positive and sustainable way.

SECID's marketing approach is now becoming widely accepted by other USAID contractors, grantees, private sector firms and farmers. SECID would like to express its appreciation to USAID; CARE; PADF; ServiCoop; several mango export firms, especially Rainbow Agro-Industries, La Finca, Carribean Produce, and JMB Export; and to the many farm groups and individuals with whom we have worked. Our marketing program successes are due to the collaborative efforts of all these organizations and individuals.

Background

Marketing research and development was not initially a major component of the SECID PLUS program. In SECID's Implementation Plan of early 1993, it is included under the section "Special Studies". "Market Opportunity Studies" were planned "to identify and quantify alternative markets and marketers for agricultural products which can be supplied profitably by project farmer-clients." These studies also aimed "to obtain the involvement of private-sector marketers to develop sustainable marketing channels for agricultural products produced by project farmers". The Market Opportunity Studies included, as a first step, gathering and reviewing existing information on the marketing of Haitian agricultural products. This resulted in SECID/Auburn PLUS Report No. 5, *Guide to the Literature and Organizations Involved in Agribusiness Research and Agribusiness Development in Haiti.* The report listed published studies; the names of individuals, firms, and organizations involved in Haitian agribusiness; and institutions and organizations assisting the development of Haitian agribusiness. It also contained other information considered useful to agribusiness research in Haiti: short reviews of key published material, discussions of the internal marketing system, and information on external trade. As the next step, a study of market opportunities for agricultural products of farmers in the PLUS Project areas was completed and published as SECID/Auburn PLUS Report No. 4. It presents detailed information gathered during a reconnaissance of PLUS Project regions, including seasonal prices and availabilities, and an assessment of the probable time to market, for the agricultural products identified as having potential. Sections for each region present an account of interviews conducted, observations relating to general market conditions and to specific agricultural products, and recommendations.

The "Market Study of Northwest Haiti" is also listed in SECID's Implementation Plan. It was initiated in October 1990 "to determine which crops are sold in primary and secondary markets over the production cycle, track the price of crops sold in these markets and to determine availability of products and to estimate potential market demand." Another goal was to evaluate marketing costs and potentials for crops produced in the region. The study was completed during 1993 and published as SECID/Auburn PLUS Report No. 14. Several opportunities for increasing farmer income were noted, including increased production of specialty crops, such as pigeon pea, sweet potato and plantain, combined with use of fertilizers to increase yield, increased fruit production, improvement of production practices for cereals, food processing, para-agricultural activities and production of small livestock. The major constraints were poor road conditions, especially to secondary markets, food storage at farm and market level, lack of access by farmers to small mills, absence of market information and poor product quality. Among recommendations were road improvement, including the construction of feeder roads, improvements to marketplaces, use of radio to diffusing market information, development of

methods to reduce storage losses, a feasibility study on locating cereal processing mills near farming areas with high potential, production for export markets and an advertisement program encouraging Haitians to buy locally-produced foods, especially local preserves. (SECID/Auburn PLUS Report No. 14)

SECID collaborated with the Haitian Development Foundation (HDF) on two other market studies. One was a study of the domestic market for processed manioc (cassava), and one was a study of the domestic market for dehydrated vegetable and fruit flours. The studies were directed by SECID, financed by HDF, and carried out by local entrepreneurs with an interest in investing in the industries being studied. SECID also provided agribusiness technical assistance to other entities in Haiti. For example, in 1994 SECID produced: a neem seed marketing proposal for MARNDR; a paper on "charcoal forests" for the PLUS team; information sheets on grain storage that were distributed to potential marketers; and studies on the vegetable sub-sector and opportunities for small-scale agricultural product processing in the Grande Anse region for CARE. During the first years of the PLUS Project, marketing activities were limited by the embargo. They were also limited by the lack of a marketing specialist.

As time went on, Dr. Lea recognized the enormous potential of marketing programs to increase farmers' income and stimulate production, and he pushed for an expansion of SECID's role. In 1994 he developed a marketing proposal for the extended PLUS Project; the proposal was accepted by USAID in 1995. Following the acceptance of the proposal, Dr. Lea began devoting more of his time to marketing activities, including handicrafts marketing. However, because of funding constraints, the Marketing Assistance Program could not really get started until July 1996, when USAID approved the hiring of Marketing Specialist Junior Paul. In the meantime SECID was able to carry out the food processing consultancy that resulted in SECID/Auburn PLUS Report No. 28, *Increasing the Marketability of Manioc and Breadfruit Products by Improving Processing Techniques*. That report is discussed in the context of the Manioc and Breadfruit subsections of "SECID Marketing Programs".

The majority of activities described in the following sections are activities that took place between 1996 and 2000. "SECID Marketing Programs" includes a program overview as well as subsections dealing with each targeted product. "ServiCoop" explains the activities and results of this agricultural products marketing cooperative, which was created by SECID in collaboration with USAID. "Coffee Processing Consultancies" discusses consultancies undertaken by Enterprise Works Worldwide (EWW) with the goal of improving the quality of coffee marketed from Haiti, particularly the *Haitian Bleu* coffee marketed by the FACN. "Institutional Strengthening Activities" describes relevant activities that have taken place within the context of SECID marketing programs. The "Lessons Learned" section presents a survey of the various programs and makes recommendations for future marketing programs in Haiti. Finally, a table presents data quantifying the direct impact of SECID marketing programs on farmer and farm group income for selected products.

SECID Marketing Programs

Program Overview

The majority of SECID's marketing programs grew out of its work with mango marketing, which began in earnest in 1997. An examination of the traditional structure of the mango export industry revealed that exporters and farmers had no direct contact with each other and all transactions were handled by intermediaries (*fournisseurs*). The *fournisseurs* had no interest in communicating to farmers the prices offered by exporters, and farmers had little choice but to sell to the *fournisseurs* at very low prices. SECID looked for a way to remedy this problem. While it is naturally impossible for an exporter to talk with each farmer individually, it *is* feasible for an exporter to cut out the intermediary by negotiating with farm groups. For this reason, SECID developed a program of strengthening the groups and bringing them into direct contact with exporters. Following an initial mango marketing trial with a group of 500 farmers, the mango program has expanded steadily each year. The major results of the program, which is discussed in more detail in a subsection of this report, are more effective farm groups and consequently higher prices for the farmers. In the Gros Morne area, for example, the farm-level price for mangos was 5 Gdes/doz before SECID intervention, 10 Gdes/doz in 1998, when the mango program was introduced, 12 Gdes/doz in 1999, and 12-17 Gdes/doz in 2000. In that year, the farm groups generally received 21-23 Gdes/doz for their role in assembling the mangos and organizing the sale, of which they paid out 12 Gdes/doz, retaining 9Gdes. Exporters benefit from an improvement in the quality of the mango received through the farm groups.

The success of the mango marketing program, and in particular the development of working relationships between SECID and various mango exporters, led to marketing programs for numerous other crops. This came about when exporters requested assistance with export trials of such crops as igname (yam), malanga, and pumpkin. SECID tried to concentrate more on crops which are beneficial to the environment and do not contribute to erosion; often these are tree crops or crops which are grown in association with trees (such as yam). In SECID assistance related to non-tree crops, it focused on farmers who participate in tree crop programs. However, SECID's top priority was always increased income for small farmers. Marketing Specialists Junior Paul and Raymond Lerebours divided responsibility for the various marketing programs for exportable crops. In time, they were assisted by three Marketing Supervisors: Brigham Labranche, based in the Jacmel-Léogâne area; Reynold Drouillard, based in the Gros Morne area; and Frantz Dorvil, based in the Mirebalais area.

In the development of a typical marketing program, SECID identifies an exporter willing to commit to a trial export shipment of the crop. SECID then collaborates with NGOs to identify farm groups who want to participate in the trial. Together, these parties conduct a survey of existing production capacity and crop prices. According to the survey findings, SECID negotiates an agreement on price and quantity of the product with the farmers and one or more exporters. SECID marketers aim for a price substantially above that of the local market price, so that not only will the farmers benefit from a higher price, but the farm groups will also be compensated for their role in assembling and field treating the product, and they will have a margin for handling rejects (the non-export-quality portion of the farmers' crop). SECID helps

the farm groups and exporters establish direct contact with each other, so that the program may be sustainable. SECID, CARE, and PADF may provide funding for the purchase and distribution of germplasm in order to reach the desired quantity and quality of the crop.

As with the mango marketing program, SECID provides training in appropriate handling and assembly techniques and in accounting and management to support the farm groups. SECID also places an emphasis on effective organization of the groups, including the formation of management/administrative committees, and training in the roles and responsibilities of each group member. Finally the time arrives for harvest of the crop and a trial export shipment. The SECID Marketing Specialists and Marketing Supervisors, as well as collaborating personnel of other NGOs, are present to help coordinate the activity. If all goes well, plans are made for further shipments. With each shipment, SECID involvement begins to diminish. Coordination of follow-up shipments is increasingly assumed by the exporter, the cooperating NGO and the farm group.

Non-export marketing programs focused on new ways to market traditional products. For example, manioc and plantain were marketed in dried form to urban processors, and the marketing of dried beans bypassed the Port-au-Prince market. Still, these programs followed basically the same development path as the other marketing programs: identification of an opportunity, negotiation with buyers, training for farm groups, and follow-up support.

The following sections detail activities for the individual marketing programs.

Program Activities and Results for Manioc (Manihot esculenta)

Kasav, a flat-bread made from processed manioc, is a traditional part of the Haitian diet. As early as 1993, SECID directed a marketing study, financed by the Haitian Development Foundation, that showed that there was significant potential for expanding the domestic market in processed manioc. Then, in late 1995, a food processing consultancy carried out by SECID clearly demonstrated that *kasav* can be made from dried manioc meal as well as from fresh manioc (see SECID/Auburn PLUS Report No. 28). SECID promoted the development of a new industry based on this "discovery". Since the dried product can be stored and transported more easily than the raw product, markets for it can be developed far from the farm. SECID Marketing Specialists worked to stimulate the development of new markets, and at the same time ensure a steady supply of manioc meal from producing groups.

Activities began on the production end of the marketing chain in October 1996, when Junior Paul and PADF employees trained members of the Camp Perrin farm group OPMAGAT in how to process the manioc and how to manage a business. Soon OPMAGAT and other local organizations were producing manioc meal, flour, and starch, and selling them to buyers that SECID helped identify. In subsequent months SECID and CARE provided training to several farm groups in the Grande Anse. In the North, a PADF intervention area, the group Coeurs Unis began manioc processing as well. Junior Paul worked with SECID Information Clearinghouse Manager Marguerite Blémur to produce a leaflet describing the dried manioc production process. The leaflet, prepared for use by extension agents, is entitled *Gid Sou Teknik Preparasyon ak*

Komès Farin Manyòk. By 1998, 10 farm groups all over Haiti were producing 2,000 pounds of manioc meal per month, and in 2000, 12 groups were producing an average of 6,033 pounds of meal per month. OPMAGAT has been enjoying success not only by selling manioc meal but also by using over 1000 pounds of processed manioc per month to make both *kasav* and candies which sells locally. SECID has supported farm group acquisition of motorized processing equipment, once by writing a small grant proposal that was accepted by USAID.

One constraint for many producing groups has been a lack of operating capital. SECID tried to address this constraint by encouraging buyers to advance money to the farm groups, and also by looking into the use of bank loans to increase operating capital. In late 1999, with the assistance of Tom Lenaghan of PRET and Raymond Lerebours, OPMAGAT negotiated a six-month loan of 15,000 Gourdes from BUH/Les Cayes, as part of the bank's "Crédit Populaire" program. The money was expected to enable the group to increase manioc meal production. However, the money may have been used for some other purpose, as production apparently has not increased, and the group's operating funds remain the same as they were last year. Still, OPMAGAT did repay the principal of the loan, along with 4% interest per month, when it was due.

On the other end of the marketing chain, SECID has worked to stimulate demand for the manioc meal. Through a SECID-administered distribution system, manioc meal was predominantly sold to two major buyers, Quisqueya and Pwodwi Lakay, although at the time of this report only Quisqueya is still a buyer. It was expected that the distribution of propane-fired *kasav* stoves, developed by SECID, would result in increased demand for the meal. In 1999, Raymond Lerebours distributed 15 of these stoves to different regions of Haiti and trained 90 people in their use. The stoves were mainly distributed to organizations working with PADF. However, most of the stoves were not in operation after several months, and those that were operating were not doing so at full capacity, which would require 500 pounds of manioc meal per month. An analysis of the problem showed that the income generated by the stoves was not sufficient to be divided between the organization and the stove's operator(s). To solve this problem, stoves were placed directly under the operators' control. In early 2000, stoves were being operated privately in Petit Goâve and Grande Rivière du Nord, and by OPMAGAT in Camp Perrin. Due to the rising cost of propane, however, the use of the stoves may no longer make good financial sense.

Another potential market for manioc meal, investigated by SECID, was a proposed manioc flour refinery that would package the flour for use in making *labouyi*, a type of Haitian porridge. OPMAGAT and CEHPAPE (an organization based in Léogâne) planned to collaborate on this project, and SECID encouraged them to start small by using 1,000 pounds of meal to begin trials. The two organizations, however, eventually decided to pursue a large-scale project without SECID's assistance. They will be receiving $50,000 from Cariforum (CARICOM financing) for this project. SECID wishes them the best but notes that seventy-five percent of the funds will be used for technical assistance, while no funds have been designated for the purpose of creating and maintaining a stock of meal.

In 2000, SECID and PADF differed over the distribution of *kasav* stoves, and also over what approach to use with producing groups who need a market for their product. SECID favored a standardized, rather centralized system whereby the processors and buyers would negotiate terms of sale and use sales contracts and regular orders. SECID believed that this would stabilize the industry. PADF, on the other hand, began encouraging individual groups to bypass SECID and go directly to the buyers without using contracts or regular orders. Because of PADF's actions, and the fact that the farmer organizations appeared to prefer PADF's approach, SECID decided to step aside and let them proceed as they wished. For this reason we do not have detailed data on recent manioc meal sales. However we do know that while many groups continue to process manioc, they have not been able to satisfy existing demand. SECID would not have made the same choices that PADF and some of the processing groups have made, but in a way, their determination to proceed independently proves the strength of the program and the potential for the industry to develop on its own.

The underlying goal behind the development of this new industry has always been increased income for small farmers. Farmers who sell manioc to the processing groups receive significantly higher prices for their crop, and this marketing channel provides a valuable alternative to traditional marketing channels, where the manioc would usually be sold while still in the ground. The groups also benefit by more than doubling the value of the manioc through processing, and they provide employment opportunities, including many opportunities for women. Each processing group employs several people on either a full-time or part-time basis. Employment is created at the other end of the marketing chain as well, for those cooking *kasav* or processing the manioc meal into flour and packaging it for sale. Farmers in program areas have a tendency to increase manioc cultivation, and the environment is relatively protected under this long-cycle crop.

Program Activities and Results for Plantain (Musa paradisiaca)

SECID plantain marketing activities grew out of conversations with a Port-au-Prince plantain flour manufacturer in late 1993. The manufacturer, Quisqueya Foods, faced problems of declining plantain (*bannann poban*) production and rising urban processing costs. A visit to the plantain production area, which was in a PLUS Project zone, showed that declining production was the result of a disease known as Black Sigatoka or Panama Disease. This led to a study of the problem (see SECID/Auburn PLUS Report No. 26) and the importation, by SECID, of a disease-resistant variety of plantain from Honduras. The new plantain was distributed to farmers by PADF and CARE. In parallel with the efforts to improve plantain production, SECID also began efforts to improve its marketing. *Bannann poban* is the variety of plantain used to produce a type of flour that is consume by Haitians as porridge. The marketing approach was to convince Quisqueya Foods to purchase its raw product in the form of dried plantain chips rather than the whole raw fruit. This proved to be an attractive procedure for the processor since it reduced its transportation cost by 75% and substantially reduced its processing costs, as it no longer had to peal, slice and dry the plantain at its facility in Port-au-Prince. Having this portion of the processing done in the countryside opened a value-added opportunity for farmers, who could convert the plantain into sun-dried chips prior to selling it to the Port-au-Prince processor. Transforming the perishable plantain into a dry, storable product also reduced the risk of

farmers' production and marketing processes. Sun-dried plantain chip production began near Mirebalais in early September 1994. By early 1997 a farm group in Lascahobas was also producing the chips, and employing several group members for the processing activity, and a group working with CARE near Jérémie had tried chip production as well. Farm groups in the North began production too, and by early 1998 all of the groups, together, were producing approximately 3,650 pounds of plantain chips (valued at 43,800 Gdes) per month. The groups generally purchased plantain at 25 Gdes per stalk (*regime*), as compared to reported local prices of 15 Gdes/stalk prior to the program. Then, they added approximately 20 Gourdes of value to each stalk through the processing activity. The groups were enthusiastic about this highly profitable marketing activity, but in 1998 there was a reduction in demand for the product and the leader of one group agreed to sell plantain chips to Quisqueya Foods at 75% of their former price. This set an unfortunate precedent, and made the processing activity considerably less attractive to the farm groups. SECID ceased its involvement with the plantain marketing program, but some farm groups have continued marketing plantain chips directly to Quisqueya, or producing plantian flour on their own.

Program Activities and Results for Handicrafts

Origin of the Program: Corn Husk Handicrafts. In 1995, when USAID accepted SECID's proposal for the amended PLUS Project, one of the first marketing programs to get underway was the handicraft marketing program. SECID arranged for a Haitian firm, Ace Basket Factory, to provide training in handicrafts manufacture to residents of PLUS Project areas. Trainers from Ace Basket provided a total of 8 days of training to women in the Camp Perrin area, teaching them how to make artificial flowers from corn husks. The group of women began producing the corn husk flowers, but in insufficient quantities for export. SECID helped them find a domestic market and secure an initial order for 600 of the flowers. Representatives of the Camp Perrin group also visited Mirebalais and shared some of their training with farmers and PADF staff there. This stimulated the interest of Mirebalais-area women, and in 1996, SECID arranged for Ace Basket to train these women in production of ornamental wreaths from corn husks. At an early stage of development, neither group could produce the quantity of handicraft items required by Ace Basket, so SECID searched for small and medium-scale markets, domestic and foreign, that could be used as stepping stones to build production up to the requisite level. SECID's initial intervention had included arranging for the leader of a federation of handicraft cooperatives to provide training for the women in organizational skills and marketing. After this, the women's groups continued handicraft production and marketing with little direct assistance from SECID.

Coconut Palm Seed Sheaths. These 2-2.5 foot long pieces of material, technically termed woody spathes, cover the bunches of palm flowers before blossoming occurs. They are not traditionally marketed by Haitian farmers. A local handicraft manufacturer, Caribbean Marketing Group (CMG), came to SECID in 1996 with an order for 500 dozen coconut seed sheaths, and offered to pay 10 Gdes/doz for them. SECID searched throughout the PLUS Project regions, via the network of marketing agents, and found that the region of Saut d'Eau had a good quantity of the sheaths of the appropriate quality. The local marketing agent then discussed CMG's offer with farmers and determined that they would be interested in the opportunity.

SECID brought the buyer to Saut d'Eau, and she made an agreement to purchase from a farm group. Several days later she sent a truck to collect the product, and the transaction was completed.

Baskets. In 1998, CMG requested SECID assistance in filling an order for several thousand hand-made baskets. The area in which these baskets are traditionally made does not fall within a PLUS Project zone. SECID suggested that farmers within a PLUS Project zone be trained to make the baskets, and this plan was adopted by all collaborators. PADF field staff recommended that the activity be carried out in Marigot and Fond Jean Noël, both near Jacmel. PADF planned and implemented a series of training sessions for interested farmers in these two localities. During these training sessions, SECID introduced the farmers to the manager of CMG, who offered the farmers a contract for their baskets. During the semester, the farmers sold approximately 300 baskets valued at 9,900 Gdes to CMG.

Program Activities and Results for Dried Immature Sour Orange{ TC \l2 "Dried Immature Sour Orange} (Citrus aurantium)

The sour orange tree usually drops a substantial proportion of the fruit it has set while the fruit is still quite small. The dropped oranges may be collected, sun-dried, and sold on the export market to provide farmers with some additional income. The market has been in existence for quite some time but PLUS farmers were not aware of this opportunity until SECID's Marketing Specialists introduced them to it, beginning in 1997. That year several farm groups in the North and Central Plateau regions sold approximately 2500 pounds of dried sour oranges to established exporters. The groups received 5 Gourdes/pound for a product that otherwise would have gone to waste. By 1999 the dried immature sour oranges were being sold through ServiCoop. Farm groups in the Central Plateau, Gros Morne, and Jacmel areas received 20 Gdes/marmite for 500 marmites of the product (approximately 2500 lb). In 2000, ServiCoop decided not to continue to market dried immature sour oranges, but SECID found that exporter Michel George of Cap Haïtien was willing to buy the product at the same price. Several farm groups in the Mirebalais area sold him a total of 351 marmites (approximately 1755 pounds). There is a large market for this product, so the program has potential to expand to other farm groups and other regions, as long as it continues to be profitable for farmers.

Program Activities and Results Relating to Mango{ TC \l2 "Mango} (Mangifera indica)

By organizing farm groups to market directly to Port-au-Prince exporters, SECID has brought about substantial increases in the farm level price of mangos, ranging from 20% to 100%. (The highest price changes have occurred in areas where traditional competition has been low.) The income of small farmers has increased, allowing them to improve their standard of living, for example by constructing new homes or making investments in livestock. In addition to increased income for farmers, other interconnected results of the program include:

- stronger farm groups;
- a new partnership between exporters and farmers;

- a lower percentage of rejected mangos, due to increased farmer understanding of the export business; and,
- a positive impact on the environment. Farmers are demonstrating greater interest in mango cultivation: planting and grafting trees. They no longer cut the trees to produce charcoal.

The mango marketing program, led by Junior Paul, is SECID's largest marketing program for an exportable crop. It began in 1995 with discussions between Dr. Zach Lea, PADF Regional Agronomist Joanas Gue, and mango exporter Jean Maurice Buteau. As a result, Gue and Buteau made a trial shipment of mango from Devarieux, near Mirebalais, to Port-au-Prince. None of the main actors had time to fully devote to the trial and the results were not promising, but this initial trial provided some experience and a base for future efforts. The program began to take off after Junior Paul, who had several years of experience in the mango export industry, joined SECID in July 1996. Later that year he met with farm groups near Mirebalais to discuss the possibility of another mango marketing trial. Then, along with PADF staff, he provided seminars to the group COEPDA, to teach participating farmers proper harvest, collection, handling, and transport techniques, and the accounting and management skills necessary to make the trial a success. During the 1997 harvest season, COEPDA sold 20,146 dozen mangos to a major exporter and received approximately 10 Gdes/doz, a huge increase over the previous local market price of 3 Gdes/doz.

In 1998, the program was expanded to 10 farm groups in 3 regions with approximately 1,420 farmers participating. Approximately 42,000 dozen mango were marketed through the program. That year ServiCoop served as an intermediary, buying from the farm groups and re-selling the mangos to exporters. It was expected that ServiCoop would allow farm groups to retain a greater portion of the export price of the mangos, in contrast to the traditional system whereby export prices were concealed from farmers by established intermediaries (*fournisseurs*), who could then keep more profit for themselves. SECID invited farm group representatives to visit the exporters and negotiate prices directly with them. The exporters competed to offer the best price possible, and when news of this price reached the mango growing areas, the higher price became the standard to which all buyers, including traditional *fournisseurs*, were forced to adapt. Farm-level prices increased from pre-program levels of 5-8 Gdes/doz to post-program levels of 8-12 Gdes/doz. Thus, the main goal of the marketing program was achieved. Unfortunately, ServiCoop lost approximately $13,000 during this experience. ServiCoop had advanced money to the farm groups for the purchase of mangos. When mangos were harvested incorrectly, or picked up late for transport to Port-au-Prince, their value declined sharply. ServiCoop was not able to recuperate the total amount of the advances through its sales to exporters. In effect, it subsidized a portion of the marketing experience. SECID learned that because the market reacted so quickly to increased competition, it was not necessary for ServiCoop to continue to be involved in mango marketing.

In 1999, the program expanded to 20 farm groups located in four regions (Jacmel/Léogâne, Les Cayes, Mirebalais and Gros Morne). These farm groups sold a total of 133,700 dozen mangos, or about 7% of all mangos exported from Haiti that year. In 2000, 15 farm groups (including one formed from 9 smaller groups) participated in the program and sold

120,488 dozen mangos for 2,623,612 Gourdes. The program reached an increasing number of farmers: about 3,400 in 2000, as compared to 2,687 in 1999. These farmers received between 12 and 17 Gdes/doz, a slight increase over the previous year and a much better price than the 5 Gdes/doz that many received prior to SECID's intervention. The farm groups received about 22 Gdes/doz for their role in assembly of the mangos and organization of their sale, retaining 9 Gdes/doz for costs and reserve funds.

Junior Paul has expanded and improved the mango marketing program via continued training and other innovations. PADF personnel and SECID Marketing Supervisors also assist in strengthening the management capabilities of the groups and improving the developing relationship between farm groups and exporters. They are constantly looking for ways to strengthen the program. For example, a sample contract was developed last year for use by farm groups and exporters as a point of reference. It covered quantity and quality of mangos, price, responsibility for transportation, and other conditions of sale. Recently, we have seen great improvement in the management and leadership capabilities of the farmer organizations involved in this program. Many groups have reached a certain level of sustainability, as shown by their increasing willingness to take responsibility for all aspects of marketing, the transparency of their accounting systems, and their improved relationships with group members and exporters. These groups demonstrated their maturity by negotiating directly with the exporters. Whereas in 1999, SECID participated in the negotiations, in 2000, SECID merely accompanied the group representatives during meeting with exporters. Exporter advances to farm groups are becoming standard practice in the industry; that mitigates the common problem of insufficient operating capital of farm groups. Even more importantly, farm groups and exporters are beginning to understand and trust each other more. This is critical, because farmers' active participation in the industry will help it to grow and respond to new market challenges and opportunities. SECID and partner organization personnel have continued to guide and support the farmer organizations by providing management training to group committees, technical training in harvest and preparation techniques to work teams, and general education for farmer members.

One result of the campaign to educate and motivate farmers is that the percentage of rejected mangos has continually decreased. The farm groups provide an important means for promoting a higher-quality product. When SECID began its mango marketing program over 30% of mangos were rejected for export, but now less than 10% are rejected. In certain localities this figure has fallen to less than 5%. The end result is that farmers sell more of their mangos in the higher, export-quality price bracket, thus further increasing their income. Another, relatively hidden, way in which the program has contributed to increased farmer income is in a change in the way mangos are sold. In many areas it was common for *fournisseurs* to buy all the production from a tree for a single price. Now, farmers sell their mangos by the dozen. They benefit from the increased fairness and transparency of the transaction.

Last year we began to see another sign that the mango marketing program is bringing about permanent positive changes in the structure of the mango export industry. When the program began, the *fournisseurs* were very much opposed to it, as it denied them the privileged place they had held in the mango export industry. As the program continued, some *fournisseurs* decided not to fight it but to participate in it themselves, as they are also farmers. A few took the

radical step of supporting the program by revealing some of the techniques they had previously used to cheat the farmers. These disclosures had tremendous impact at farmer training sessions. They were especially valuable because once the farmers and farm groups understand how they were cheated in the past, they will never allow the old system to return.

SECID's mango marketing program has succeeded in achieving the two main goals of the program: increased income for participating small farmers, and a positive impact on the environment. But before closing this section, let's return to the impact that the program has had at the organizational level. Its success helped contribute to the strength of the Gros Morne cooperative KOPAKGM (discussed in a subsection of "Institutional Strengthening Activities") and made it more popular with farmers. Exporters, too, have begun to respect the cooperative and other farmer groups. Also, the group-level profits have allowed farm groups to undertake activities, outside of marketing, that relate to the mango program and should contribute to its future success. KOPAKGM has set aside a portion of its profits for the construction of assembly centers. In Miok, the local committee of the cooperative used 3,000 Gdes to rent a tractor in order to repair a portion of the road so that trucks can reach the area more easily. The farm group in Cazale started a mango nursery of 10,000 seedlings. And in Marigot, near Jacmel, the farm association AKOLAD used 10,000 Gdes of its profits to begin a nursery of Francique-variety mangos. 20,000 mango seedlings survived, and Mr. José Sylvain of La Finca agreed to purchase 5,000 of them for 25,750 Gdes. These seedlings will be distributed to several farmers in the area who agreed to plant them in a contiguous plantation. This novel partnership could provide a practical model for encouraging the systematic development of mango production in Haiti.

Program Activities and Results for Breadfruit{ TC \l2 "Breadfruit} (Artocarpus incisa)

SECID first began investigating marketing possibilities for breadfruit back in 1995. Breadfruit is plentiful in Haiti, and often goes to waste for lack of an acceptable market. It was thought that perhaps breadfruit, like manioc and plantain, could be processed in rural locations and then stored or shipped to urban locations for further processing and consumption. A food processing consultancy carried out by SECID showed that breadfruit could be dried as chips or flour for future use, but that chip thickness should be carefully controlled, and that only small amounts of the flour could be satisfactorily incorporated into bread (see SECID/Auburn PLUS Report No. 28). Breadfruit did not return to the forefront of SECID marketing activity until 1999, when it was on a list of products with potential for development that was shared with exporters. In April 1999 the first trial shipment of fresh breadfruit was successfully carried out through collaboration between SECID, PADF, the farm group ATPAF, and Mr. Raphael Larrea, the director of Rainbow Agro Industries. The breadfruit was of good quality and the international price was high, so Mr. Larrea agreed to offer 25 Gdes/doz for future shipments. He and Mr. José Sylvain of La Finca undertook a total of 5 trials in various regions of the country. All together, 1076 dozen breadfruit were exported through these trials. Farmers were universally enthusiastic about the program, since breadfruit sells for only 6 Gdes/doz on the local market, when there are buyers. The program did not continue during 2000 in part because of exporter difficulties in fulfilling the technical requirements for packing the fruit, and mainly because of problems in transporting the breadfruit from the rural areas where it is grown. Conditions in

Haiti make it almost impossible to guarantee that the breadfruit will arrive in Port-au-Prince (for shipment by air) on the same day that it is harvested, yet because of the fruit's extreme perishability, it will spoil if not exported almost immediately.

Program Activities and Results for Kenep{ TC \l2 "Kenep} (Melicocca bijuga)

Kenep is a common fruit in Haiti, but it has traditionally been exported only in very small quantities. In 1997 and 1998, certain exporters made trial shipments to the North American market. These did not meet with great success, due partially to the perishability of the product and partially to the method of its collection (through intermediaries), which did not allow adequate control of quality nor allow a price premium to reach the farmers. Meanwhile, farmers in various regions of the country were asking SECID to develop a marketing program for kenep. Several farmer associations conducted surveys that showed that there was a large quantity of kenep available for the export market. SECID then contacted exporters to determine their interest in negotiating terms and price, and proceeded with plans for a trial shipment. Mr. Larrea was willing to offer the best price: 30 Gourdes for a case weighing 30 lbs, or two and a half times the average price on the local market (12 Gdes). In September 1999 two organizations in Léogâne participated in the program and sold 566 cases of kenep, or 16,980 pounds, to Mr. Larrea. The trial was a success, but it could not be repeated immediately because the harvest season was ending. The harvest season began again in July 2000, and SECID was prepared. Marketing Supervisor Brigham Labranche, under the direction of Marketing Specialist Junior Paul, worked with 7 farmer groups in the Léogâne area. During a two-month period these groups sold a total of 1705, 25-lb cases of kenep, or 42,625 pounds, to both Mr. Larrea and Mr. Sylvain. The price remained the same as last year, 1 Gde/lb, which the groups divided between farmers, pickers and packagers, and the group accounts. The most important development in 2000 was that the farmers took greater control over the marketing operation. Whereas in 1999 the exporter sent his employees to supervise the harvesting and packaging of the kenep, in 2000 the exporters simply dropped off boxes at the associations. After the farmer associations had harvested and packaged the kenep, the exporters' employees returned to accept delivery of the product.

Program Activities and Results for Igname{ TC \l2 "Igname} (Dioscorea spp.)

Igname (yam in English and *yanm jòn* in Haitian Creole) is an important food crop in many areas of Haiti, occupying substantial space in farmers' gardens in those areas. Accordingly, as SECID discussed various marketing opportunities with farmers and with PADF and CARE field staff, igname was often suggested as a crop for inclusion in our marketing efforts. The igname marketing program began in late 1996. SECID Agronomist Yves Jean had been studying methods of controlling a disease attacking igname tubers at the request of PADF, and through him Dr. Lea learned of the crop's importance to farmers. He asked Junior Paul to investigate the possibility of assisting PLUS farmers in the area of Plaisance to market their igname. Mr. Paul found a buyer in Port-au-Prince who placed a trial order for 500 lbs. Unfortunately, the igname tubers arrived in such poor condition that the buyer refused to pay for them. Due to this poor result the program was suspended, but it provided a learning experience that helped define roles and responsibilities for other marketing efforts. In 1998 Mr. Paul began

collecting more information about igname and found that areas of concentrated production include Plaisance and Pilate in the North and Cap Rouge in the south near Jacmel. The Grande Anse is also known to have zones where igname is a major crop. Three exporters expressed high interest in making trial shipments to test the feasibility of exporting igname.

With the collaboration of PADF, surveys were undertaken to evaluate the quantity of production in several regions, and meetings were held with farmer groups to educate them about the standards of quality required by the export market. The exporters would require a high-quality product, but were willing to pay 3 Gdes/lb to the farm groups. Of that money, the farmers would receive 2 Gdes/lb, double the local market price of 1 Gde/lb. From December 1998 through March 1999, approximately 18,000 pounds of igname were marketed through the program, in quantities of up to 3,000 pounds per trial shipment. The igname came from four farm groups located in two regions, Cap Rouge and Plaisance. The farmers were very pleased with the price offered via the program, and also with the fact that their payment was calculated based on the weight of the product as determined on a scale. The farmers felt that this method was highly preferable to the method used by their traditional buyers, who usually judged the weight by eye and negotiated both price and weight with the farmers. The exporters were not as pleased with the results of these trials because of quality problems; the first trial shipment was a total loss. However, they expected that the quality problems would be resolved over time.

During the following year's harvest season, exporters made two attempts at trial shipments, one successful. One attempt was made at the end of December 1999 by Mr. Germain Paul, and the other was made at the beginning of March 2000 by Mr. Wilhelm Reimers. Both times, the price offered to farmers was again 3 Gdes/lb for selected igname. Mr. Reimers successfully shipped 15,000 pounds of igname. Following the shipment, he notified SECID that the igname was well received by the U.S. market, but that PLUS should improve the farmers' competitiveness in regard to quality and price. He also let us know that Caribbean Produce would henceforth offer a price of just 1 Gde/lb, and that he planned to make another trial shipment of 10,000 pounds, this time buying the igname through another intermediary. In response, SECID wrote to Mr. Reimers to inform him that his proposed price was not acceptable to the farmer groups that we work with. The 1999-2000 igname trials could have been more successful if production estimates had not been greater than the actual level of production, if international conditions had allowed the exporters more leeway to offer better terms, and if farmer organizations had better followed our recommendations regarding the planning of the igname collection.

Mr. Reimers kindly shared his subsequent experiences with us. We report them here in the hope that this shared knowledge will contribute to an igname program that is ultimately a success for all involved. In May 2000 Caribbean Produce used an independent *fournisseur* (intermediary) to buy a total of 10,000 lbs of igname in the Beaumont region. (During the previous semester SECID, in collaboration with PADF, had encouraged igname production on five hectares of land owned by farmers belonging to three organizations in both Beaumont and Camp Perrin.) The Beaumont farmers received 2.50 Gdes/lb for their igname. The first shipment was a great success, but the percentage of rejects went up to over 40% for the next trial, due to a combination of poor selection at the farm level and rain damage en route. Mr. Reimers

decided to make another trial in Camp Perrin in June, with Agrotechnique S.A., a company affiliated with Caribbean Produce, as the *fournisseur*. Agrotechnique S.A. chose to buy igname at the public marketplace, and to use *machann* ("market women") to make the actual purchases. None of the 5,000 pounds collected this way met export qualifications. Following this disappointing result, Mr. Reimers suspended igname trials.

Meanwhile, SECID is working with PADF to increase igname production in various regions of the country, in the hope that export shipments will be more successful in the future. Using 6,000 pounds of rejected igname that was donated by Mr. Reimers at the end of last semester, PADF planned to produce igname "minisets". To make minisets, an igname tuber is cut into pieces and the pieces are treated with pesticide and fungicide and allowed to sprout. Then the minisets are planted individually. After one year, they may be replanted, and by the end of the second year they produce relatively disease-free standard-sized yams that are better accepted by the international market. It is hoped that the minisets produced by PADF and distributed to farmers in the North will produce enough igname to provide 90,000 pounds of export-quality product, or three containers' worth, next year. In Beaumont, one farmer is investing in production of igname by "macroset" (in this method, the entire tuber is planted). Should the production program be successful, there should be no lack of buyers.

Also concerning the igname production program, there is a possibility for collaboration with MARNDR and FAO. Mr. Lesky Dominique, the Director of FAO's Agricultural Inputs Program, showed an interest in developing synergy between the SECID/PADF program and the igname miniset production program run by MARNDR with financing from FAO. This program could include training in the miniset method of production, and also subsidized provision of igname plants.

Program Activities and Results for Malanga{ TC \l2 "Malanga} (Xanthosoma spp.)

SECID began its malanga production and marketing program in response to the interest that exporters Rainbow Agro Industries and La Finca expressed in making trial export shipments of the crop to the United States. During December 1998-January 1999 an exporter requested 4,000 pounds of malanga for shipment to the United States. A farm group in Don Don collected that quantity of malanga, and was to receive 1.5 Gdes/lb for its assembly role, while farmers received 2 Gdes/lb for the product. The price on the local market was 1 Gde/lb. In the end, the exporter selected and bought only 2,000 lbs of higher-quality product, so the farm group lost money. It was felt that the program had potential, however, if commercial quantities of malanga (up to 10,000 lbs per week) could be assembled. Consequently, SECID began a small program to expand production. Approximately 10,000 lbs of malanga was purchased by SECID and CARE for distribution to farmers in the Grande Anse, with the expectation that further trial shipments would take place when the malanga was harvested, at 8-12 months after planting. Distribution of the desirable Grande Anse variety "violette" to PADF Regions III and IV was also planned but rendered impossible by transportation problems. At the end of 1999, harvested malanga was redistributed in the same area to encourage production. However, no additional trial shipments were made, in part because the harvest season did not correspond with the time period when malanga commands the highest price in the United States, May through August.

Additionally, there is a high demand for malanga on the local market, and although the exporters were theoretically offering triple the local market price, the local market does not demand the high standard of quality that the international market does. It is easier for a farmer to sell his or her entire production to one buyer than to go through the selection process required for export crops. We do not expect that malanga will be exported from Haiti at any time in the near future.

Program Activities and Results for Pumpkin{ TC \l2 "Pumpkin} (Cucurbita moschata)

Caribbean pumpkin first came up in discussions with exporters in 1998. At that time, they believed that the local Haitian pumpkin was not of the uniform size and quality required by the international market and wanted to introduce appropriate foreign varieties. SECID began exploring this proposal, and thus was born the pumpkin marketing program. In January 1999, Junior Paul asked Mr. Raphael Larrea and Mr. Lucien Rousseau of Rainbow Agro-Industries if they would be interested in exporting local pumpkin or participating in a program to produce foreign varieties of pumpkin. Mr. Rousseau suggested that we begin with marketing of the local variety, which is valued for its taste. Mr. Larrea first asked for SECID's assistance in May 1999. He hoped to collect 30,000 lbs of pumpkin for a trial shipment. SECID met with organizations in many regions of the country to try to find this quantity, and by the end of the semester, four farmer groups in two regions, Jacmel and Camp Perrin, had participated in the program and sold 21,066 lbs of pumpkin. Mr. Larrea bought the pumpkin at 2 Gdes/lb, more than double the local market price of 0.50-0.75 Gdes/lb at the height of consumer demand.

After the success of the initial trials, SECID and partners PADF, CARE, and ASSET worked intensively to identify the best regions of production and interested farmer groups, and to train the farmers in quality criteria and management. The regions with the highest level of production were Jacmel, Belle Fontaine, Jérémie, and parts of the Northwest. SECID signed a production and marketing contract with Rainbow Agro Industries, which agreed to purchase up to 250,000 pounds of pumpkin between the months of November and February. During this time period approximately 155,000 pounds of pumpkin, with a value to the farm groups of 310,000 Gourdes, were sold through this program. Farm groups also benefitted from the experience of money management. After paying their members for the pumpkin and also paying the expenses incurred in collecting and selecting the pumpkin, they were able to put aside some money for other activities. For example, APKF, in Fond Jean Noël (near Jacmel) used part of its profits to support building a community school.

In 2000, SECID began to prepare early for the pumpkin harvest, which began in July. We focused on production, education of farmers so as to ensure a high quality product, and the extension of the program to new areas of the country. All of these activities were successful. The program was extended to the area of Mirebalais, and about 20 farmer groups participated, as compared with approximately 10 groups in 1999. During July through September, the beginning of the year's harvest season, over 170,000 pounds of pumpkin was exported– more than was exported during the entire 1999-2000 harvest season. This represents a farm group revenue of 347,574 Gdes. Once a profitable marketing chain was established for pumpkin, SECID began exploring ways that farmers could increase their production by planting higher-quality seeds. SECID worked with two cooperatives that selected 12 pounds of seeds for distribution to farmers, and Mr. Larrea provided 28 pounds of Panamanian pumpkin seeds for the same purpose. The Panamanian variety reaches maturity in 2½ to 3 months, as compared to 5 to 6 months for the local variety.

This marketing program provides a perfect example of how marketing activities alone can significantly increase farmers' incomes, and thus lead to increased interest in production. The intervention remained almost entirely on the level of marketing and administration training for farmer groups and assistance in coordination and communication with the interested exporter. The program benefitted everyone involved. Farmers were delighted to have increased their revenue from this product by double or triple what it would have been without the SECID program. Pumpkin was formerly grown mainly for domestic consumption and does not enjoy a large demand on the local market (with the exception of a very brief period of time at the end of the year). Pumpkin has now become an attractive crop for the farmers, not only because of the price they have received, but also because it is relatively easy to grow. Farm groups are gaining experience and enjoying revenues of their own, and Mr. Larrea is equally satisfied with the program. SECID's efforts in working with the farmers to ensure a high-quality product paid off, as the Haitian pumpkin was very well received on the international market. Whereas pumpkin exports to the United States from Haiti were previously negligible, they have increased to the point that the product is now included in the USDA report.

Program Activities and Results for Cacao (Theobroma cacao)

Cacao is a crop that helps conserve natural resources, stabilizing the soil and attenuating rainwater runoff on low-altitude hillsides, where it is usually grown in combination with larger shade trees. The cacao program got its first start in 1996 when Dr. Lea visited the cacao marketing cooperative in Don Don with a private sector marketer interested in exporting cacao. This led to subsequent meetings with the Mennonite Economic Development Associates (MEDA), an organization that had been extremely involved in cacao marketing in the mid-1980s. The private sector firm agreed at the time that it would attempt to assist the cooperative market its cacao along the lines previously established by MEDA. Early in 1997, at the suggestion of Dr. Wahab of USAID, Junior Paul helped a Port-au-Prince chocolate processor purchase 150 lbs of fermented cacao beans from Cooperative Jean Baptiste Chavannes in Grande Rivière du Nord. The buyer purchased the beans for about double the market price for unfermented beans. SECID's first large-scale involvement with cacao marketing came with the establishment of ServiCoop later in 1997. An introduction to ServiCoop, and a discussion of its

cacao marketing activities, can be found in a separate section of this report. For cacao, the first priority was to provide farmers and farm groups with a good market for their product. This was done through the creation of ServiCoop as an alternative to traditional marketing channels. Then, with farmers receiving a higher percentage of the export price of cacao, SECID instituted the Cacao Yield Improvement Program to help teach farmers simple techniques for increasing cacao production. Finally, SECID became involved with improving product quality, through the installation of greenhouse drying facilities for farm groups and the provision of quality control training for these groups. All three of these complementary programs are described in the following subsections.

Cacao Yield Improvement Program

In the context of establishing ServiCoop, USAID brought to Haiti Mr. B.K. Matlick, a cacao production specialist associated with the American Chocolate Research Institute and M&M/Mars. After visiting typical cacao gardens in the two major cacao-producing areas of the country, the North and the Grande Anse, Mr. Matlick suggested that farmers could be educated in simple cultural practices that would increase the yield of their trees by 20-30%. At the request of USAID, SECID developed a cacao yield improvement program (CYIP) based on B.K. Matlick's ideas. This program was implemented through a partnership between SECID, CARE, and PADF. SECID engaged cacao production expert Chris Stevenson as consultant to provide technical assistance to PADF and CARE extension agronomists and local farmer groups in efficient cacao production techniques. This was done through the use of demonstration plots. The CARE and PADF agronomists then had the responsibility of extending the techniques to cacao farmers, supervising the demonstration plots, and monitoring the progress of the plots by collecting data. CYIP's goal was to demonstrate to farmers how they can improve the efficiency of production within their existing cacao gardens; that is, how they can increase the yield of cacao from their existing gardens with a relatively small increase in investment. Improved prices and production translate into the higher profits that in turn encourage the farmers to continue to grow cacao.

Mr. Stevenson made his initial visit to Haiti in March 1999. He was accompanied by Dr. Purdy, a plant pathologist specializing in cacao diseases. USAID had requested that SECID use its PLUS Project funds to bring Dr. Purdy to Haiti to investigate reports of "Witches Broom" disease in Haiti, which had tentatively been identified during Mr. Matlick's trip. "Witches Broom" disease has been identified as the primary cause of a substantial reduction in cacao production in Brazil, so the report of the disease being in Haiti caused considerable alarm. Fortunately, Dr. Purdy confirmed that the diseased trees were actually infected with a relatively innocuous gall. Later in 1999, SECID published a report of cacao yield improvement activities to date, SECID/Auburn PLUS Report No. 48.

Between March 1999 and November 2000 Chris Stevenson made five trips to Haiti, choosing, establishing, and following up on 15 demonstration gardens. The gardens are located in cacao-producing areas in both the South, in the Grande Anse between Dame Marie and Jérémie, and the North, between Port Margot and Bahon. Most of the owners of these gardens are members of local cooperatives, and almost half of the owners are women. During his visits,

Mr. Stevenson focused on teaching correct pruning of the cacao trees, grafting, and shade adjustment (thinning out the branches of overgrown shade trees to reduce shading from over 50% total shade to the desired range of 35%-50%). He also answered questions about the control of disease and pests. Many of those who participated in the work done on the demonstration gardens also applied the techniques they learned to their own gardens. Farmers in Port Margot even organized cacao pruning teams that worked on dozens of gardens in the region.

During his visits, Mr. Stevenson discussed with CARE and PADF the importance of collecting harvest information that would allow a comparison between the production of the demonstration plots and that of the control plots. He also requested that project partners take special measurements of high-producing trees in order to determine which are the best producers in terms of bean size and quantity. These trees would be marked as budwood donors and provide material for grafting onto low-producing trees. Finally, Mr. Stevenson asked for pH testing of soil from the plots, since pH has a noticeable effect on cacao production. Data collection activities were slow to start. However, by early 2000, both organizations had recorded and shared with SECID basic information about the plots – demonstration and control plots for PADF, and solely demonstration plots for CARE. CARE had also completed pH and nutrient testing on soil samples. Later in the year, PADF provided soil samples that SECID sent for testing. PADF took some special measurements of high-producing trees, but to SECID's knowledge CARE did not do so.

Both CARE and PADF had planned to begin collecting harvest data seriously during the harvest season that ran from late February to May 2000. To assist its CYIP partners, SECID prepared a set of sheets to be used specifically for harvest data collection. CARE made an attempt at harvest data collection but did not use the sheets prepared by SECID. Instead, they collected data on a single date for one garden, and on two dates for one other garden; the dates were not noted. An accurate estimate of the yield of a cacao garden requires periodic visits to the garden throughout the harvest season. Also, for comparison purposes, the control plots should have been monitored along with the demonstration plots. The data was therefore unuseable. In the spring of 2000, CARE closed down its field activities in the Grande Anse, and did not transfer responsibility for the demonstration plots to any other organization or to the local Bureaux Agricoles Communales (BAC). PADF modified the sheets provided by SECID and began using them to record harvest data in February. They were assisted in the data collection by employees of the Ministry of Agriculture's BAC. Data received from PADF in May 2000 showed a significant increase in production for the demonstration plots as compared to the control plots. Anecdotal evidence also indicated that almost all of the demonstration plots were responding well to the interventions and that farmers were enjoying increased yields from their trees. Demonstration plot maintenance and data collection should be continued to ascertain the actual impact of CYIP.

Midway through CYIP, Mr. Stevenson acted as technical consultant for a Creole-language cacao production booklet entitled *Annou Plante Kakawo Byen*. This booklet, prepared by Sarah Belfort, is a revised edition of a booklet produced by MEDA in 1985. MEDA gave SECID permission to revise and reproduce the booklet. In 2000, copies of *Annou Plante Kakawo Byen* were distributed to cacao farmers and cooperatives by PADF in the North and by

CARE and others in the Grande Anse. SECID also distributed copies of the booklet to various development organizations, for their libraries. A collection of technical sheets provided by Mr. Stevenson was published as SECID/Auburn PLUS Report No. 50, *Training Manual for Improving Cocoa Production in Haiti.*

Greenhouse Drying Facilities

During the year 2000, SECID organized the installation of 17 cacao drying facilities for cooperatives or associations of cacao producers located in the north near Cap Haïtien and in the south near Jérémie. These drying facilities are actually commercial-grade greenhouses installed over concrete decks or patios. The greenhouses are 24 feet wide and 50 feet long with a maximum interior height of approximately 11 feet. The greenhouses will be used by the producers' organizations to sun-dry their cacao in preparation for sale. Note that a total of 19 greenhouses were purchased by the SECID PLUS project. Seventeen were installed at cacao purchasing centers and two were installed at the coffee marketing cooperative at Don Don, COOPACVOD, to support their coffee marketing program.

The greenhouses are being provided to the farm groups in response to observed problems with cacao quality. During the cacao marketing season beginning in August 1999, ServiCoop exported approximately 300 mt of cacao that failed to meet the quality standards set by the US Food and Drug Administration (FDA). This cacao had been purchased by M&M/Mars, Inc. and resulted in a significant financial loss for the company. M&M/Mars, Inc. plays a major role in supporting the development of the cacao sector in Haiti by providing a ready market for cacao produced and marketed in association with the USAID/SECID PLUS cacao program. M&M/Mars, Inc. had agreed to purchase cacao through ServiCoop at a preferential price with the expectation that Haitian farm revenue from cacao would increase significantly and that the purchased cacao would meet FDA and M&M/Mars, Inc. quality requirements. Thus, the export of some 300 mt of poor quality cacao was a shock to the USAID/SECID PLUS program. In response, personnel representing USAID, SECID, ServiCoop and M&M/Mars, Inc. met and decided on a program of assistance, to be financed by USAID through SECID PLUS, to address the cacao quality problem. The resulting program was accepted for funding by USAID at a level of $211,300; the funding was provided through an amendment to SECID's PLUS contract with USAID that was signed on February 25, 2000.

Implementation of the cacao quality improvement program began early in 2000. Approximately $20,000 was spent to establish ServiCoop's northern purchasing center at Cap Haïtien. Additionally, the planned $50,000 was granted to ServiCoop for recapitalization of its operating capital. The planned installation of increased cacao storage and heated cacao dryers was delayed due to uncertainty over the fate of ServiCoop, which raised the question of the sustainability of the heated driers in the absence of technical assistance. The installation of the covered (greenhouse) drying patios was completed as planned.

The justification for the use of greenhouses for drying cacao is based on the following considerations.

- To properly prepare cacao beans for export and to preserve their export quality, the beans must be dried to below 8% internal moisture within 10 days of harvest. Once properly dried in a timely manner, cacao quality can be easily maintained by keeping the cacao dry. If the internal moisture content of the beans remains above 8% for an extended period of time, mold growth in the interior of the bean occurs. If more than 4% of the beans develop internal mold, the cacao is no longer acceptable to the US market and must be exported to Europe or elsewhere at significantly lower prices.

- The traditional Haitian method of drying cacao is to spread it out in direct sunshine, turn it occasionally to increase drying efficiency, pick it up and bring it inside at night and when rain threatens to re-wet it. This process is continued over approximately five days until the cacao has been dried below 8% internal moisture content.

- The traditional cacao drying system (uncovered concrete decks or patios) often resulted in poor quality cacao because frequent rains prevented complete drying. Often the threat of rain led operators to decide to keep the beans in their warehouse during times when sunlight was sufficient for drying. At such times, the operators probably felt that it was not worth the effort to spread the cacao on the patio, when it might be necessary to collect it and return it indoors in just a couple of hours, so the cacao remained in the warehouse in ideal mold-growing conditions. When the beans were out on the drying patios, quickly appearing rains could fall before workers had enough time to collect the cacao, and it would be moistened by the rain.

- The system of movable covers (roofs supported by rollers resting on steel rails) used in the Dominican Republic was considered inappropriate for Haiti because the Haitian farm organizations do not own enough land at their cacao buying centers to accommodate the rolling roofs. Note that when the Dominican-style rolling roof is drawn back, it occupies as much land area as the drying patio it was protecting.

- M&M/Mars, Inc. consultant, B.K. Matlick, provided pictures and information on cacao drying patios which were roofed with transparent plastic sheeting. This type of facility, with a stationary roof, appeared to best suit Haitian conditions.

- When we considered the problems of constructing 19 of these facilities in remote Haitian locations, we felt that prefabricated, steel-pipe-framed greenhouses normally used in commercial horticultural enterprises in the US would significantly reduce construction time and problems when compared to the alternative of building frames from wood. We felt the commercial-grade greenhouses would be more likely to withstand strong wind conditions since they were designed for use in hurricane zones.

- The number of greenhouses (19) was decided based on the number that could be shipped in a single, 40' ocean freight shipping container.

The greenhouses were ordered from a Florida manufacturer in early April 2000. The greenhouses were released from Haitian customs in late August 2000 and construction was begun immediately, under the supervision of SECID Marketing Specialist Raymond Lerebours. Farm groups, also, were actively involved in supervision of the construction work. USAID/SECID funding covered many of the costs, such as the greenhouse structures and some cement and labor, directly, while most of the purchasing and contracting was done through the farm groups. Some farm groups contributed labor and some local materials, such as rock and sand. By the end of September 2000, 10 of the concrete decks had been completed and erection of the steel-pipe frames of the greenhouses had begun. By February 2001, the work was entirely completed. 17 greenhouse drying facilities had been installed for 13 cacao marketing groups.

Quality Control Training

In order to maximize the benefit of the cacao drying greenhouses to farm groups, SECID provided training in quality control measures to many of the groups. In September 2000, a three-person team provided this training to Jérémie-area groups. Ronald Laroche, who worked in quality control for ServiCoop, was responsible for the majority of the training. He showed the group members how to perform quality and humidity tests, gave them an explanation of the causes of poor quality cacao, and advised them on ways to improve quality. He also explained what happens to the cacao in Port-au-Prince, and how quality affects the price ServiCoop receives for cacao on the international level. Dalien Michel, ServiCoop board member, native of the Dame Marie area, and President of the group ATEDTD, facilitated meetings with the local groups and provided them with further advice, support, and encouragement. Sarah Belfort, SECID Program Assistant, was also along to represent SECID.

Each training session with a group, or with representatives from several groups, lasted approximately two and a half hours. The sessions included discussion of cacao harvest and post-harvest practices and how they impact quality. For example, a common practice that must be discouraged at all levels of the marketing chain is the mixing of different batches of cacao. At the farm level, a farmer may harvest small quantities of cacao from whatever garden he is working in on a given day. Understandably, he will most likely mix Wednesday's harvest in with Monday's harvest as he dries the cacao. Often, too, a farmer may stop drying cacao before it is completely dried, so that it will not lose weight before it can be brought to a buyer. The buyers, especially speculators, place the blame for mixing batches of cacao on the farmers, but they also employ this practice, mixing cacao bought from different farmers and cacao bought on different days. Ronald Laroche suggested drying various batches of cacao in separate areas of the drying patio, and perhaps including a slip of paper with the date the cacao was received. The practice of mixing cacao results in serious mold damage, but it will take time to discourage. Buyers (cooperatives and speculators) must also improve their storage practices. Many use pallets to keep sacks of cacao off of the floor, but not all buyers do so, and not all do so consistently. The training team advised the use of pallets or of pieces of wood.

The discussion generally led into and merged with a demonstration of quality testing. In cacao quality testing, 100 beans are randomly chosen from a batch of cacao and split open. The

number of these beans that show signs of internal mold translates into the percentage of cacao that is affected by mold. Anything over 4% is unacceptable to the US market, while 1% is considered high-quality cacao. The demonstration of quality testing, plus supervised testing practice by the meeting participants, was followed by demonstration and practice of humidity testing (using a Dole Model 400B Moisture Tester that the training team brought along). It is extremely difficult for most people to assess whether or not cacao beans have been sufficiently dried just by looking at them or touching them. Almost everyone who received humidity testing training expressed an interest in having a moisture tester. The quality of Grande Anse cacao should improve as a result of the greenhouse dryers and associated training, but the farmers and local buyers will most likely need continued training and encouragement to completely adopt improved practices.

Program Activities and Results for Coffee (Coffea arabica)

SECID first became involved with coffee marketing in September 1996. At that time Zach Lea met with IICA to discuss ways in which farmers in PLUS Project areas, such as Don Don, might be able to benefit from the marketing channel established by the Coffee Promotion Project. That marketing channel is the FACN (Fédération des Associations Caféières), which produces *Haitian Bleu*, a registered trademark specialty coffee. The FACN would have had to modify its By Laws to accept cooperatives from other areas, and this idea took a back burner. By late 1998 ServiCoop was actively involved in marketing coffee through other channels; ServiCoop coffee marketing activities, including recognition by Europe's Fair Labeling Organization, are discussed in a separate section of this report. During 1998, SECID began taking steps to increase the flow of better quality coffee from Haiti by bringing in a program to improve coffee processing at the village level where coffee is first treated after harvest. SECID brought a team of coffee processing and marketing specialists to Haiti to survey current processing centers and to make recommendations that formed the basis for a follow-on consultancy to improve practices at village-level processing centers. The coffee processing consultancies, implemented by Enterprise Works Worldwide (EWW), are discussed in another section of the report. SECID also provided direct support to a few coffee marketing groups. That support is described in the following subsections. A subsection on organic certification activities is included here, although organic certification was in effect a joint project of SECID and ServiCoop.

Marketing Credit for Farm Groups

By 1999, SECID and ServiCoop, working together, had developed new markets for coffee from farm cooperatives at Don Don (near Cap Haïtien) and Thiotte (near the frontier with the Dominican Republic in southeastern Haiti). However, the cooperatives did not have cash to use in purchasing and processing coffee from their farmer members prior to payment by the international buyers. The international buyers were reluctant to advance marketing funds to the farm groups and ServiCoop did not have adequate working capital to do so. ServiCoop was to do final processing on the coffee and export the coffee as the agent of the farm cooperatives.

To solve the financial problem, SECID negotiated an agreement with ServiCoop to control one of its lines of credit. SECID placed funds into ServiCoop's local bank, which granted the line of credit. This deposit allowed an expansion of the line of credit. SECID then negotiated agreements with the cooperatives to which SECID would advance marketing funds. The agreements stipulated that the advanced funds, including interest charged by the bank, would be repaid with the proceeds from the sale of the coffee to the international buyers. By agreement with the farm cooperatives, the value of the marketing advances would not exceed 70% of the sales value of the coffee; thus, repayment was assured. Marketing fund agreements were made with the cooperatives at Don Don and Thiotte. The agreements were based on a single container of coffee. The funding-marketing cycle proceeds as follows: the funds are advanced, the coffee is sold, ServiCoop and the cooperative receive the payment, ServiCoop and SECID settle accounts. If there is a sales agreement for an additional container of coffee, the lending cycle can be repeated.

It was anticipated that the need on the part of these cooperatives for the credit program would end after one coffee marketing year. The international buyers would be willing to advance marketing funds to the cooperatives the following year. Other sources of funds could be arranged for coffee marketed to other markets. For example, SECID was advising some cooperatives to market their coffee to the *Haitian Bleu* marketing network, which advances marketing funds to participating farm groups. Based on the 1999 experience, it was believed that the farm cooperatives and ServiCoop might be able to arrange with the local bank to provide a line of credit using marketing contracts as the guarantee for marketing advances. In effect, this would replace the cash deposit made by SECID with a marketing contract. Thus, the short-term advance from SECID would have purchased the experience required for the cooperatives, ServiCoop and the bank to develop methods to accomplish the transaction without SECID.

Organic Certification Activities

Our efforts in organic certification were initiated in 1999 by Mr. Michel Gélis, a French businessman who had been purchasing coffee through ServiCoop. Mr. Gélis convinced us that certified organic products represented an important growing market in Europe due to many Europeans' concern over what they consider unwise manipulation of the world's natural resources. SECID therefore included a small organic certification program in the budget and amended scope of work that was accepted by USAID in its amendment of the SECID PLUS contract on 25 February, 2000. The program planned to certify cacao and coffee produced near Cap Haïtien as organic. It would cover coffee produced by COOPACVOD near Don Don and cacao produced by a group of cacao producers located near Grande Rivière du Nord. COOPACVOD had been chosen as the best group to initiate organic coffee marketing because its members use no inorganic inputs on their coffee.

Implementation of the organic certification program began in early March 2000 with the arrival in Haiti of Michel Gélis of Café Michel, France; Michel Reynaud of ECOCERT International, Germany; and two French businessmen, Olivier Bernadas of OLIANE and William Pecout of Arco Ocean Indien. Along with Henry Bélizaire of ServiCoop and Zach Lea of SECID, this group visited the offices of COOPACVOD near Don Don. Mr. Reynaud

inspected the cooperative's records of purchases of coffee from its members and concluded that the records were adequate to fulfill the "tracing" requirements of organic certification which mandate that coffee sold as organic can be traced from the processor in Europe back to the farmer who produced the coffee. Mr. Reynaud also interviewed three candidates, presented by ServiCoop and PADF, for the post of inspector. The inspector was hired on a part-time basis in Summer 2000 to make inspections that were to enable organic coffee to be exported from the Don Don cooperative later the same year. The inspector's responsibility is to visit coffee farmers and their cooperative to certify various aspects of the production and marketing process as it takes place during the years of certification. The inspector will also be available to certify other products as the need arises, a possibility that could greatly encourage other organic product marketing efforts.

Mr. Gélis pledged to purchase the first container of organic coffee (first in Haitian history) from COOPACVOD during the 2000-2001 season. It was expected that ServiCoop would provide the final processing and export services for the coffee. However, when it became apparent in June-July that ServiCoop might not be in business to process the coffee from Don Don, SECID notified Mr. Gélis that it could not pay for the organic certification process until it became clear how the coffee could be exported. Mr. Gélis responded that he wanted to proceed with the certification process in spite of the unresolved questions and would personally pay for the certification. At this point, SECID offered to assist with the certification process by providing logistical support to the organic certification official during his inspection visit in August 2000. The organic certification process proceeded as planned; however, we have not yet been given a report from the certifying agency, ECOCERT. Unfortunately, we then received disappointing news from Don Don. Francis Dubois, General Manager of COOPACVOD, reported that due to the intense level of insect attacks on coffee cherries in the producing area around the cooperative, COOPACVOD had decided not to purchase and process coffee during the 2000-2001 season. Thus, the shipment of the first container of organic coffee from Haiti has not yet taken place.

Other Activities at Don Don

As part of its program of assistance to COOPACVOD, SECID PLUS installed two greenhouse coffee dryers on the cooperative's premises at Don Don in 2000. The greenhouses were imported into Haiti along with 17 other greenhouses that were installed at cacao purchasing centers. All of the beneficiary groups were actively involved in supervising the construction of the structures. The installation at Don Don was prompted by observations by a team of SECID PLUS coffee processing consultants that rainy weather conditions at Don Don during the coffee harvest limited the production of high quality coffee by the cooperative. The consulting team felt that the cooperative could use the greenhouses to sun-dry its coffee without danger of the quality of the coffee being damaged by unforeseen rainfall. Instead of spreading the coffee on uncovered concrete decks or "drying patios" (*glasi*) the cooperative can now spread some of its coffee on the concrete floor of the greenhouse. The transparent cover of the greenhouse will allow sunshine to reach the coffee while protecting the coffee from rainfall. We expect that the installation of these two greenhouses will allow COOPACVOD to fully test this approach to drying coffee at Don Don.

Activities at Baptiste

In response to requests from coffee farmers near Baptiste (a town in the Central Plateau near the Dominican border), and an analysis of their situation relative to coffee marketing, SECID began in 1999-2000 to assist the farmers market their coffee. SECID's approach is to encourage several smaller farm cooperatives and associations to join together in a single organization and market their coffee cooperatively to the highest value market available. Targeted markets are FACN *Haitian Bleu*, the European Fair Trade Coffee buyers, or traditional Haitian coffee exporters. To present the farmers' coffee to these potential buyers required that the farmers develop a wet processing center and learn to produce high quality parchment coffee. SECID took two main steps to assist the Baptiste farmers achieve their marketing goals:

- Installation of a wet process center at Baptiste using funds from the European Union
- Application to the Fair Labeling Organization (FLO) for certification of the central Baptiste farmer organization as a fair trade farmer marketing organization.

The major problem faced by the farmers at Baptiste was the lack of a wet processing center. Although Baptiste has been a center of coffee production with several relatively large-scale privately-owned wet processing centers and a USAID-financed coffee research and extension station, the region has been almost completely abandoned by the private and governmental sectors over the past ten or more years. When SECID visited the area with EWW in 1999, all of the wet processing centers were abandoned and in a state of nearly complete destruction. At that time, we spoke with the farm groups and found that they were selling all of their coffee to buyers in the Dominican Republic. The farmers indicated that they felt the absence of a practical alternative to the Dominican market placed them in a very poor negotiating position and resulted in lower prices and a lack of market services. They requested our help in finding ways to market their coffee through Haiti. We made some investigations and found that the European Union's STABEX program was offering assistance to coffee producers and might be receptive to a proposal from the Baptiste group.

SECID Extension Specialist Valdo Jean escorted the European Union's Chief of Delegation to a meeting with the farm groups, where he indicated his support for the farmers' efforts. It was suggested to the groups that they unite as a single organization so that they would have a better chance of obtaining both assistance from the EU and recognition from FLO to enable them to market coffee through the fair trade network. The farm groups decided to unite under an existing cooperative, CAB, and began working more intensively with us to achieve their marketing goals.

SECID suggested that developing a wet processing center fast enough to be in place in time for the Fall 2000 harvest season might be possible if the group could obtain permission from the Haitian Government to build their wet processing center on the grounds of the USAID-financed coffee research station facility at Baptiste. Building at the research station would mean that the wet processing facility would be able to use the station's water supply, warehouse and drying patio. This would reduce the cost and time of installing the wet processing center.

Together with the farm group, we spoke to a prominent coffee official at the Haitian Ministry of Agriculture, Agronomist Julien Etienne, who agreed to write to the Minister requesting permission for this activity. The Minister replied positively and in the meantime, SECID and CAB submitted a joint proposal to the National Office of STABEX for funding to develop the wet processing center and provide training to its operators.

The SECID/CAB proposal was accepted on August 16, 2000. Construction of the wet processing facility was managed by Engineer Thony Mondésir, who had recently built several wet processing centers for the FACN and knew how to deal with the problems of building such facilities in remote areas of Haiti. The construction was completed by the end of October 2000.

Valdo Jean and Eduardo Ramos of the SECID/EWW/FACN coffee sub-project provided approximately two weeks of training to the operators of the Baptiste wet processing center in early November 2000. As the Baptiste facility began to produce parchment coffee, SECID/EWW expected to assist in presenting samples of the coffee to prospective buyers and help the farm group to negotiate its first coffee sales.

SECID helped CAB present its application to the Fair Labeling Organization (FLO) for Certification as a fair trade farmer marketing organization in May 2000. FLO replied that it would not be able to make the required certification visit to CAB during the visit that it had scheduled for Haiti for Summer 2000. Thus, CAB would most likely not receive certification to market fair trade coffee during the year 2000.

Program Activities and Results for Other Marketing Programs

Programs described in this section did not result in any successful export trials or other large-scale marketing activities, although the hot pepper program may have potential for expansion. Descriptions of these programs are included in this report for informational purposes, to aid understanding of what criteria are required for successful marketing programs. Other products that were considered for marketing, but never developed into actual programs, are: pineapple, mirliton or chayote, essential oils, *latanye* (a type of palm frond used in basketry), and neem seed for natural insecticide.

Okra{ TC \l2 "Okra} (Hibiscus esculentus)

Unlike some of the other crops targeted by SECID's marketing programs, with okra, the local variety is not acceptable to the international market. However, because Mr. Larrea was interested in exporting it, and because it is a traditional crop in Haiti, in late 1999 SECID decided to establish an okra production and marketing program, headed by Marketing Specialist Raymond Lerebours. One farmer from the group APEM successfully planted a *carreau* (1.29 hectares) of okra near Camp Perrin. Other plots, planted by the group CEHPAPE in Léogâne and in collaboration with PADF in Mirebalais, did not turn out well. Okra production from Camp Perrin alone was not of sufficient quantity for export. The minimum quantity that may be profitably exported is 3000 pounds, while each harvest from the lone APEM plot was an average

of just 270 pounds. Without any refrigeration facilities, okra cannot be stored and must therefore be shipped very soon after each picking– 2 or 3 times per week. There were other barriers to continuation of the program as well. Mr. Larrea decided soon after the okra was planted not to continue with the program in Camp Perrin, due to its distance from Port-au-Prince and the costs involved in transporting the product twice a week. He also discovered that the export market he was targeting would require a chemical treatment of the okra that would render the product unacceptable to consumers. The farmer who produced the okra had no choice but to sell his crop on the local market in Les Cayes, and he suffered a small loss. SECID offered him a subsidy to offset this loss and the loss of expected income that he incurred by committing to the program. For obvious reasons, this marketing program is not being continued; however, SECID was able to collect useful data on production and costs. That data was presented in Appendix B of SECID's semi-annual report of 1 April - 30 September 2000.

Hot Pepper{ TC \l2 "Hot Pepper} (Capsicum annuum)

This marketing program, like the okra marketing program, required simultaneous production and marketing activities. Exporters and a US buyer expressed their interest in a hot pepper program in early 1994 and 1995, but such a program could not get underway due to problems such as the embargo and, subsequently, lack of funds. The program began in July 1999 with the preliminary identification of regions able to produce sufficient quantities of hot pepper variety Scotch Bonnet, also known as habanero. SECID Marketing Specialist Raymond Lerebours reached agreements for production with representatives of several organizations in the south, southeast, and central regions of the country. Then he negotiated with interested exporters. SECID signed a production contract with Mr. Raphael Larrea (of Rainbow Agro Industries) for 3,000 lbs per week and a contract with Mme. Nancy Mourra Fombrun (of Agropack) for 7,000 lbs/wk. The price they agreed to offer, $0.40/lb, was approximately double the local in-season price. Hoping to ensure a supply of export-quality hot pepper, SECID provided a total of 7 lb of the seed to farm groups for planting. Unfortunately, a number of production problems were encountered. Flooding destroyed the first plantings. Other plantings suffered from drought, pests, and mismanagement. This was true for plots managed by PADF as well as those managed by most of the farm groups; the most successful plots were managed by APEM, near Camp Perrin, and covered an area of approximately two *carreaux*. Even before the plants were producing enough hot pepper for export trials, other buyers had already shown an interest in the crop. For example La Famosa purchased 700 pounds of hot pepper from APEM at 25 Gdes/marmite, which translates into a slightly higher price than the exporters were offering. It is using the hot pepper in a tomato sauce and may also use it to produce a hot sauce for the local market. La Famosa's interest could result in a regular production contract. Mid-2000, three export trials took place in collaboration with Agropack. The first trial shipment was of insufficient volume for export, the second did not succeed because of planning problems within Agropack, and the third shipment was of poor quality because political problems delayed transport and the hot pepper had started to spoil. Despite all of these problems, we believe that the program has potential. Raymond Lerebours recommends that any continuation of the hot pepper production and marketing program be carried out within traditional hot pepper production areas, and include technical assistance.

Pigeon Pea (Cajanus cajan)

Responding to a request from an exporter in late 1998/early 1999, Junior Paul organized a trial shipment of fresh pigeon pea (*pois congo*, in French) from Cap Rouge near Jacmel. Fresh pigeon peas are very fragile and must be harvested in the cool hours of the morning and quickly placed under refrigeration to preserve quality. In order for the trial shipment to be economical, the exporter wanted at least 3,000 pounds of the product. Given the scattered nature of small-scale farms in Haiti, assembling this quantity of pigeon peas within a single morning was a significant organizational challenge. Amazingly, some 4,400 pounds of pigeon pea were collected from approximately 120 small-scale farmers and delivered on time to the exporter at the designated collection point. Junior Paul led the effort and was assisted by PADF field personnel and the leaders of the farm group. Farmers were pleased with the trial because they earned 3 Gdes/lb for the pigeon pea versus the current local market price of 1.5 Gdes/lb. Unfortunately, the exporter was not able to get the pigeon peas cooled fast enough after accepting delivery of them from the farm group and the majority of the peas spoiled. The exporter was not interested in attempting another trial, and so this marketing program was not continued.

Dried Beans (Phaseolus vulgaris)

In late 1996, the PADF marketing agent in Region II, near Jacmel, found that the farmers there were interested in finding a market for their beans that was better than the Port-au-Prince market. With Junior Paul's assistance and the support of PADF's regional agronomist, the marketing agent made contact with her counterpart in PADF's Region IV, near Mirebalais. Working together, the three marketers put together a sale of 6,600 marmites of beans from Region II farmers to Region IV farmers, bypassing the Port-au-Prince market completely. Junior Paul made an analysis of the established pricing system and showed the farmers how they could make more money by selling their beans at what appeared to them to be a lower price than that offered by the Port-au-Prince buyers. The Port-au-Prince buyers were offering 40 to 42 Gdes/marmite, a price that seemed to compare favorably to the 35 Gdes/marmite offered by the farm groups in Region IV. The "trick" in the Port-au-Prince price was that the marmite measure used there was actually 40% larger than a standard marmite. (The Port-au-Prince "marmite" was a 7-*gode* measure, while the Region IV marmite was a 5-*gode* measure.) Dr. Lea suggested that Junior Paul express the price in terms of pounds rather than volumetric (and variable) marmites. Expressed in this manner, the Port-au-Prince price was 5 Gdes/lb while the Region IV price was 5.30 Gdes/lb. The farmers appreciated the analysis and the sale was completed. More than six farm groups took part in the activity. The total value of the sale was 231,000 Gdes. Since the Region IV marmite weighed 6.6 pounds and the difference between the Port-au-Prince and Region IV prices was 0.30 Gdes/lb, the farmers realized an extra 1.98 Gdes per marmite on the transaction, or an extra 13,068 Gdes total. The reason that this program was not continued may have been that the reliance on PADF staff was not sustainable. Alternatively, transportation costs may have been prohibitively high, or there may have been some other reason.

SERVICOOP

Introduction

The creation of ServiCoop was perhaps the most innovative initiative of the PLUS Project. Dr. Lea conceived and designed ServiCoop as an agricultural products marketing cooperative. SECID's USAID Project Officer supported the initiative from SECID's first presentation of the idea in December 1996, and USAID staff within the Economic Growth Office provided several valuable suggestions relating to staffing and performance incentives for ServiCoop staff. The goal of ServiCoop was identical to the goal of the SECID marketing assistance program: to increase farmers' income through efficient marketing. The difference was that ServiCoop was designed as a private sector business that would support itself through its marketing activities. As such, it could establish permanent marketing relations with farmers, buyers and consumers. SECID could not do this, and as a result often found itself in the difficult position of trying to establish permanent marketing relations between farmers and buyers without entering directly into the relationship. ServiCoop was different from most other private sector businesses because it was a non-profit, a cooperative committed to returning a major portion of its profits to the farm groups from which it purchases product. It planned to focus first of the export of cacao, and then, as soon as resources permitted, begin marketing other agricultural products.

USAID authorized the creation of ServiCoop on July 27, 1997, and ServiCoop received start-up funding, valued at approximately $250,000, from USAID in September 1997. By the end of September, it had already received authority from the Haitian government to operate as an agricultural marketing cooperative; hired its staff and established its offices and warehouse; established cacao selling arrangements with US buyers; and established purchasing arrangements with 8 farmer groups. By January 1998 ServiCoop had invested all of its start-up funding and was operating on its earnings from agricultural marketing activities and a small monthly stipend of approximately $2,000 from USAID. At the end of its first year, ServiCoop completed reception of all USAID financial assistance programmed at the time of its initiation. This included $150,000 in cash and $27,000 paid over 12 months to the general manager of ServiCoop, as well as in-kind assistance in the form of used office equipment and vehicles amounting to approximately $100,000.

During 1998, it became obvious that ServiCoop should proceed to develop other lines of business rather than depend solely on cacao exports. Coffee was an easy choice, since it is a major export of Haiti, and since there was an already existing coffee processing facility that ServiCoop was able to lease and move into. However, ServiCoop was not in a financial position to take advantage of the opportunity without additional assistance. Between July and November 1998, USAID provided $96,450 to ServiCoop via SECID to assist ServiCoop refurbish the coffee processing facility and enter the coffee export business.

ServiCoop was controlled by individuals associated with the PLUS Project, so most of its marketing activities were done in close coordination with that Project. The primary focus of those activities was cacao (cocoa beans), which is discussed below. ServiCoop coffee marketing activities, begun in mid-1998, are also discussed in a separate section below. There were a few additional marketing activities. During the first six months of its operations, ServiCoop assisted farm groups market 60 mt of black beans, 30 mt of maize, and 10 mt of sorghum. In 1998 and 1999, ServiCoop marketed dried immature sour oranges, as discussed in a section of "SECID Marketing Programs". Also, during 1998, ServiCoop acted as an intermediary for farm groups selling mangos to Port-au-Prince-based exporters. (See the mango section of "SECID Marketing Programs.")

Between September 1998 and March 1999, the international price of cacao fell and the average sale price of cacao sold by ServiCoop during that time was $1284/mt, as compared to about $1600/mt during the previous semester. The drop in the international price, combined with misunderstandings between ServiCoop and its farm cooperative suppliers/clients, resulted in financial losses for ServiCoop throughout most of the semester. USAID provided assistance to keep ServiCoop in business: $44,000 of operating capital, and two used trucks valued at about $60,000. In April 1999 the ServiCoop Board of Directors approved a plan to open a cacao-purchasing center in Dame Marie. USAID allowed SECID to use $50,000 of PLUS Project funds for the establishment of the purchasing center. Those funds were spent on buildings and equipment, a truck, and to guarantee a line of credit for operating purposes.

In late 1999, ServiCoop learned that approximately 300 mt of cacao that it had shipped to M&M/Mars during September, October, and November were below acceptable quality standards. The Dame Marie purchasing center had substantially increased the flow of cacao from the Grande Anse, but ServiCoop had failed to adequately control the quality of that cacao. Steps taken to address the quality problem are detailed in the Cacao section below. Also, in December 1999, ServiCoop instituted the standard practice of marketing its cacao to M&M/Mars through a broker, instead of directly to the company as it had done previously. The broker receives the cacao and offers it for sale to M&M/Mars. M&M/Mars checks the quality of the cacao and then completes the purchase only if it meets industry standards. This process ensured that M&M/Mars did not purchase any more poor quality cacao from ServiCoop. Unfortunately for ServiCoop, the process cost an additional $30 per metric ton and raised ServiCoop's operating capital requirements, since ServiCoop had to wait several weeks to be paid for the cacao in the "pipeline."

ServiCoop's efforts to pay the highest possible prices to farmers unfortunately contributed to its financial difficulties, which were exacerbated by the fact that the international price of cacao fell to about $750/mt over 1998-1999. Further, business analysts have indicated that ServiCoop was under-funded at its initiation. To assist ServiCoop in facing these challenges, in 2000, USAID granted ServiCoop $50,000 to cover operating losses. It also transferred to ServiCoop another two trucks valued at $60,000, and provided $25,000 for use in setting up a cacao purchasing center in Cap Haïtien. It was expected that the purchasing center would attract higher volumes of cacao from that region, and duplicate the success of the Dame

Marie purchasing center. However, the expected increase in volume did not materialize. ServiCoop experienced operating losses on its cacao operations during January-June 2000.

During the summer of 2000, ServiCoop suspended commercial operations as a result of operating losses it incurred on its cacao and coffee marketing operations. Faced with a financial crisis, the Board of Directors of ServiCoop decided to transfer management control of ServiCoop to a new group of ServiCoop members who would agree to inject new financial capital into ServiCoop and to continue to strive to achieve the objectives of ServiCoop, namely, to operate ServiCoop in a manner that will assist small-scale Haitian farmers earn higher revenues from agricultural products marketed through ServiCoop. ServiCoop ended its third fiscal year in August 2000 having suffered a substantial loss for the year. Despite the problems, which were in part brought about by changes in international markets, we can also report successes. With the steps taken to restructure ServiCoop's management, we believe that ServiCoop will weather the present storm and will continue to contribute to the improved welfare of Haitian farmers.

ServiCoop Activities and Results for Cacao

Cacao marketing was the primary focus and economic foundation of ServiCoop. ServiCoop exported its first 40-foot container of cacao (20 mt) in December 1997, and by the end of March 1998 it had exported 6 containers, or 120 mt. A specific objective of the cacao marketing program was to increase the proportion of the international price of cacao received by farmers from the previous norm of 30% to the target of 50%. The period of time projected to achieve that proportional increase was two years. The objective was achieved within the first year. When ServiCoop entered the market, existing buyers bid up the price of cacao. The farm-level price of cacao rose from 4.5 Gdes/lb to 6.5 Gdes/lb within a few months, while the international price remained about the same. (In March 1998, it was US$ 1650/mt.) In addition, those farm groups that marketed their cacao through ServiCoop received an additional payment for their cacao at the end of the year, in the form of profit-sharing (*ristourne*). For those groups, the goal of 50% of the international price of cacao was exceeded. In later years, when the international price of cacao dropped and the farm-level price of cacao was forced to decline as well, the farm-level price still remained at about 50% of the international price. It would not have been nearly that high without the existence of ServiCoop.

In its first year of operations, September 1997 through August 1998, ServiCoop exported a total of 300 mt of cacao, or approximately 10% of Haitian cacao exports. As noted above, the international price was in decline by the end of 1998, and ServiCoop was forced to adapt to the changing conditions of the market. In December 1998, the Board of Directors decided that ServiCoop should no longer promise farmers a share of profits, but rather pay them the highest prices possible at the time of sale. It was also decided that after reserving a responsible percentage of the profits, ServiCoop would provide profits to its farm cooperative clients in the form of material improvement to their cacao marketing capacity rather than in the form of cash.

Another decision, taken in April 1999, was to open a cacao-purchasing center in Dame Marie, in the Grande Anse. This center allowed ServiCoop to remain in business despite adverse market conditions. The increase in volume of cacao purchased and exported by ServiCoop more

than made up for the continued decline of the international price. Prior to the establishment of the purchasing center, ServiCoop received fewer than 100 sacks of cacao per week from the Grande Anse, but during the 1999 season ServiCoop received 300-500 sacks per week. Clearly, the decision to open the center was a good strategic move. It was also a good move from the point of view of ServiCoop's underlying goal: to increase farmers' incomes. When established exporters heard of ServiCoop's plan to set up the Grande Anse buying center, they raised prices from 3 Gdes/lb to 4 or 4.5 Gdes/lb almost immediately. Thus, ServiCoop's presence, as desired, increased competition in the industry. That resulted in gains for *all* cacao farmers, and not only the farmers who sold through cooperatives dealing with ServiCoop.

In part due to the increased volume of cacao coming from the Grande Anse, ServiCoop was able to export 1,000 mt of cacao during the 1998-1999 year, and it was expected to maintain that level of exports for the 1999-2000 year. (ServiCoop's actual cacao exports for 99-00 totaled 738 mt.) However, as noted above, the mounting volumes of cacao were not subjected to adequate quality control measures, and 300 mt of poor quality cacao had been shipped to M&M/Mars before the problem was discovered. In addition to the step of selling through a broker, USAID, M&M/Mars and ServiCoop took other steps to assure that ServiCoop would ship acceptable quality cacao. The steps included the following:

- M&M/Mars provided two days of quality control training in the USA to three quality control personnel from ServiCoop. Most of the travel costs were supplied by USAID.
- ServiCoop instituted tighter quality controls at its facility at Port-au-Prince:
  a. Better lighting installed over quality control table
  b. Magnifying glasses obtained for use by ServiCoop quality control personnel
  c. Instituted policy of not shipping to M&M/Mars cacao with mold levels over 2%
- USAID approved additional funding to ServiCoop and to the farm cooperatives or associations from whom ServiCoop purchases cacao for the following purposes:
  a. $57,800 for 16 green-house-covered cacao-drying patios at farm association locations outside of Port-au-Prince, and 1 at ServiCoop, PauP
  b. $50,000 for ServiCoop to establish a cacao-purchasing center at Cap Haïtien
  c. $50,000 in additional operating capital for ServiCoop
  d. $10,000 for additional storage at ServiCoop's Dame Marie facility
  e. $35,000 for fuel-heated cacao dryers
  f. $2,500 for additional testing equipment for ServiCoop
- M&M/Mars will send a team of quality control experts to Haiti to observe the cacao marketing process from farm to export container and make recommendations for improving it.

ServiCoop Activities and Results for Coffee

ServiCoop coffee activities began with an alliance it formed with French coffee roaster Michel Gélis, who visited Haiti in the early summer of 1998. ServiCoop General Manager Henry Bélizaire emphasized to Mr. Gélis ServiCoop's commitment to exporting a quality product. Mr. Gélis responded by giving ServiCoop its first contract for a container of green

coffee; a container holds 250 60-kg sacks. (Mr. Gélis's involvement with coffee marketing activities eventually extended to organic certification activities, which are discussed in a separate section under "Coffee," in "SECID Marketing Programs)."

Mr. Gélis told Mr. Bélizaire that he would like to help ServiCoop become the recognized coffee shipper for Europe's Fair Labeling Organization (FLO). FLO's primary purpose is to help assure that small-scale coffee farmers receive "fair" prices for their coffee. It does this by allowing coffee merchants in Europe, who have complied with FLO regulations, the right to label their consumer packages of coffee with the FLO insignia. The FLO insignia certifies that the coffee merchant has paid coffee farmers the FLO-determined price for the coffee so labeled. European consumers, sensitive to charges that small-scale farmers have been economically exploited by powerful coffee buyers, are willing to pay a premium for coffee marketed under the FLO label. With FLO certification, ServiCoop could bring this preferential pricing system to Haitian farmers and further achieve ServiCoop's goal of increasing farm incomes while simultaneously increasing its economic stability via its ability to market large volumes of agricultural products. Henry Bélizaire had already begun working on achieving FLO recognition before he met Mr. Gélis. However, since Mr. Gélis was an established buyer and a FLO-certified marketer of coffee in Europe, his favorable recommendation of ServiCoop to the FLO helped ServiCoop obtain the FLO certification. A FLO certifying team visited Haiti in February 1999, and subsequently made a recommendation to their European office that ServiCoop and five of its associated cooperatives should be certified to market coffee through the fair trade network. With the FLO certification, ServiCoop could market coffee from the certified cooperatives to certified coffee buyers in Europe at a price that would not fall below $1.24 per pound. With comparable international prices of coffee at $1.06 in early 1999, the fair trade price was about 17% above prices farmers could expect to receive through other buyers.

Henry Bélizaire worked hard to convince farm cooperatives to sell coffee to the French buyers' group represented by Michel Gélis. The cooperatives agreed, and began delivering coffee to ServiCoop for processing. With this step, ServiCoop was able to put the large coffee processing facility it had rented into commercial production. As the processing proceeded, ServiCoop sent samples of the finished green coffee to the European buyers. The buyers liked the quality of the coffee and ordered more; however, due to the lateness of the season, ServiCoop and the farmers could arrange only one additional container before March. Thus, ServiCoop exported its first two containers of coffee during January and February of 1999. Shortly after the containers of coffee arrived in Europe, the FLO certification was awarded to ServiCoop and the farmer cooperatives that provided the coffee. Michel Gélis requested that FLO certify one of the previously purchased containers of coffee as fair trade coffee to be marketed under the FLO label. FLO accepted to make this certification on the condition that the farmers be paid the difference between the FLO price of $1.24 per pound and the price actually paid which was approximately $1.08 per pound. Michel Gélis and the other French buyers paid the difference and the additional sales revenue was shared between ServiCoop and the farm cooperatives in a manner that was approved by FLO. The farmers were happy to be so quickly rewarded for having worked with ServiCoop.

In addition to forming marketing alliances with the European fair trade organization, FLO, and with Michel Gélis and other European coffee buyers, ServiCoop developed marketing relationships with Oxfam Europe and the FACN. (For more about the FACN, refer to the following section, "Coffee Processing Consultancies.") In 1999, Oxfam Europe was considering suggesting to several coffee cooperatives with which it worked near Cap Haïtien to purchase final coffee processing services from ServiCoop. ServiCoop assisted the FACN in exporting its *Haitian Bleu* coffee by picking up the finished coffee from near Jacmel, loading it into a shipping container and expediting its customs processing and export.

During the fall of 1999, ServiCoop exported another two containers of coffee under fair trade conditions, one for the coffee producers' cooperative COOPACVOD of Don Don, and one for the Association des Producteurs de Café de l'Arrondissement de Belle-Anse (APKAB) of Thiotte. This brought the total number of containers of coffee exported in 1999 to four. In 2000, ServiCoop exported three containers of APKAB coffee under fair trade conditions. ServiCoop earned a reasonable fee for its processing and exporting services, between $0.13 and $0.15 per pound of coffee exported. Unfortunately, the coffee delivered to ServiCoop from APKAB for the preparation of the last container was not of the same high quality as previous deliveries, and ServiCoop lost approximately $4,250 on that container.

ServiCoop experienced similar problems with coffee quality in connection with another container of coffee, which it shipped during July 2000. This was a container of natural (unwashed) coffee. In violation of established procedures which specified that ServiCoop should not purchase coffee on its own account but should sell only processing services, ServiCoop's General Manager, Henry Bélizaire, purchased the coffee on the account of ServiCoop from one or two coffee intermediaries. It turned out that the coffee was of very poor quality. Hence, after processing and sorting, ServiCoop could only export 208 bags rather than the 270 bags planned. The resulting loss on the container was approximately $6,350.

Coffee Processing Consultancies

Initial Consultancy with Enterprise Works Worldwide (EWW){ TC \l2 "Consultancy with Enterprise Works Worldwide (EWW)}

Based on its experiences with ServiCoop in coffee and cacao marketing, SECID was practically certain that it could assist coffee producers sell more coffee at better than traditional market prices if it could arrange for farm groups to prepare better quality coffee. To help confirm or strengthen this expectation and to generate specific recommendations for better marketing of coffee, in 1999 SECID engaged EWW to conduct a survey of coffee marketing groups in areas of Haiti not currently participating in major coffee industry development programs such as USAID's *Haitian Bleu* marketing program.

The EWW team noted many instances in which the Haitian coffee industry lags far behind those of Central America and Africa. Coffee farm yields are low in comparison to potentials. EWW noted that an improvement in farm management practices could help increase productivity on

existing farms. They also noted that the ostensibly grim current situation could present Haiti with a great opportunity to target the fastest growing coffee market segments–organic and gourmet–which command high price premiums on the international market.

At the initial processing (village level) stage, poor techniques and equipment result in low yields from the wet processing process, the percentage of damaged beans is high, and because of intermixing of coffees from different altitudes and varieties, overall quality of the final product is poor. To help solve these problems, EWW made numerous recommendations among which were that the farm groups:

- be introduced to efficient and easy-to-handle processing equipment
- be trained on the use of the equipment
- be trained on modern, clean processing techniques
- be led to process more of their coffee conjointly so as to profit from economies of scale and standardize quality.

As a result of this initial reconnaissance, whose findings were published as SECID/Auburn PLUS Report No. 49, SECID engaged EWW under a purchase order to implement some of their recommendations. That project is described in the following sections.

Background

Haitian Bleu, the registered trademark specialty coffee of the Fédération des Associations Caféières Natives (FACN), is the product of a series of USAID-funded efforts to increase the quality of coffee exported from Haiti and thereby increase farm revenue from this environmentally friendly crop. USAID had become increasingly concerned, during 1997-1999, that *Haitian Bleu* was losing its market in the USA and was in danger of completely disappearing as a viable commercial product. During this same time period, SECID had become more involved in assisting farm groups market Haitian coffee, notably through ServiCoop and the Max Havelaar fair trade network of Europe. While implementing these marketing programs, SECID engaged EWW to conduct the production and marketing diagnostic of the Haitian coffee sector that is described above. Based on these experiences and its knowledge of the *Haitian Bleu* situation, SECID began discussions with USAID to develop a program of assistance to assure that *Haitian Bleu* would continue to be the "flagship" Haitian coffee leading the revitalization of the Haitian coffee sub-sector. In reference to this objective SECID submitted a series of four unsolicited proposals to USAID during the period of November 1999 through January 2000. USAID accepted a modified proposal from SECID on February 25, 2000, "to address the major problems of *Haitian Bleu* quality and volume of sales and save *Haitian Bleu* from bankruptcy" (quoted from the SECID PLUS Coffee Sub-Project Proposal). The contract amendment extended the contract completion date by two months to February 28, 2001 and increased the total funding obligation by $895,974. SECID issued an RFP. After the proposals were evaluated, EWW was chosen to implement the program.

Results

SECID re-established working relations with Mr. Gary Talboy, the specialty coffee consultant who created the *Haitian Bleu* marketing system. Mr. Talboy quickly re-assumed marketing leadership of the brand and, at his suggestion, officials of the FACN, USAID, EWW, and SECID met with the US buyers of *Haitian Bleu* at the Specialty Coffee Association of America's annual convention in San Francisco, April 14-18, 2000. Four out of five of the original group of US buyers signed agreements extending their commitments to purchase *Haitian Bleu* coffee from the FACN at the FOB price of $2.00 per pound.

The team of EWW coffee experts arrived in-country in May and, with FACN representatives, developed a draft business plan for the FACN and a work plan for the USAID-funded activities. A priority for the team was to address the question of *Haitian Bleu* quality. The following problems and associated solutions were identified and implemented:

- Problems in coffee storage procedures that result in deterioration in coffee quality. Solutions implemented included stacking the coffee away from walls to allow better circulation of air, monitoring and adjustment of moisture levels in stored coffee, use of a first-in-first-out inventory system, and reconstruction of portions of warehouse walls to block entry of moisture.
- Quality of coffee received from the FACN wet processing centers. Mario Mora, EWW Coffee Project Manager, noted that a major problem confronting the Tombe Gateau facility was the quality of parchment coffee being sent to the facility for processing by the FACN coffee associations. Part of the problem was that most of the associations' coffee depulpers had defective depulping screens that were damaging the coffee as it was being processed. Defective depulping screens were replaced on approximately 50 FACN depulpers. An additional component of the solution was training of the operators of the wet processing centers in proper processing of coffee. SECID/EWW/FACN personnel presented three training sessions for the operators of the wet processing centers. A short manual on coffee processing in Creole was developed for use in these sessions. Additional re-enforcement of good processing practices was provided during the processing season by two FACN extension agents who visited the processing centers to assist processing managers apply the practices.
- Rate of Coffee Processing at Tombe Gateau. Coffee can lose its color if it is exposed for extended periods of time to high humidity environments such as found at the FACN coffee processing and storage facility at Tombe Gateau. The obvious solution to at least a portion of the loss-of-color problem was to speed up processing at Tombe Gateau. Since hand-sorting is the most time-consuming step in the process, measures to increase processing speed were focused on assisting the women to speed-up the hand-sorting process. Electric lights, supported by an electric generator, were installed in the hand-processing room, thereby allowing the women to continue to work on cloudy days. In addition, a broad, slow-moving, sorting belt is being installed to make the hand-sorting process more efficient.

As the recommendations were implemented, the FACN/EWW team succeeded in processing and exporting all of the quality coffee at Tombe Gateau, four containers, before the end of September.

SECID/EWW Institutional Strengthening Consultant Philippe Accilien visited the FACN central office in Haiti and several FACN associations to conduct an institutional analysis of the FACN. A draft report of his findings was published for comment. Mr. Accilien's primary recommendations for strengthening the federation and its member associations were:

- Help the federation put in place a better structure for information-sharing and decision-making with its member associations.
- Help strengthen the institutional capacity of federation and member associations through specialized training.
- Help the associations undertake other income-generating activities to complement their coffee income and remain employed during the off-season period.
- Create a committee structure that encourages member participation in the decision-making process, and maintains a permanent framework for technical assistance.
- Find ways to transfer as much of the income as possible to the producers in the beginning of the season instead of waiting until the end of the year and giving it to them in the form of profit-sharing.
- Work with the federation and associations to improve their capacity for coffee production and processing.
- Work to get more women involved in leadership positions and other production and processing activities in both the federation and the associations.

SECID/EWW Management Consultant Yamilee Bastien visited the FACN central office in Haiti and FACN associations near Jacmel to review their accounting procedures and begin implementation of Mr. Accilien's recommendations. Ms. Bastien trained 20 representatives of the Jacmel associations in bookkeeping, basic budgeting and planning, the role of the associations within the FACN structure, and simple accounting procedures.

Ms. Bastien's direct work with FACN's accounting system was limited to reconciling their bank statements with the expense reports they have submitted to EWW/Washington, and training to assist FACN provide more thorough documentation of the expenses they incur with SECID/EWW funding. Ms. Bastien reports that FACN has already begun providing more thorough documentation.

Ms. Bastien also made the following recommendations:

1. Increase Number of Extension Agents
2. Ongoing Training in Financial Management
3. Computerizing the Management of Information at Tombe Gateau

More details regarding the EWW team's activities and recommendations can be found in SECID's Semi-annual Report of 1 April - 30 September 2000 and in EWW's final report of February, 2001.

Institutional Strengthening Activities

This section describes activities that have taken place within the context of SECID marketing programs. The strengthening of participating farm organizations has been a highly positive "side effect" of SECID's efforts to fulfill the stated PLUS project goals, increased farm income and enhanced natural resource conservation. Improved organizational strength is another facet of the sustainability promoted by SECID.

Training for PLUS Project Partners

When SECID's role in marketing research and development was expanded, in 1995, it planned to provide training and leadership for Marketing Assistants employed by CARE and PADF. That was delayed until the arrival of Junior Paul as SECID Marketing Specialist in July 1996. Two weeks after he began working, he presented a seminar on marketing to the Supervisors of PADF's four operating regions and the newly appointed Marketing Agents from those regions. At the close of the seminar, plans were made for Junior Paul to make training visits to the four PADF regions. Mr. Paul spent an average of 5 days in each region, providing additional training to the PADF Marketing Agents and visiting farmers' organizations with the Marketing Agents to explain the PLUS Marketing Assistance Program. Additional objectives were to disseminate information about known marketing opportunities, test farmers' interest in the opportunities, and collect marketing information on potentially marketable products. Later, in 1997, Mr. Paul provided further marketing training to Marketing Agents in PADF Region I. Throughout the implementation of marketing activities, SECID Marketing Specialists have provided partner organization personnel with guidance and support, and additional training as needed.

Training for Farm Groups

It would be impossible to list all of the training seminars given to members of farm groups in the context of the marketing programs. During the first semester after Junior Paul's arrival, for example, he gave over 12 sessions to as many groups on subjects ranging from marketing, to dried immature sour oranges, to mango harvesting and selection, to food processing. Subsequently, detailed records of training sessions were not kept, but special training activities for a particular product are often mentioned within the subsection relating to that product. Here, a general idea of the topics and results of training is given.

In the context of marketing activities, organizations receive training in accounting techniques and management, as well as training in such subjects as proper harvesting and handling of the produce. Managing the assembly, field processing and shipment of large quantities of produce provides the farm groups with valuable hands-on management and organizational experience. Since management skill is one of the most limiting factors for production and marketing in rural Haiti, the increases in management skill provided via the marketing program will no doubt have productivity impacts in other agricultural and civic endeavors. Meanwhile, the organizations and their members also develop the experience to

function with less supervision from SECID and partner organizations. The roles and responsibilities of all organization members are stressed in meetings. This is done to encourage all members to play an active, informed role in the association, so that the association does not simply generate income for a small group of officers.

Junior Paul and PADF personnel train participating farm groups in appropriate accounting procedures to account for the flow of produce and money into and out of the groups' hands. The farm groups put their knowledge to work almost immediately in their financial dealings with members and exporters. For example, a farmer association marketing mangos may buy them from its members at 14 Gourdes/dozen, spend 5 Gourdes on handling and management expenses, save 2 Gourdes for working capital and unforeseen expenses, and sell mangos to an exporter at 21 Gourdes. The association must also account for large cash advances from exporters. The necessity of careful record-keeping was dramatically demonstrated in 1999 when on several occasions the exporter and farmer association books showed differences in the quantities of mango delivered. In one case an exporter who had given a cash advance to one association believed that the association owed him more than 40,000 Gourdes. The association had records, signed by the exporter's employees, showing that a much greater quantity of mangos had been provided to the exporter. A meeting between representatives of the association, the exporter, and Junior Paul concluded with the association receiving an additional 8,000 Gourdes due as payment for the mangos delivered.

Ongoing Support

As the farm groups move from theory to practice, they need guidance and support. SECID Marketing Specialists Junior Paul and Raymond Lerebours, the SECID Marketing Supervisors, and personnel of partner NGOs have provided this support. They assist the groups in managing the marketing activities and encourage group members to play an active role in this management. In preparation for each marketing activity, Marketing Supervisors help the groups conduct surveys of farmers in their areas to invite them to become members and to estimate the quantity of the target product available. Through their presence and support during surveys, meetings, and export trials, the Marketing Supervisors are critical to the success of a marketing program in its early stages. As the farm groups become more experienced and confident, they do more by themselves. Ultimately, they will be able to function on their own.

Formation of a Marketing Cooperative at Gros Morne

In 1999, farmer association members in the region of Gros Morne, motivated by the success of the mango marketing program, conceived the idea of forming a federation of cooperatives and requested assistance from SECID. After discussions with the Haitian Government's Conseil National des Coopératives (CNC), PADF and CARE, it was decided that a CARE trainer, Mr. Francisco Boursiquot, would provide the training in association with SECID. Following the basic training would be a series of meetings over the course of several months, with the ultimate goal of the establishment of a marketing cooperative. This cooperative, named KOPAKGM, was inaugurated on March 1, 2000. Its administrative, supervisory, and training committees all have representation from each of 9 areas, while each

area retains its own local association committee. By mid-2000, KOPAKGM had completed almost all of the paperwork required by the CNC for official government recognition. While it is relatively young and fragile, it has the benefits of a well-designed constitution, practical administrative experience, and good member participation. The representation of every locality allows KOPAKGM to respond well to the needs of its members and encourage their further participation and involvement. Even more than that, the process of cooperative training and formation has raised farmer consciousness about the necessity and means of organizing themselves. The farmers are motivated to defend their interests and get the maximum profit from their produce.

KOPAKGM would like to build assembly centers in its 9 member areas, and it would also like to expand its activities to include avocado, kenep, and pumpkin marketing; production and marketing of such crops as hot pepper, igname, malanga, manioc, and pigeon peas; and other projects such as grafting of mature mango trees; planting an additional 100-150 *carreau* of land in mangos, perhaps in partnership with exporter José Sylvain; irrigation; and soil conservation. KOPAKGM planned to hold a General Assembly meeting during the fall of 2000 to present its financial statements to members, and it hoped to begin construction of its first assembly center soon after that. With continued NGO support, there is no reason why KOPAKGM should not enjoy even greater success. Its broad goal of "improving the condition of people's lives" matches flawlessly with the USAID goals of increasing small-farmer income and improving the quality of the environment through the conservation of natural resources.

For more information on the formation of the Gros Morne Cooperative, see SECID's Semi-annual Report of 1 October 1999 - 31 March 2000.

Concluding Remarks on Marketing

The Marketing Program begun by SECID made a significant contribution to farmer income within the PLUS Project area. Table 5 lists the direct economic impact of 12 commodities marketed with assistance of the PLUS Project. Actual impact was much greater because of the effect of higher prices to PLUS farmers often resulted in higher prices paid to all farmers within a production area. Market demand has in turn created a demand for improved production practices as well as improved handling of produce. By associating agronomic and horticultural technical support to a marketing program, it should be possible to increase the effectiveness of both types of assistance.

Table 5. Direct Impact of SECID PLUS Marketing Programs for Selected Products. Indirect Impact not shown.											
Product	Year	Region(s) where the program was active	Number of Farm Groups	Number of Farmers	Price before program	Price with program	Unit	Quantity sold through program	Unit	Increase in Revenue (Gourdes)	Increase in Revenue per Farmer (Gourdes
Manioc	1999	South, Camp Perrin, Grande Anse, North, Mirebalais, West	12	434	0.17	0.3	Gdes/lb	217,188	lbs	28,234	65.00
Manioc Meal*	1999	South, Camp Perrin, Grande Anse, North, Mirebalais, West	12	434	0.9	2.5	Gdes/lb	72,396	lbs	115,834	266.90
Plantain	97-98	Camp Perrin, South, North, Lascahobas	11	946	15	25	Gdes/stalk	7,077	stalk	70,770	74.81
Plantain Chips**	1/97-9/97	Lascahobas, North, Jérémie	5		6.5	12	Gdes/lb	4,284	lbs	23,562	
Coconut Seed Sheaths	1996	Saut d'Eau	1		0	10	Gdes/doz	500	doz	5,000	
Dried Immature Sour Orange	1999	Central Plateau, Gros Morne, Jacmel			0	4	Gdes/lb	2,500	lbs	2,500	
Mango***	2000	Gros Morne, Cazale, Mirebalais, Léogâne, Jacmel	15	3400	5	22	Gdes/doz	120,488	doz	2,048,296	602.44
Breadfruit	1999	Les Cayes, Marigot, Cap Rouge,	4		6	25	Gdes/doz	1,076	doz	20,444	
Kenep	2000	Léogâne	7	min. 53	0.4	1	Gdes/lb	42,625	lbs	25,575	482.55
Igname	98-99	Plaisance, Cap Rouge	4		1	3	Gdes/lb	18,000	lbs	36,000	
Pumpkin	99-00	Jacmel, Bassin Bleu, Belle Fontaine, Central Plateau, Camp	22	approx. 2,000	max. 0.75	2	Gdes/lb	328,787	lbs	410,984	205.49
Cacao	97-98	North, Grande Anse	12	est. 4500	4	6.5	Gdes/lb	661,500	lbs	1,653,750	367.50

* The price before program is the equivalent for non-processed manioc, relying on data that shows that approximately 3 lbs of raw product is necessary to produce 1 lb of processed product. The increase in price reflects the value added through processing. Yearly data for this and raw manioc is based on average monthly sales of processed manioc, reported in the Semi-Annual Report of 1 Oct 1999 - 31 March 2000. The number of farmers is based on Dr. Lea's statement that the average farmer sells 500 pounds of raw manioc (Cf. the Estimated Impact report of August 1, 1998).

** The price before program is what was calculated to be the equivalent for non-processed plantain at 25 Gdes/stalk. Again, the increase in price reflects the value added through processing.

***The before-program price is the average price of mangos in 1997, before the SECID marketing program first began.

F. Monitoring and Evaluation (M&E)

The Productive Land Use Systems (PLUS) project, initiated in 1992 when its predecessor project, Agroforestry II (AFII) was amended in a "mid-course correction", was created with very ambitious targets for such outputs as: trees planted, conservation practices introduced and adopted, increased crop yields, and farmer income increased. The amendment and SECID's Scope of Work specifically mandated the development and implementation of an effective monitoring and evaluation system that would be designed to assist in transforming the project from an "agenda-driven" approach to one that is "farmer-driven." Specifically, USAID gave SECID responsibility for the following activities:

- to actively support CARE, PADF and the USAID Mission in the proper monitoring and evaluation of the socio-economic impacts of project activities,
- to guide CARE and PADF in setting up regular monitoring of project activities, including the development of indicators for assessing purpose-level and output-level achievement,
- to assist CARE and PADF in interpreting and analyzing data emerging from their monitoring systems and identifying programmatic lessons that apply to the entire project, and
- to assist CARE and PADF in modifying their training programs in light of feedback received.

Unfortunately, USAID did not modify the Collaborative Agreements (CAs) of CARE and PADF to provide the contractual conditions that would encourage CARE's and PADF's enthusiastic implementation of USAID's wishes related to M&E and farmer-driven programming. Specifically, the ambitious deliverable targets relating to numbers of trees planted and conservation structures installed (set before the M&E system was mandated) were not relaxed such that they realistically could be "farmer-driven," and, no additional funds were added to the CARE and PADF CAs to pay for M&E activities. Additionally, USAID did not modify SECID's contract to allow it to implement data collection activities associated with M&E. USAID mandated that M&E data collection would be carried out by CARE and PADF using existing project resources. This created a quandary for CARE and PADF as they tried to meet their deliverables agreements with USAID while installing M&E systems that drew resources away from efficient delivery of those deliverables.

This quandary severely hampered the development and implementation of an M&E system designed to achieve the objectives USAID set for it. During the mutual design of the M&E system, the pressure to implement conflicting directives created a contentious environment among the PLUS project partners as SECID attempted to create a relatively elaborate M&E system that would meet USAID's complex objectives while CARE and PADF sought to minimize the complexity of the system to reduce the diversion of project resources from implementation. USAID's mandate to transform the PLUS project from an "agenda-driven" to a

"farmer-driven" approach created further tension between SECID and CARE and PADF. SECID felt USAID's mandate required including in the M&E system Strategic Performance Indicators (SPIs) designed to demonstrate the transformation of the project's approach. CARE and PADF felt this was equivalent to micro-management and an unwarranted intrusion into their areas of expertise that was not allowed under their CAs with USAID. Driven by these forces, the M&E system began as an elaborate system designed to achieve multiple goals and evolved into a very simple system addressing minimum USAID reporting requirements.

A Résumé of M&E System Design and Evolution

Initial Design

The initial design of the M&E system included:

- two baseline studies (one quantitative, one qualitative),
- a marketing baseline study conducted in the Northwest,
- a review of predecessor projects impacts,
- financial evaluation (incremental net returns) of the four primary project interventions via longitudinal data gathered from case studies of farmers implementing rockwalls, checkdams, hedgerows and vegetable gardens,
- a series of 19 Strategic Performance Indicators (SPIs).

The two baseline studies, the marketing study and the review of predecessor projects were carried out by SECID staff and consultants. The case studies were designed and the resulting data were analyzed by SECID while CARE and PADF were responsible for data collection using protocols established by SECID. The SPIs were calculated from information supplied by CARE and PADF. Several of the SPIs were designed to demonstrate changes in project implementation from "agenda-driven" to "farmer-driven" methodologies.

First Modification of the M&E System

CARE and PADF felt that several of the SPIs detracted from rather than aided project implementation, primarily, because the effort to develop and report on the SPIs diverted project resources from achievement of deliverables. Further, they considered the SPIs that sought to change the way the project was being implemented as violations of their Collaborative Agreements with USAID given that the agreements gave CARE and PADF the right to decide how to implement the PLUS Project. Not long into the implementation process CARE and PADF called for a re-evaluation of the SPIs. An initial "refinement" of the M&E system in 1994 discussed the efficiency of the SPIs and suggested a survey of project partners (USAID, CARE, PADF and SECID) to obtain their opinions on the "relative usefulness of the SPIs (SECID/Auburn Report No. 16)."

Second Modification of the M&E System

A second "refinement" of the M&E system in 1995 by Romanoff et al. recommended a reduction of SPIs from the original 19 to11. An agreement between USAID, CARE, PADF and SECID relating to the adoption of the Romanoff et al. recommendations resulted in a further reduction of the number of SPIs from 11 to 7. Additionally, the second refinement of the M&E system phased out the case studies, because it was felt that they had achieved their purpose, namely, to demonstrate the financial viability of the interventions being studied and thereby guide decisions on their continued use in the project. An additional reason for discontinuing the case studies was that it had become impossible to compare cropping results with and without the interventions as farmers installed the project interventions on plots that were being used as "controls" in the experimental design of the case studies.

The second refinement of the M&E system replaced the case studies with an annual study of a large, randomly-drawn sample of participating farmers because it was felt that such a study would be more representative of project impacts on typical farmers than the case studies which focused on a small set of project participants. The plan for the annual survey, including a copy of the survey questionnaire used, is published in SECID/Auburn Semi-Annual Report, 1 October 1995 - 31 March 1996, pages 31-46.

Because of the US budget crisis of the Fall of 1995, the implementation of the first large-sample survey of participating farmers was delayed approximately 4 months: from November-December 1995 to March-June 1996. The funding crisis caused an almost complete halt in PLUS project field operations. This delay moved the survey implementation period from an ideal time during a lull in agricultural activities following harvest season to a season of intense agricultural activities–planting season. At the time, SECID reported:

> "....we are certain that the quality of the responses we are receiving from the farmers is reduced below what would have been the case...in the present situation, farmers are busy and have little time to reflect on their agricultural activities of last year or to accompany our enumerators to their widely scattered farm plots to investigate the impact of Project interventions on the environment conditions of the plots. In addition, we are having to spend more staff time and transportation resources, making multiple visits, to complete each questionnaire because we have to accommodate the farmers' current heavy work schedule (SECID/Auburn Semi-Annual Report, 1 October 1995 - 31 March 1996, page 14)."

With the second refinement of the PLUS M&E system, the focus of the data collection effort shifted from attempting to quantify "incremental net returns" to gross production and revenue. The reasoning behind this decision was that collecting net income data from a large sample would be too costly and would not contribute proportionately to the decision-making value of the collected information. However, this decision would return to haunt the project when a USAID Inspector General, reviewing project performance in later years, ruled that

project results were not adequately documented. Project implementors felt this was an unfair criticism of the M&E system since the ruling appeared to ignore the reasoning behind the design of the system, namely, to provide decision-making information in an efficient manner.

SECID's contract with the PLUS project was initially scheduled to terminate in September 1997. However, SECID's marketing programs had developed such that USAID decided to extend SECID's participation in the PLUS project through the project's termination date of December 31, 2000. However, with the extension of the contract, USAID requested that SECID reduce its M&E activities to the provision of technical advice and data analysis services. The provision of field supervision of data collection and data entry was no longer part of SECID's M&E responsibilities.

USAID Mandated Modifications to the M&E System

USAID mandated two other modifications to the M&E system after it had been reduced to an annual, large-sample study of project participants. One modification occurred in 1998 when USAID modified its Strategic Objectives and changed its reporting cycle such that it required the results from the PLUS M&E annual survey at a time that conflicted with the PLUS M&E calendar of activities. To conform to the new Strategic Objectives and Intermediate Results, the PLUS project partners, USAID, CARE, PADF and SECID met on September 15, 1998 and agreed upon the following set of performance indicators and associated sources of indicators:

PLUS Project Performance Indicators as of September 15, 1998					
Indicator	Increase in ag. income	Increase in crop yields	% improved practices being mantained	Participants using sustainable practices	Number of trees planted
Source	Annual survey	Annual survey	Annual survey	Implementor records	Implementor records

Additionally, USAID asked SECID to report annual marketed values of cacao, mango and coffee marketed through PLUS Project marketing efforts.

Conforming to the new reporting schedule caused problems for PADF. PADF schedules its annual survey in December to coincide with the end of harvest season when farmers have more time to participate in a survey and when they have harvest data fresh in their minds. In Oct-Nov 1998, USAID announced that it would need the results of the survey by mid-February 1999. When PADF informed USAID that it would be impossible to have the survey results by the announced deadline because of the quantity of data that needed to be entered into computerized form and analyzed, USAID requested that PADF reduce its sample size by two thirds.

The second modification of the annual survey mandated by USAID occurred in 1999. Responding to criticism from a USAID Inspector General that the annual survey did not measure

net income (as the IG assumed it should), USAID requested that SECID assist CARE and PADF add questions to their annual survey to obtain data on farm cropping expenses so that an estimate of net farm income experienced by participating farmers could be obtained.

The following sections describe the development, refinement and evolution of the PLUS project M&E system from the perspective of the external consultants who advised the PLUS project on its M&E system.

Developing the M&E System

SECID M&E Specialist Dr. Angelos Pagoulatos came to Haiti in early 1993 and led the effort to develop the M&E system. Representatives of USAID, CARE, PADF, SECID's local staff and Dr. Pagoulatos worked together intensively for several weeks, discussing M&E objectives, methods and roles. By the end of Dr. Pagoulatos' consultancy, the M&E system had been drawn in working draft form, with several data collection and analysis tasks defined and approved; however, much detail was left to be filled in and many questions relating to the proposed Strategic Performance Indicators (SPIs) remained. Dr. Pagoulatos described the system in SECID/Auburn PLUS Report No. 3.

In his foreword to Dr. Pagoulatos' April 1993 report, Dr. Dennis Shannon, SECID Campus Coordinator, noted:

> "The system described herein is the product of extensive discussions held with CARE, PADF and USAID over the two month period [Jan-Feb, 1993]. It seeks to respond to concerns of USAID that the project chart its progress in adapting to the increased emphasis on sustainability, income generation and farmer-client orientation. It also respects the Grantees' need to be efficient with respect to labor requirements for data collection. The focus of the evaluations are on the technical innovations rather than on performance of the institutions involved.
>
> Due to the extensive time required to obtain consensus of all parties on the Strategic Performance Indicators and the uncertainty of the Grantees on the choice of technologies, it was not possible to finalize all the details of data collection that might be desired by the implementors. Nevertheless, the framework of a system which is both flexible with respect to future technologies and practical in application has been put into place. Refinements of the system are anticipated with future visits of Dr. Pagoulatos. (SECID/Auburn PLUS Report No. 3, page ii) "

In his executive summary to the report, Dr. Pagoulatos reported:

> "A Monitoring and Evaluation (M&E) System for PLUS was set up during a consultancy to Haiti between January 8 and February 26, 1993. The system was designed in collaboration with USAID, CARE and PADF, with the assistance of

the SECID long-term staff. The system is general in nature, but will be refined as implementation plans are finalized and as more information becomes available. Key aspects of the M&E system are:

- a conservation farming systems approach;
- sustainability of environmental improvements;
- a learning process with information flow leading to refinement of existing interventions and identification of new interventions;
- Strategic Performance Indicators (SPIs) to measure progress of the project to meet its goals;
- the use of baseline information;
- monitoring of intervention packages;
- evaluation of intervention packages by farmer appraisal as well as by technical and economic assessment;
- refinements of the interventions; and
- refinements of the M&E system. (SECID/Auburn PLUS Report No. 3, page iii)"

Refining the PLUS M&E System: Phase I

SECID brought Dr. Pagoulatos to Haiti approximately 12 months after his first visit to review progress in the development and utilization of the M&E system and to make recommendations to improve its performance. Dr. Pagoulatos's report from this consultancy is SECID/Auburn PLUS Report No. 16. Specifically, Dr. Pagoulatos addressed the following five main issues:

1. Assessment of the M&E information collection and reporting system, including individual responsibilities of CARE, PADF, and SECID. Make recommendations to achieve the M&E objectives.

2. Assessment of the relevance, utility, and appropriateness of information reported by PADF and CARE for use in the M&E system. Make recommendations to achieve the M&E objectives.

3. Assess calculation algorithms for all Strategic Performance Indicators with special emphasis on the net incremental returns for each intervention.

4. Critique financial evaluations of project interventions.

5. Recommendation of an analytical methodology for economic evaluation of interventions.

In his executive summary to his March 1994 report, Dr. Pagoulatos noted:

> "The experimental design, implicit in the Monitoring and Evaluation (M&E) of PLUS, addresses adequately the needs of the M&E system with a learning process that continually refines interventions and their implementation, and identifies new interventions requiring a continuous formative evaluation.

> PLUS has established an on-going system to determine the farm-level impact for the project's four primary interventions: hedgerows, checkdams, rockwalls and vegetable gardens. Protocols and questionnaires have been developed to monitor each intervention in selected watersheds in order to obtain the necessary information to address the Strategic Performance Indicators (SPIs) of the PLUS M&E system. The progress that has been made to date, in implementing the M&E system and associated "learning process", is remarkable (SECID/Auburn Report No. 16, page 1)."

In his review of the data collection system, Dr. Pagoulatos noted the division of M&E roles between SECID and CARE and PADF.

> "SECID is responsible for providing technical assistance, verifying, storing, analyzing, determining algorithms and calculating the strategic performance indicators (SPIs) of the PLUS M&E system. PADF [and CARE] are responsible for the collection of all the monitoring data in their regions of intervention and their transmittal to SECID. Verification by SECID is directed toward the accuracy of the monitoring information collection (SECID/Auburn Report No. 16, page 1)."

Dr. Pagoulatos noted:

> "Several visits in the field, by SECID, revealed problems in collection of the monitoring data. Delays due to motivational problems coupled with under-staffing of enumerator teams and lack of transportation, scales for weighing etc. Drought in some instances did not allow for data collection from some farmers. Enumerators in some cases did not follow instructions and provided wrong measurements or simply did not fully complete the forms. In all cases the problems were jointly resolved by the PLUS team (Reports: Yves Jean, January 27, 1994; Roosevelt Saint-Dic, January 14, 1994, December 3, 1993, December 17, 1993, February 11, 1994; J. D. Zach Lea, December, 1993). The process of the monitoring effort verification is working well (Pagoulatos, SECID/Auburn Report No. 16, page 1).

It is likely that these data collection problems were due to the problems CARE and PADF were having allocating adequate project resources to the newly designed M&E system in the face of continuing pressure to meet deliverables targets set before the creation of the M&E system. SECID's recommendation to resolve this problem was to have SECID assume responsibility for both data collection and analysis. However, as this would have required a substantial increase in SECID's PLUS project implementation budget, the recommendation was not considered practical.

Refining the PLUS M&E System: Phase II

Continued dissatisfaction with the PLUS M&E system among the PLUS project team (CARE, PADF, SECID and USAID) relating to the cost and value of the system led to another review and refinement of the system beginning in 1995. The review team was composed of Dr. Steven A. Romanoff, M&E Specialist; Dr. Donald E. Voth, Agricultural Economist; and Dr. Malcolm Douglas, Land Husbandry Specialist. Their report of their findings and recommendations is SECID/Auburn PLUS Report No. 25.

The assessment team noted the accomplishments made to date by the M&E system, as well as the acknowledged deficiencies in data collection, and proposed that the system shift emphasis from an intensive focus on case studies of a few farmers to an extensive focus estimating project-wide impact through a large-sample survey of project participating farmers. The team reviewed the project SPIs and recommended that several be dropped or modified, reflecting their recommendation relating to the shift of M&E focus. An important example is their recommendation that the M&E program shift from estimation of incremental net returns for each intervention to incremental gross revenue, especially in the context of the large-sample survey of participating farmers for the estimation of project impact. See pages vi,13, 20 and 33 of their report.

The team also made several recommendations to use participatory methods to gather farmer input on project intervention evaluation and design. For example, the team recommended that four SPIs intended to demonstrate project responsiveness to farmer' desires be dropped as separate SPIs and replaced with a program of participatory M&E activities. The information from these activities would be reported in the annual M&E reports. The team recommended that the occurrence of these activities be monitored.

Refining the PLUS M&E System: Phase III

Following the departure of the Romanoff team, the PLUS project partners, USAID, CARE, PADF and SECID held a series of meetings to adapt the Romanoff team's recommendations and develop a mutually agreed upon system. SECID chaired a series of seven meetings in which the recommendations of the Romanoff team were reviewed and suggestions made for incorporating them into the PLUS M&E system. SECID distributed meeting minutes of each meeting prior to the following meeting. The final meeting minutes, from the September 21, 1995 meeting, were published in SECID's Semi-Annual Report, 1 April - 30 September 1995. The practical outcome of the refinement of the system was that the level of M&E activity was reduced substantially. The M&E system was reduced to a large-sample annual survey of participating farmers; a shortened series of SPIs, most of which were to be compiled and used internally by CARE and PADF; and a series of short studies by SECID whose timing would be determined by CARE and PADF. This was the final, major refinement of the system. Two additional, but smaller, modifications to the system were mandated by USAID in 1998 & 1999. The following is a description of the PLUS M&E system as refined by the project partners.

The M&E System as of 21 September 1995 contained the following nine components:

Component 1. Region-level dossiers containing general information on the regions:
- bio-physical conditions (rainfall, etc)
- general farm type
- most important crops by production
- most important crops by consumption
- marketing information
  - major crop seasons, quantities, and prices
  - distance to first motorized transport, first major village and town
  - markets normally used by farmers
- size of village or center of locality
- presence of a school
  - human resource development achievements resulting from PLUS activities:
  - individuals trained by sex and subject
  - non-farm enterprises operating commercially
  - enterprise or group accounting systems in operation
  - reports of seed bank or seed boutique operations (quantity & type of seeds distributed)
  - tool bank operations

Component 2. Farm-household dossiers containing:
- name of head of household
- numbers, ages, and sex of members of farm household
- location of household (name of locale and UTM coordinates)
- type and quantity of interventions installed
- name and sex of household member (project participant) responsible for each intervention

Component 3. An annual, large-sample impact survey of randomly selected participant households addressing the following:
- characteristics of farm plots:
  - number of plots per farm
  - size of plots, slope class, number of trees (of certain size) present
  - land use or crops per farm plot by season
    - crops yields
    - harvest-time prices
    - type and quantity of germplasm used
- characteristics of interventions:
  - units of each intervention installed before current year and units installed in the current year
  - maintenance status of intervention
  - gross environmental impact of the units implemented

farmer's estimation of comparison of production with and without interventions
how adopted (primary or secondary)
number of secondary adopters motivated to adopt by responding farmer
units reported but not in fact implemented

Component 4. At the meeting to discuss the M&E system held on 8 September 1995, it was decided that this component of the M&E system [An annual (small-sample) survey to confirm crop yields via crop cuts] should not be implemented until it became clear that adequate resources were available for its implementation.

Component 5. Additional small-sample surveys:
an as-needed survey to elucidate gender issues and project impact on women.
an as-needed survey to enumerate the number of secondary adopters.

Component 6. A series of studies to be undertaken by SECID. These include:

Analysis of Where an Intervention is Having Impact

Romanoff et al. indicate (p. 16) that, "project implementing agencies have requested that the M&E system show where an intervention is appropriate and where it is having impact." This type of analysis can be done in office with information from the region-level dossiers, supplemented with data from other studies underway or planned and existing data. I (Lea) do not attach a high level of priority to this type of study since areas of project implementation have already been determined and the available data are still limited. As sufficient data became available, SECID would conduct this study.

Financial and Economic Analysis in M&E

SECID is responsible for carrying out the following M&E Evaluation Team recommendations with the support of CARE and PADF regional personnel. The execution of these tasks has been modified as discussed above under the actions taken at the September 21 meeting; namely, that SECID should develop these budgets to the fullest extent possible using data obtained from baseline surveys and the annual impact survey. Only after obtaining the approval of CARE or PADF, should SECID collect additional data to complete any missing elements of the budgets. Approval of CARE and PADF would be contingent on a demonstrated value for these budgets.

- Develop and make available to field staff simple enterprise budget and financial analyses for each intervention, tailored to as many sub-regions as possible. These should be done with and without labor as a cost.

- Develop typical whole-farm descriptions of key target group farms, and include, in this process, rough whole-farm budgets. These descriptions should include the following:

a. the physical layout of the typical farm,
b. description of the various enterprises on the farm and their interactions (e.g., outputs of one enterprise as inputs into another),
c. description of the farm family,
d. description of labor, cropping/production, and consumption calendars,
e. rough whole-farm budgets, including, to the extent feasible, all income sources and expenditures.

Component 7. Monitoring Case Studies. The monitoring cases studies relating to hedgerows and rockwalls will continue at a lower level of intensity. Visits to case studies will be reduced from weekly to bi-weekly intervals. We will continue to monitor harvests of major crops via crop cutting samples from treated plots and will include cuttings from witness plots where possible. We will collect information on crops not covered by crop cuttings via farmer recall. SECID, CARE, and PADF will develop a data collection form for this purpose. Case studies relating to checkdams and vegetable gardens will be eliminated as a component of the M&E system after the harvest of the crops planted this year.

Component 8. An annual series of farmer involvement activities (participatory diagnostics and farmer evaluation sessions).

Component 9. PLUS Project Strategic Performance Indicators. This is the finalized list of SPIs as reworded, renumbered and accepted by the M&E working group at their September 8th meeting.

SPI-1
Incremental gross revenue and incremental food production (calories and protein) to primary producers, analyzed by intervention and area.

Comment:
The information for this SPI will come from the annual impact survey which asks farmers to report yields, harvest-time prices and to comment on how their yields from plots treated with Project interventions compare with what they would expect from an untreated plot.

SPI-2
Secondary adopters per project-assisted adopter analyzed by area and intervention.

Comment.
During the annual impact study, participating farmers will be asked how many farmers, living outside the Project area, they have influenced to adopt a Project-promoted intervention. A follow-up survey will interview the farmers named in order to estimate what percentage of them should be classified as secondary adopters. This information will be used to adjust the number of secondary adopters claimed in the impact study.

SPI-3
Percent of participating farm households using each and any project intervention analyzed by area.

Comment:
The information to calculate this SPI will come from Project reports and from the annual impact survey.

SPI-4
Amount of each intervention installed and percent of each intervention ever installed still effective or in use.

Comment:
The data to calculate this SPI will come from the annual impact survey.

SPI-5
Area planted with Project seed/planting material (monocrop equivalent).

Comment:
The data to calculate this SPI will come from the annual impact survey.

SPI-6
Counts of continuing, commercial or voluntary, activities stimulated by Project training programs.

Comment:
The data for this SPI will be reported by regional team leaders through the regional dossiers.
Example activities targeted by this SPI are:

enterprises operating commercially, enterprise or group accounting systems in operation, seed bank or boutique operations, voluntary or commercial grafting programs.

SPI-7
Percent of each Project area rated as good to excellent on better husbandry scale.

Comment:
This SPI will be calculated at the regional or sub-regional level as a component of a farmer participation activity designed to focus farmers' attention on the environmental state of their community.

M&E System Outputs: Reports

SECID delivered three types of written reports to USAID, CARE and PADF in the context of the M&E system. The first type of reports related to specific studies, and they were published formally as SECID/Auburn documents (see Appendix A). The second type of reports related to informal reports, transmitted under transmittal letters, which presented results from surveys and SPI calculations relating to the M&E System prior to September 15, 1998 (see Appendix B). The third type of reports consisted of a simple table of annual marketing program results relating to a selected group of products (see Appendix C) and used (after September 1998) by USAID in its annual Strategic Objectives Report. The Strategic Objectives (SO) reports began with the report covering fiscal year 1998. Beginning in 1999, USAID asked that the SO reports cover calendar year periods.

M&E System Outputs: Reported Results

The results reported by the M&E system were the values calculated for each Strategic Performance Indicator for each year of the program. In most cases, the values of the SPIs were reported in disaggregated form, that is, they were reported for each region and often for each technology. This generally resulted in tables of values for each SPI. For example, SPI-3: (Percent of participating farm households using each and any project intervention, analyzed by area) values from the first annual survey for the PADF regions was reported in a table having nine rows and eleven columns. This level of detail was provided to allow the implementors to use the information in managing the implementation of the project. These values are available from the implementing organizations and are not reported here. Here we note only that the results were quite encouraging.

USAID/Haiti was more interested in aggregated results that could be reported in the limited space provided for such results in the Mission's annual report to Washington. Accordingly, over time, PLUS project attention focused more narrowly on the performance indicators of most interest to USAID. Ultimately, the number of indicators was reduced to five as noted above in the section dealing with the development and evolution of the M&E system. The five indicators were as follows.

1. Percent increase in agricultural income.
2. Percent increase in crop yields.
3. Percentage of improved agricultural practices being maintained.

4. Number of participants using sustainable practices.
5. Number of trees planted.

In all years reported, the levels of indicators expressed in percentage terms (indicators 1-3 above) were greater than the implementation targets that were set at various levels below 20%. The numbers of participants and trees planted were reported directly to USAID by CARE and PADF to USAID and always exceeded implementation targets.

G. Hillside Agricultural Assessment

Objective

The objective of the assessment was to review interventions in the Haitian hillside agriculture sector, as practiced by small farmers and supported by all development organizations, including the Government of Haiti (GOH), Private Voluntary Organization (PVOs), NGOs and donors. The assessment team is responsible for identifying strengths and weaknesses, lessons learned, and new marketing opportunities to improve small farmers' incomes and to protect against environmental degradation.

Introduction

Although most of Haiti's mountainous slopes are considered too steep to be arable, hillside residents continue to cultivate them, due primarily to population pressures and lack of alternative forms of employment. Consequently, the steeper slopes continue to erode causing severe environmental degradation; forcing hillside farmers to cultivate even more non-arable land to subsist. Over the past forty years, various Haitian government agencies and donors have sought to address this cycle of rural poverty and environmental degradation through a variety of natural resource management and employment generation projects. Although some progress has been made, the problems of environmental degradation and rural unemployment have intensified, and the vicious cycle continues.

In its efforts to address these problems, USAID has assisted the hillside agriculture sector through various initiatives. These initiatives have evolved over the years from simple agro-forestry and small holder agricultural efforts to the current focus upon community based development and marketing of its natural resources, on a sustainable basis. A number of other donors and international PVOs have joined USAID in this approach. USAID commissioned SECID to perform an assessment of the hillside agricultural sector. The Assessment, supported by all agencies and donors throughout the country, to sought what effective progress had been made to increase hillside farmer revenues and to preserve the hillside environment.

The purpose of the *Hillside Assessment* report was to offer some preliminary findings, conclusions and recommendations, to assist USAID and its development partners to better assist Haitian hillside farmers break the cycle of their environmental and employment problems and their dependency upon outside assistance.

Principal Findings

- Haitian government resource and infrastructure constraints impede development of the hillside sector. Developmental agencies attempt to fill the resulting void with technical assistance projects.

- Most projects working in the hillside sector promote similar "baskets" of soil conservation and income generation activities. These technologies are effective as they produce the results intended in those areas where they are actively promoted and practiced. Effective initiatives include rockwalls, inter-cropping, agro-forestry, improved marketing techniques, on-farm processing, etc.

- PADF's and CARE's approaches to extension are quite similar, differing more from regions than between the two organizations. Extension methods developed within the PLUS Project are effective at promoting improved income-generating and soil-conserving technologies within project zones of intervention.

- The spread of improved technologies throughout the Haitian hillsides is slow due to a variety of reasons among which include weak Government of Haiti (GOH) infrastructure, inadequate information exchange, and farmer reluctance to try what they consider to be risky technologies.

Principal Conclusions

- The sustainability of hillside development interventions is questionable without continued donor support, given the weak Government of Haiti infrastructure and lack of a strong private sector presence in rural Haiti.

- The accuracy of estimates of PLUS Project impacts could be improved by moving from farmer-recall data to actual, regular measurement of inputs, outputs, and prices, and by inclusion of social indicators. This change will require training of staff and a considerable increase in resources devoted to M&E.

- An adaptive research component to hillside agriculture projects could increase the cost-effectiveness of extension activities by better identifying the adaptation of technologies and permitting better targeting of extension recommendations. In particular, it would facilitate quicker adoption of introduced germplasm. Research on the tree/crop/livestock interface would increase understanding of constraints to soil conservation technology adoption, and would help identify opportunities to improve soil fertility and reduce soil erosion.

- Some Government of Haiti policies are adversely affecting hillside agricultural development. By supporting ServiCoop and other private-sector groups to increase the

net price paid to farmers for export crops, donors can assist the GOH to overcome the policy bias against coffee, cacao, and fruit crops.

- Effective hillside natural resource technologies to improve income and conserve the water and soil exist, but due mainly to poor infrastructure and information exchange, hillside farmers outside of project areas are not adopting these valuable technical packages.

Principal Recommendations{ TC \l5 "Principal Recommendations}

- Recognizing the need to ensure sustainability, donors should coordinate their efforts to improve hillside agriculture by supporting activities to encourage sustainable income enhancement, and transferring land management to communities, involving the GOH and the private sector as much as possible.

- Donors must take a more active role in promoting NRM and agricultural policies that support sustainable development of Haitian hillsides to overcome current pricing biases. If marketing systems can be improved such that the net price of export crops from hillsides is increased, production of exportable crops will be encouraged.

- Hillside projects should conduct a weaning process to place more input supply activities into a private, for-profit sector and quasi-private sector groups such as producer associations and cooperatives, such as ServiCoop.

- Marketing should be a major component of future hillside development projects, concentrating efforts in three activities: information dissemination, technology and organizational training, and enterprise creation/support services.

- Donors could better address hillside farmer needs by adopting a more multi-disciplinary, holistic, problem-solving, integrated watershed approach. This would better support sustainable revenue generation within the whole hillside farming system, producing benefits for both upstream and downstream farming and non-farming communities.

- A project-based unit responsible for adaptive research and research/extension liaison is needed to improve information exchange and should be established by donors. This unit would have senior staff with expertise in agricultural economics and marketing, social science, soil and water conservation, and adaptive (i.e., on-farm) research. The unit could also be charged with M&E, and with training of GOH staff in farming systems research/extension methods and marketing.

- To be cost-effective and sustainable, agricultural extension activities should focus on technical support services to core farmer groups; information and training for larger, more varied audiences; input supply (in the short term) to a large number of clients; and implementation of soil conservation works.

- An information exchange program is critically needed. USAID should take the lead to improve the flow of information related to hillside agriculture at the national and international levels. This should be an objective of USAID's upcoming conference.

- Donors and Non-Governmental Organizations (NGOs) should only support those soil conservation projects where intended beneficiaries are the most likely to be committed to adopt proposed technologies, based on "triage" criteria. These criteria will vary regionally and should be an important part of the selection decision.

- Future hillside agriculture project designs should be based on cost-recovery as a means to reduce subsidization and promote sustainability by encouraging private sector agricultural marketing activities. Given the disparity of the hillside resources, projects should work with those groups that have the necessary human and natural resources and infrastructure to succeed.

III. LESSONS LEARNED

A. Contributions of Technical Assistance to PLUS

Technical assistance provided to the PLUS Project by SECID played an important role in orienting the project to more effectively target farmer needs and to positively impact the environment and economy of Haitian farmers. This was accomplished through farming systems surveys, market surveys, consultancies by subject matter specialists, literature searches and contacts with experts around the world, as well as applied and adaptive research. Technical support through applied research, expert consultants and the Information Clearinghouse provided PLUS with technical solutions to increase crop yield, combat crop diseases and pests and to increase farmer revenues.. SECID also served as a catalyst for encounters between buyers and sellers (farmer groups) and provided training to farmer groups in order to enable farmers to meet market demands. Training was provided to staff of the implementing agencies, PADF and CARE. The M&E program provided information on the effectiveness of technologies and the effectiveness of the project to meet its goals.

Without the technical assistance provided in Tree Germplasm Improvement Research, Agroforestry Adaptive Research, On-farm Agronomic Research and technical assistance in crop variety and management improvement, soil and water conservation, and market research and Marketing Support, PLUS could not have been as effective in improving crop yields, increasing farmer income and conserving the environment.

Technical Lessons

Tree Improvement

Most tree planting projects are based upon seed sources obtained at random from unselected trees within the country or at convenience from suppliers outside the country. Research undertaken by SECID demonstrated that trees of selected, known genetic background give faster growth, better quality poles or lumber and more wood than unselected sources of the same species. In the past, farmers were unwittingly supplied with seed of trees genotypes that were later shown in trials to be considerably less productive than other genotypes of the same species. That is not a criticism of the implementing agencies, but is evidence of the benefits of research supported implementation projects. Better than simply providing the information, SECID provided future projects in Haiti and throughout the tropics with a means for farmers to obtain seed from better genetic sources of several tree species. This contribution will serve future tree planting projects for decades to come, provided the seed orchards are maintained and harvested for sale to farmers.

As the Haitian environment continues to degrade, loss of habitat as well as harvesting of lumber results in genetic erosion of valuable and increasingly rare indigenous tree species. Genetic conservation through seed orchards and arboreta in protected areas, together with tree planting projects provide a means to conserve these valuable genetic resources.

On-farm Adaptive Research

As with tree improvement, on-farm adaptive research clearly demonstrated that crop yields increases can readily be achieved through selection of varieties that yield higher or that have other characteristics superior to local varieties. These include improved storage due to insect resistance (cowpea) and greater flexibility planting period (sweet potato, common bean) and location (common bean). Better disease management is possible by use of disease-resistant varieties identified in the trials (common bean) or by management practices (yam). Farmers eagerly accept new crop varieties, as evidenced by formal discussions with farmers and anecdotal accounts, as well as by the theft of planting materials of select varieties from experimental plots (cassava). Had the program continued for a longer period, greater improvements in crop varieties would have been achieved, both in the Northwest and in Grande Anse. Information on integrated pest management in vegetables and other crops was provided.

Agroforestry and Soil and Water Conservation

As a result of research conducted under AF II, PLUS and the Soil Management CRSP, clear guidance is available with regards to choice of hedgerow species for low and mid elevations up to 1200 m elevation for a range of rainfall conditions, and with respect to various objectives, including as N source, and resistance to livestock browsing. Information is now available on how to best manage hedgerows for crop production at low elevation. Alley cropping was shown to give higher crop yields than other soil conservation barriers because of the improvement in soil fertility. For alley cropping to be effective at sustaining crop yields, the hedgerows should be properly managed and leaves should be applied to the soil. Choice of hedgerow species is important and is affected by elevation and other factors. Information on soils and on methods of soil and water conservation is available.

Research on soil conservation barrier effects on crop yields suggests that one should not expect large yield benefits from conserving soil alone. In shallow, degraded soils on steep slopes and under erratic rainfall conditions, the net effect of installing soil conservation alone may be to decrease, rather than increase crop yield, due to the loss in cropping area as a result of the conservation barriers. The combination of soil fertility improvement from inorganic fertilizer, as well as N-rich organic sources are needed to sustain crop productivity over the long term. Because of the cost of applying soil conservation practices, interventions that increase the value of produce obtained from the land, such as high value crops will help to make soil conservation more cost effective.

Marketing

Programs with a focus on marketing have great potential to significantly and sustainably increase farmers' incomes, and at the same time have a positive impact on the environment. To be effective, marketing programs must incorporate training. Most directly, this training involves teaching farmers the basics of marketing; how to harvest, treat, and store their products to maintain quality; and how to negotiate sales. This type of direct marketing training naturally

leads into training that increases organizational strength: management and accounting skills, and the roles and responsibilities of group members.

Dr. Lea noted in 1996 that, "there is much training to be done and it has to be done in the context of commercial transactions in which buyer and seller learn to make and keep honorable contracts". This comment appears remarkably prescient in light of a recent report prepared by Junior Paul. The report evaluates the relationship between farm groups and exporters. Mr. Paul notes that while the farm groups sometimes experience losses due to their own mistakes or negligence, they have always been willing to accept responsibility and learn from their mistakes. By far the largest potential for improvement in the farm group-exporter relationship lies on the side of the exporters. They must take steps to ensure that:

- Their employees act honestly and responsibly.
- Transactions are properly coordinated at all stages: selection, transport, delivery, and payment.
- They honor the agreements they make with farm groups.
- They improve the efficiency and reliability of payments to farm groups.

Junior Paul recommends, among other things, establishing a better system of communication between farm groups and exporters, and developing tools such as technical sheets that can serve as reference points for the farm group-exporter transactions. He notes that certain farm groups and certain exporters have been able to develop good working relationships based on respect, a sense of responsibility, and mutual trust; an example is the relationship between AKOLAD in Marigot and Mr. José Sylvain of La Finca.

One way that programs focused on marketing can extend their reach is by linking with or adding complementary programs that aim to improve product quality. Two examples are the igname program, which has supported PADF efforts to improve quality by promoting an igname multiplication program that greatly reduces the incidence of disease, and the efforts through the EWW subcontract to improve village-level coffee processing techniques, thereby improving the quality of coffee exported through the FACN marketing channel.

Ultimately, in their continuing efforts to expand their reach in meaningful ways, marketing programs will probably have to address issues such as storage and transportation of perishable products, and production. Some products with valuable export markets, such as pigeon pea and breadfruit, are not currently being exported from Haiti due solely to the inability of existing infrastructure to move them to market quickly and without spoilage. In other cases, well-managed production programs could help farmers to enter new markets or exploit existing markets more fully. SECID's hot pepper program, for example, shows promise, but the distribution of improved seeds alone was not enough to ensure success. In these types of programs, the marketing aspect and the distribution of improved germplasm must be combined with farmer education in the techniques required for good production. In the case of cacao, ServiCoop was providing a good market for the product, and SECID believed that the next step in helping farmers to increase their incomes was by showing them how to potentially increase production by about 30% by implementing improved tree management practices. This program

was hurt by the drastic decline in the international cacao price, which consequently made cacao a less attractive crop to farmers, but it was a step in the right direction.

Conditions for a Successful Marketing Program

This section details criteria that should be considered when developing a marketing program for any product. If the product does not meet one of the criteria, that problem may be surmountable, but if it does not meet several of the criteria, then one should seriously consider whether project resources might not be better allocated to another program. The questions to ask about a product, in no particular order, are:

- **What quantity is available?** A lack of accurate knowledge about quantity, and a lack of sufficient quantity in general, were the biggest barriers to the success of the igname program. On the other hand, both breadfruit and kenep are very plentiful, and that was one reason that marketing programs were begun for those products.
- **By how much would an intervention increase farmer income?** The dried immature sour orange program has never taken off, perhaps because the 20 Gdes/marmite price is not attractive enough to farmers or does not adequately compensate them for their effort in collecting, drying, storing, and transporting this product. The most successful programs, such as for mango and pumpkin, allow farmers to double or even triple their income from a product.
- **How perishable is it?** High perishability was the stumbling block for breadfruit and pigeon pea programs, as mentioned above. One technique for marketing perishable products is to transform them into less-perishable products, as SECID did with manioc and plantain. Other products, such as igname and pumpkin, can be stored for weeks or months without processing.
- **What is the quality? Must germplasm be introduced?** The two programs relying on introduced germplasm, hot pepper and especially okra, were stopped because of production problems. Any introduction of germplasm or other production activities must be carefully planned. For most successful programs, germplasm introduction was unnecessary. For mango, the high-quality variety Francique was already in widespread production.
- **What are the local or export market options? How much demand exists?** The reason behind the decline of the plantain chip marketing program was that there was only one buyer for the product. In an ideal program there will be competition between several buyers. An example is the competition between buyers for mango or kenep. For kenep, the demand question also extends to the international market: the international demand for kenep is lower than the demand for mango or coffee, so that program probably cannot be expanded indefinitely.
- **How interested are buyers or exporters?** If there is a sustained interest by exporters, there is more chance that the program will succeed. There is still hope for the igname marketing program because several exporters remain interested in the product. If only one exporter shows only a half-hearted interest in a product, chances are the program will be less successful.

- **What is the existing method of marketing this product?** Examine the market structure. If there is already considerable competition between buyers, it will not be necessary to create more, but if competition is low then the establishment of an alternative buyer may make sense. ServiCoop's differing experiences with mangos and cacao demonstrate this. Another aspect of the marketing method is its quality requirements. The malanga export marketing program was discontinued in large part because farmers preferred to sell all their crop at the local market price rather than go through the rigorous selection process to sell a portion of their crop at the higher price offered by exporters.
- **What is the environmental impact?** Obviously, this has no direct effect on the main goal of increasing farmers' incomes. However, this question has helped guide us into working more with tree crops, crops grown in association with trees, or long-cycle crops. It is one reason we did not continue with dry bean marketing.

Development of a Successful Marketing Program

SECID has found that the following steps should be followed in the development of a successful marketing program:

- Gather preliminary information, and then do an in-depth, careful survey covering all the questions from the previous section. The survey should also include current and potential farm-level prices, any special problems with the product, such as disease, and time and length of harvest.
- Make sure you have enough personnel and time to invest in the program. Also consider the product's harvest time. As an example, SECID did not develop an avocado program in part because the avocado harvest overlaps with the busy mango harvest season.
- Find and/or choose groups to work with, preferably those that are already fairly well organized.
- Provide training that is geared to each group's needs (managerial / institutional / product-specific). Training may also be conducted in concert with marketing trials. Training is critical to the success of a program.
- Negotiate with buyers or exporters. Include farm group participation.
- Assist in organizing and supporting a trial shipment.
- Follow up on the program. Decide whether or not to continue with it. Address any problems. Provide additional training and supervision as needed.

A more detailed series of steps can be found in the SECID/Auburn PLUS Semi-Annual Report of 1 October 1998 - 30 March 1999.

B. Programmatic and Institutional Lessons

Technical assistance provided by SECID could have been more effective at achieving its goals, had there not been certain constraints and limitations placed upon various technical assistance programs. Key elements to a successful program of technical support are:

- continuity of effort
- adequate staffing resources
- institutional structures that enhance cooperation and complementarity

Continuity of Effort

Lack of continuity of effort was one of the greatest constraints affecting the three research programs. Applied and adaptive research is different from other types of development activities because of the time lag between initiation of activities and the time that the results have an impact on a large number of farmers. This leads to impatience with the research process, especially when program objectives change. In the case of the Tree Improvement Program, which began under AOP, considerable losses occurred in the field because of the 1-year project suspension between AF II and PLUS. Project objectives changed under PLUS and the Tree Improvement Program was not included in the original plan. The combined efforts of PADF, CARE and SECID led to re-inclusion of this activity within SECID's mandate, but at a lower level of support. The lack of personnel trained beyond the MS degree was severely felt at the time the program was terminated in 1995. Despite efforts by the Forestry Consultant, reports on improvement activities on 6 species remain unreported.

Also, due to the premature closing of the seed orchards, trials and orchards were left unattended and risked being lost, due to the lack of project support. SECID had recommended that efforts be made to train orchard owners in orchard management and that they be organized as an seed production cooperative. Those directly or indirectly involved in the tree planting program were pleased when PADF was later assigned the duty to oversee the tree nurseries as that assured their future survival.

Similarly, with the closing of the On-farm Adaptive Research program in 1996, slightly more than three years after it began, trials in the field were abandoned and the six months given to close down the program were inadequate to analyze all the data collected and to publish the results. Included in the abandoned trials were newly established trials with new plantain varieties imported from Honduras and long-term studies with soil and water conservation (*bann manje* and alley cropping) conducted in PADF areas. Time did not allow for as thorough an analysis as would have been desired or to include socioeconomic information associated with the trials, a deficiency pointed out in the Hillside Agriculture assessment. The agroforestry research program would have suffered a similar fate, had it not been for the good fortune that outside funding from the Soil Management Collaborative Research Support Program allowed for the trials to be continued under other auspices. This explains why a more thorough analysis can be reported for the Agroforestry research results than for the other adaptive research areas.

Adequate staffing

Inadequate staffing at all levels seriously affected the quality of research results, particularly in the case of On-farm Agronomic Research, and when combined with the sudden termination of programs, resulted in under-reporting and unreported trials, both in the agronomic research and the Tree Germplasm Improvement Program. In the former case, we had a program for which there was a high demand by the implementing agencies, but without a corresponding commitment of resources. SECID was allowed only one agronomist in this program, to oversee trials in four PADF regions, four CARE Regions in Northwest Haiti, and eventually also in the Grande Anse. This meant that despite being almost constantly on the road, the SECID agronomist could not spend adequate time with each trial and with each field assistant implementing the trials. In addition, with two cropping seasons a year, the travel time did not allow sufficient office time to analyze and report results. When the order came to terminate the program, it was necessary for the Campus Coordinator to order the agronomist to immediate suspend all field visits in order to concentrate on data analysis and reporting. Nevertheless, he was not able to complete the task in the time allotted.

The Agroforestry Research Program differed from the On-farm Agronomic Research Program in that control of the trials in the former was under the direct control of the SECID technical staff, whereas the trials conducted under the On-farm Agronomic Research program were under the control of CARE and PADF field staff. Although on paper, the staffing for on-farm research may have been adequate, in actual fact, the CARE and PADF staff assigned to implement the trials were often assigned extension duties that took priority over the research trials and took them away from the trials for extended periods, resulting in data being collected at the wrong time, crops harvested too late, poor quality data and many lost trials. In the first year of the program over half of the trials conducted by CARE had to be abandoned, in large measure due to poor management. By contrast, the Agroforestry Research Program/Soil Management CRSP Project never lost a trial in nearly 10 years due to poor management. In 1994, following the high loss of trials in the preceding year, PADF and CARE accepted in principal to assign staff uniquely to the research trials. In practice certain Regional Coordinators refused to implement this decision and added extension duties to the newly-hired research staff. A year later, budget cuts resulted in the research staff of PADF and CARE being laid off. The quality and quantity of data transmitted to SECID declined.

Quality of staffing is also an important consideration. Each of SECID's programs in PLUS was headed by a MS level Haitian and supervised by an international staff trained at the Ph.D. level. Having capable, well-trained staff was one of SECID's strengths, which ensured its success. In most cases, this was adequate, although in the case of the Tree Improvement Program, the complexity of the statistical analyses and other considerations implied that even a MS level was inadequate. The deficiency was partially resolved by hiring an experienced consultant, Mr. Joel Timyan, but his involvement was not sufficient to fully meet our obligations.

Institutional Structures fostering Collaboration and Complementarity

Both the successes and failures of SECID's technical assistance in the PLUS project were tied to the degree with which collaboration and complementarity occurred between SECID, as agent of technical assistance, and the Grantee organizations and project implementors. SECID would not have been successful had it not been for collaboration on the part of the senior staff and regional employees of PADF and CARE. Where it was not successful, as in the staffing problems encountered in the On-farm Agronomic Research Program cited above, the quality of the work suffered. Part of the problem was with an organizational structure inherited from the AOP and AF II projects that fostered competition rather than collaboration. At the beginning of PLUS, SECID was seen as the "little brother" of the Grantees, whose very existence was dependent upon the will of its "big brothers." When SECID needed to hire more staff, USAID, rather than judging issues on the merits of the SECID's needs, would ask PADF and CARE for their approval. Since the funds available to PLUS were fixed, this amounted to asking the Grantees to cut their own budgets in order to increase SECID's budget. The natural response of the Grantees was to protect their "share of the pie" by refusing to accede to SECID's wishes. SECID's status, thankfully improved, as it became more broadly accepted as a full partner in the project in its own right.

Another institutional problem inherited from AOP and AF II was the proprietary attitude with regard to farmers. In these projects, the Grantees were conceived the authorities on the farmer, who instructed SECID on what was good for the farmer, what the farmer would or would not accept, etc. and served as the intermediary between SECID and farmers. Thus the Grantees determined both the extension and research agendas, and SECID's role was to do what the Grantees wanted. This institutional division of labor separated the technical assistance team of SECID from close interaction with farmers and flies in the face of the "farmer-driven" participatory approach envisioned for PLUS. Although this was overcome in part through SECID's participation in surveys and on-farm trials, the institutional separation of technical support and research from extension ultimately served to limit SECID's ability to obtain farmer feedback on technologies. Furthermore, SECID had no input into extension decisions, including those related to implementing research results. In many cases, SECID has only limited knowledge about the extent to which information and research results provided to the Grantees were conveyed to farmers.

Future projects should learn from these problems, to avoid institutional separation between technical support and applied research on one hand and the extension function. Better integration is needed between the research and extension functions, to ensure that researchers and other technical support staff interact with farmers and also participate in decisions relating to technology transfer. Technical support and applied research should be a full-fledged component of development process with a personnel and budget adequate to meet its needs. Finally, it should be recognized that to obtain results from applied research a sufficiently long time-line is needed. In fact, it should be continuous. Ideally, the research needed to support a given 5-year program should be initiated prior to project implementation, such that the results are available in time to have a major impact on farmers.

Information Clearinghouse

The Information Clearinghouse was a new innovation. Its effectiveness is difficult to measure because its work was so integrated into the overall work of SECID, CARE and PADF from providing information to plan research, searching the literature to provide extension workers with technical information, editing newsletters, editing technical reports, etc. The key to its success was staffing by a capable agronomist, rather than a librarian, someone who was qualified to read, analyze and interpret technical information for the benefit of project users. This is a model that should be adopted elsewhere.

Lessons Learned from the PLUS M&E Experience

1. The design of the M&E system was overly ambitious for the level of resources allocated to its implementation. USAID wanted a M&E system that would redirect the implementation of the PLUS project from agenda-driven to farmer-driven implementation methodologies; yet, it did not modify the Cooperative Agreements of the implementing agencies to provide the resources and the incentives (through changed deliverables) to develop a M&E system that would achieve its objectives. Additionally, the complexity of small-scale farming in Haiti combined with the complexity of technical packages provided by the PLUS project implied a much higher-than-provided level of effort to achieve the expected level of coverage and accuracy. USAID required that data collection for M&E purposes be conducted by project implementation staff. This turned out to be infeasible as implementation staff gave first priority to implementation and did not have sufficient time for M&E data collection.

2. Approval of the M&E system by the technical office within the USAID/Haiti Mission did not assure approval by higher levels of USAID. The PLUS M&E system was criticized as theoretically flawed by the USAID Inspector General two to three years after the system had been approved by the USAID/Haiti technical office and installed by the PLUS project.

3. As conducted, the case studies provided limited amounts of decision-making information. However, because the results were almost uniformly positive, project implementors decided to continue with the promotion of all the technologies included in the case study series. Due to lack of resources, the number of case studies (longitudinal studies of selected farmers implementing specific technologies) was initially limited to 25 per selected technology. To make matters worse, these numbers were reduced during implementation because the case study methodologies were not followed by the field personnel who were distracted by their dual rolls as data collectors and project implementors. Additionally, farmers participating in the case studies did not adhere to their agreements to implement their traditional agricultural practices alongside the project-promoted technology for comparison purposes. Instead, the farmers implemented the project-promoted technologies exclusively. This deprived the M&E system of its planned means of comparison. Thus, the case study program was discontinued after only one or two seasons.

4. The M&E system was designed to provide information to guide program implementation. Several SPIs were designed for this purpose. A series of special studies were also planned to address this purpose. The system's capability to contribute in this fashion appeared to be constrained by project implementors' concern that this type of contribution constituted micro-management, to wit, the quick reduction in the SPIs that addressed this purpose. In the one case in which a special study was made, the M&E system was able to make a significant contribution to improved project implementation. The study was on the management and impacts of hedgerows (SECID/Auburn Report No. 24). The study showed that hedgerows were often not being well managed. This finding resulted in a change in project implementation approaches from simply having soil and water conservation structures installed to assuring that they were installed and well maintained.

5. The efficacy of the annual, large-sample survey of participating farmers to accurately demonstrate PLUS project impact was increasingly questioned over time. Because the survey took place during a short period of time, it relied on farmers recollection of their crop yields and prices. Critics doubted whether farmers could accurately recall these data. Changes in USAID funding levels and reporting times caused significant disturbances, note above, in the implementation of the survey. Thus, it is difficult to maintain that such a survey is the ideal method of determining project impact at significant levels of accuracy. What is more reasonable to assert is that the survey provided an indicator of project impact as expressed through farmer satisfaction with project activities. This may be all that can be reasonably expected of the M&E system given the complexities of the situation being studied. The survey coupled with the above suggested lower expectation on its reliability gains status as an indicator of choice when compared to an early suggestion that project impact be indicated by changes in the roofing materials of farm houses in project areas.

IV. CONCLUSIONS AND RECOMMENDATIONS

SECID made valuable contributions to the information base available to PLUS and future projects. This information base contributed to actual and potential increases in farmer income, increased sustainability and increased food production. More could have been accomplished with greater resources, but progress was made in all areas. Much more remains to be done.

Crop Production, Protection and Management

Farmers lack access to improved varieties and improved cropping techniques that could increase the productivity of their land and the sustainability of their system. Future projects should avail themselves of every opportunity to provide farmers with high yielding, high quality crop varieties, and recommendations for improved crop and soil management and crop protection. Introduction of improved varieties should not preclude preservation of existing land races and varieties.

Under normal circumstances adaptive research to improve crop production should be the function of national institutions. Given the weak financial condition of national institutions, however, it is unrealistic to expect them to meet the needs of farmers in USAID project areas unless USAID is prepared to assist in covering the costs of this assistance. Secondly, international research institutions can provide expertise and improved varieties but cannot substitute for the need for local adaptive and applied research. It would be irresponsible, for example, to distribute improved varieties to farmers without first testing within the environment in which they are to be grown. While they might be superior in their country of origin, they could be susceptible to a local disease, such that its distribution could be disastrous to farmers. A strategy to include adaptive research in support of project farmers will increase project effectiveness and also will create an environment that will facilitate support from international centers and U.S. Land Grant Universities. The CRSP programs of USAID can be a useful resource to address difficult questions requiring in-depth study. Where possible, tying production research to the marketing program will ensure that it is more effective.

Improvement in soil fertility is an important way in which farmers can increase productivity and thereby the value to their land. Increasing the value will enhance soil conservation and environmental protection. There is an urgent need for fertilizer response trials to develop appropriate recommendations for different soils and crops. USAID should abandon its opposition to the use of fertilizers in development projects.

Tree Improvement

The tree seed orchards and trials established by SECID are a valuable resource that should be maintained with technical support from USAID. Organization of a seed production cooperative and training in orchard management, seed handling and commercial marketing of tree seed should be considered. These orchards provide a means to increase farmer income, improve the environment and to fight against loss of biodiversity.

Agroforestry and Soil Conservation

There will always be a need for soil conservation as a component of hillside agriculture programs. Greater emphasis needs to be given to maintenance of soil fertility. Alley cropping, in which prunings are applied to the soil, is one of the solutions that should be promoted. Greater emphasis on hedgerow management and soil application of prunings should be made as part of the extension effort. Application of phosphorus should be encouraged, and where appropriate, potassium and sometimes zinc or other nutrients. Farmers will have more incentive to install and maintain hedgerows or other soil conservation barriers if there is a good chance of higher yields and income. The extension effort for alley cropping should target women as well as men, because of their higher rates of adoption and management compared to men.

Greater attention is needed to the roles of livestock in soil and water conservation. Traditional swine production, with its reliance on fruit trees for food and shade, should be encouraged, because of the environmental benefits of increased tree cover. Socioeconomic studies and community dialogue are needed to identify alternatives to free grazing of livestock on Haitian hillsides. If these practices could be replaced by confined grazing, more could be accomplished in reducing land degradation than years of constructing rock walls and planting hedgerow barriers.

Information Clearinghouse

Future USAID projects need access to technical information from the scientific literature as well as from the experiences and research of past projects. A library consolidating technical information and project records, staffed by a competent agronomist would enhance the performance of USAID projects in Haiti. The Information Clearinghouse is a model that should be replicated in future projects. An Information Clearinghouse can serve several projects at one time and should be seen as a long-term investment.

Marketing

SECID has shown that marketing activities alone can significantly increase farmers' incomes, and thus lead to increased farmer interest in production. SECID recommends a project approach to agricultural and economic development that focuses on marketing activities first. Marketing activities attract farmer involvement because such activities cause price increases and provide increased income to farmers. Naturally, the increase in income captures farmers' interest. They quickly begin asking the project for more assistance and this sets up a situation in which technology transfer can take place at an accelerated pace. Because the rewards for the farmers' behavioral changes (using the new technology) come from the market through product sales, the sustainability of the behavioral change is more assured than if the rewards came from the project in the form of subsidies. This should also result in a higher rate of first and secondary adoption than traditionally subsidized approaches. As stated above, training and institutional strengthening are key aspects of the SECID approach; they add to the sustainability of interventions by boosting business skills and group participation.

The SECID approach provides a rationale, and the beginnings of a methodology, for linked interventions that positively impact farmer income, agriculture, the environment, organizational strength and the development of civil society / participatory democracy. Future agricultural development projects should place a high priority on agricultural marketing.

Recommendations for Designing and Implementing Future M&E Programs

USAID and its partners should use a more systematic approach to the development of M&E systems. The approach should include reviews and approvals from all levels of authority within USAID that have authority to do so, including those authorities outside of the local Mission who may judge the system at a later date. Because of the significant trade-off between M&E system quality and funding, the review and approval process should include a review and approval of funding for the system. The designed system should give consideration to effects of possible disruptions in project and M&E program implementation on the viability of its results. For example, relying on a single annual survey exposes the system to the risks that the survey and thereby the whole program will be disrupted. Given the uncertainties of agricultural development programs in underdeveloped countries, it may be wise to set modest goals for M&E systems and provide more than one method of obtaining acceptable M&E results. Once the system has been designed and approved, it should be the subject of a written agreement between the project implementor(s) and USAID.

Literature Cited

Herwig, K. and E. Ludi. 1999. The performance of selected soil and water conservation measures - case studies from Ethiopia and Eritrea. Catena 36: 99-114.

Isaac, L., C.W. Wood and D.A. Shannon. 2000. Decomposition and nitrogen release of prunings from hedgerow species assessed for alley cropping in Haiti. Agronomy J. 92: 501-511.

(Formal SECID/Auburn reports are listed in Appendix D).

APPENDIX A
SECID/Auburn Formal M&E System Reports

Report No.

7. **Farmer Needs Assessment Exploratory Surveys Executive Summary Recommendations.** by Richard A. Swanson, William Gustave, Yves Jean and Roosevelt Saint-Dic. October 1993.

8. **Farmer Needs Assessment Exploratory Surveys Field Information Acquisition Guide and Methodology.** by Richard A. Swanson. October 1993.

9. **Farmer Needs Assessment Exploratory Surveys PADF Cap Haïtien Region 3.** by Richard A. Swanson, William Gustave, Yves Jean and Georges Condé. October 1993.

10. **Farmer Needs Assessment Exploratory Surveys: CARE Northwest Regions 2, 3, & 4.** by Richard A. Swanson, William Gustave, Yves Jean and Roosevelt Saint-Dic. October 1993.

11. **Farmer Needs Assessment Exploratory Surveys PADF Jacmel Region 2.** by Richard A. Swanson, William Gustave, Yves Jean and Roosevelt Saint-Dic. October 1993.

12. **Farmer Needs Assessment Exploratory Surveys: PADF Mirebalais Region 3.** by Richard A. Swanson, William Gustave, Yves Jean and Roosevelt Saint-Dic. October 1993.

13. **Farmer Needs Assessment Exploratory Surveys PADF Les Cayes Region 1.** by Richard A. Swanson, William Gustave, Yves Jean and Roosevelt Saint-Dic. October 1993.

14. **Food Marketing in Northwest Haiti: CARE Regions I – IV.** by Curtis M. Jolly and Nelta Jean-Louis. December 1993.

16. **First Assessment and Refinement of the PLUS M&E System.** by Angelos Pagoulatos. March, 1994.

17. **Initial Financial Evaluation of Hedgerows.** by John Dale (Zach) Lea. June 1993.

18. **Project Plus Baseline Information.** by John Dale (Zach) Lea. February 1994.

22. **Rates of Adoption of PLUS Project Interventions Northwest Haiti.** by John Dale (Zach) Lea. July 1994.

24. **Gestion et Impacts des Haies Vives PADF/ Camp-Perrin.** by Frishner Pierre, John Dale (Zach) Lea, and Roosevelt Saint-Dic. May 1995.

APPENDIX B
SECID/Auburn Informal M&E System Reports Prior to September 1998

Preliminary plus Project Hedgerow Case Study Results: December 1993 - September 1994.

Intervention Success Stories: Productive Land Use Systems Project, 1993.

Vegetable Garden Case Study Results, Spring 1994.

Plus Project Case-study Results: First Corn Harvest Yields from Gully Plugs, Sauval, Passe Catabois, Northwest Haiti, February-March 1994.

Rapport sur les Etudes de Cas "Jardin Légumes" PLUS, Campagne Agricole Septembre 94 - Août 95.

Plus Project Case-study Results: Comparing Traditional with Rockwall Yields Barbe Pagnole, Summer 1994.

Project Plus1994 Monitoring Case Study Results, January 1995. (Draft SECID/Auburn PLUS Report.

PLUS Project Rockwall Case Study Results: Comparing sorghum yields on tradition and rockwall farm plots Mirebalais, January 1995.

PLUS Project Hedgerow Case Study Report, December 94 - February 95.

Rapport sur les "Baraj Ravinn," Données collectées de November 1993 à October 1995.

PLUS Project Strategic Performance Indicators (noted in Oct 94-Mar 95 semi-annual report).

Summary Report of Project PLUS 1994 Monitoring Case Study Results (noted in Oct 94-Mar 95 semi-annual report).

Strategic Performance Indicators from the PLUS Project Impact Survey of PADF Zones (March 16 - June 21, 1996), October 1996.

Strategic Performance Indicators (SPIs) de l'Impact du Projet PLUS dans l'Aire d'Intervention de CARE au Nord'Quest d'Haiti, November 1996.

Analysis of CARE 1995 Grande Anse Baseline Data, January 1997.

Summary Report: SECID Analysis of CARE and PADF 1998 plus Project Extensive Surveys, July 1999.

APPENDIX C
SECID Strategic Objectives Reports After September 1998

SELECTED MARKETING ACCOMPLISHMENTS SEPT/98 - AUG/99

Product	Marketer	No. Farmers Directly involved	Total Sales Value of Products Marketed Thru Program	Increased Sales Value of Products Marketed Thru the Program	Increased Sales Value of of Products Market Thru other channels[a]
Cacao	Farm Groups via ServiCoop	4,500	$550,000	$34,000-$68,000	$150,000-$300,000
Mango	Farm groups via Traditional Exporters	5,000	$135,000	$27,080	$50,000-$100,000
Coffee	Farm Groups via ServiCoop	750	$116,490	$14,730	n.a.
Manioc	Farm Groups	225	$10,178	$5,000	n.a.
	Totals	10,475	$816,668	$80,000-$115,000	$200,000-$400,000

a This increased value is created when competition caused by our programs stimulates an increase in prices for the same products sold through competing market channels. Cacao results assumes 0.50-1.00 Gdes/lb increase applied to estimated national exports. Mango results assumes 1.00-2.00 Gdes/dz increase applied to estimated national exports.

SELECTED MARKETING ACCOMPLISHMENTS Jan/99 - Dec/99

Product	Marketer	No. Farmers Directly involved	Total Sales Value of Products Marketed Thru Program	Increased Sales Value of Products Marketed Thru the Program	Increased Sales Value of of Products Market Thru other channels[a]
Cacao	Farm Groups via ServiCoop	4,500	$872,171	$52,804-$105,608	$174,079-$348,058
Mango	Farm groups via Traditional Exporters	5,000	$147,401	$29,480	$100,000-$200,000
Coffee	Farm Groups via ServiCoop	750	$164,052	$32,810	n.a.
Manioc	Farm Groups	225	$9,474	$4,737	n.a.
	Totals	10,475	$1,193,098	$119,831-$172,635	$274,079-$548,058

a This increased value is created when competition caused by our programs stimulates an increase in prices for the same products sold through competing market channels. Cacao results assumes 0.50-1.00 Gdes/lb increase applied to estimated national exports. Mango results assumes 1.00-2.00 Gdes/dz increase applied to estimated national exports.

Selected Results from SECID/PLUS Marketing Programs Year 2000

Product	Marketer Organzations	No. Farmers Directly involved	Quantity	Total Sales Value of Products Marketed Thru Program
Cacao	Farm Groups via ServiCoop	4,500	297mt	$221,601
Mango	Farm groups via Traditional Exporters	5,000	120,448 doz	$131,181
Coffee	Farm Groups via ServiCoop	750	145,779lbs	$169,676
Coffee	Farm Groups via FACN	20,000	128,000lbs	$256,000
	Totals	30,250		$778,458

APPENDIX D
SECID/Auburn University Publications

Book

Bwa Yo: Important Trees of Haiti. by Joel C. Timyan. 1996. South-East Consortium for International Development, Washington, D.C. 418 pp. Paperback. ISBN: 0-9645449-0-3.

Dissertation

Pierre Rosseau, 1995. An Analysis of on-farm practices on hillside production systems in Haiti. PhD. Dissertation, Auburn University.172p.

SECID/Auburn PLUS Special Reports

SECID/EWW Coffee Sub-Project Final Report. by Jose Gemeil, EnterpriseWorks Worldwide,15 pp, February, 2001.

Haiti Hillside Agriculture Assessment Report/Etude Prospective de Projets D'Appui a L'Agricuture de Montagne en Haiti. by John Eriksen, John Russell, Claude St. Pierre, Anthony Juo, Michael Reed and David Dupras, 55 pp, March, 1999.

SECID/Auburn PLUS Reports[1]

Report No.

2001

52 **Findings of Surveys on Yam (Dioscorea spp.) Production in the Grade Anse Department, Haiti.** by Dennis A. Shannon. 40 pp.

51. **Cowpea variety trials in Northwest Haiti.** by Dennis A. Shannon, Yves Jean and Frank E. Brockman. 33 pp.

50. **Training manual for improving cocoa production in Haiti.** by Christopher Stevenson. 41 pp.

1999

49. **Haiti small-scale coffee producers production, processing, quality control and marketing.** by Gilberto Amaya, Victor Mencía, Patrice Gautier, José A. Gemeil. 37 pp.

48. **Technical Support to Haitian Cocoa.** by B.K. Matlick, L.H. Purdy and C. Stevenson.

47. **Technical assessment of the irrigation systems of Marigot and Jacmel and preliminary observations on the Marigot watershed.** by Kyung H. Yoo and Dennis A. Shannon. 26 pp.

---

[1] All reports in French have English summaries. Most reports in English have summaries in Haitian Creole.

1998

46. **Recherche de variétés d'arachide (*Arachis hypogea*) adaptées aux conditions de culture du Nord-Ouest et de la Grande-Anse.** by Yves Jean, Dennis Shannon, Frank E. Brockman and Julène Moïse. 32 pp.

1997

45. **Recherche de variétés de manioc (*Manihot esculenta*) adaptées aux conditions de la presqu'île du Nord-Ouest d'Haïti.** by Yves Jean, Dennis A. Shannon, Julène Moïse and Frank E. Brockman. 32 pp.

44. **Essai d'Adaptation de Variétés de Patate Douce (*Ipomea batata*) aux Conditions de Culture du Nord-Ouest d'Haïti.** by Yves Jean, Dennis A. Shannon, Frank E. Brockman and Julène Moïse. 37 pp.

43. **Essai Comparatif de Variétés de Haricot Résistantes à la Mosaïque Dorée et au Stress de Chaleur.** by Yves Jean, Dennis A. Shannon, Frank E. Brockman, Julène Moïse and Emmanuel Prophète. 44 pp.

42. **Essai de Techniques Culturales Contre la Pourriture au Champ de Tubercule d'Igname dans les Systèmes de Culture Agro-forestiers Traditionels Haïtiens.** By Yves Jean, Frank Brockman and Dennis A. Shannon. 38 pp.

41. **Haitian Oak (*Catalpa longissima* (Jacq.) Dum. Cours.) Seed Orchards and Progeny Trials in Haiti: 1988-1996.** by Joel Timyan, L. Verret, C.A. Béliard and Y. Elie. 15 pp.

40. **Mahogany (*Swietenia*) Trials in Haiti: 1989-1996.** by Joel Timyan, L. Verret, C.A. Béliard and Y. Elie. 32 pp.

39. **Five Year Results of a Neem (*Azadirachta indica*) Trial at Roche Blanche, Haiti.** by Joel Timyan, L. Verret, C.A. Béliard and Y. Elie. 13 pp.

38. **Evaluation de Provenances de *Gliricidia sepium* (Jacq.) Walp. en Haïti.** by Joel Timyan, L. Verret, C.A. Béliard and Y. Elie. 28 pp.

1996

37. **Five Year Results of the *Pinus* Trial near Kenscoff, Haiti.** by Joel Timyan, L. Verret, C. Béliard and Y. Elie. 19 pp.

36. **Résultats Comparatif d'Espèces de de *Casuarina* à Lapila, (Pignon) Haïti: Résultats de Cinq Ans de Croissance.** by C.A. Béliard, L. Verret, J. Timyan and Y. Elie. 12 pp.

35. **Five Year Results of *Senna siamea* Trials in Haiti.** by Joel Timyan, Louis Verret, Carmel André Béliard and Yvon Elie. SECID/Auburn PLUS Report No. 35. 19 pp.

34. **Résultats de Croissance de Provenances de *Enterolobium cyclocarpum* après Cinq Ans en Haïti.** by C.A. Béliard, L. Verret, J. Timyan and Y. Elie. 15 pp.

33. **Essais de Provenances de *Cordia alliodora* en Haïti: Résultats après 5 Ans de Croissance.** by Carmel André Béliard, Louis Verret, Joël Timyan and Yvon Elie. 15 pp.

32. **Résultat de Deux Années de Suivi: Etudes de Cas "Baraj Ravinn".** Données collectées de Novembre 1993 à Octobre 1995. by Frisner Pierre et John Dale (Zach) Lea. 26 pp.

31. **Résultats de Croissance de Provenances de *Cedrela odorata* après Cinq ans en Haïti.** by Carmel André Béliard, Louis Verret, Joël Timyan and Yvon Elie. 24 pp.

30. **The Effects of Alley Cropping and Other Soil Conservation Practices on Maize (*Zea mays*) Yields over Two Years of Cropping.** by Lionel Isaac, Dennis A. Shannon, Frank E. Brockman and Carine R. Bernard. 54 pp.

29. **Soil Profile Descriptions for Agroforestry Research Sites in Haiti.** by Richard L. Guthrie, Lionel Isaac, Gerard Alexis, Carine Bernard and Marguerite Blemur. 26 pp.

28. **Increasing the Marketability of Manioc and Breadfruit Products by Improving Processing Techniques.** by John Y. Lu, J.D. (Zach) Lea, Louis R. Chery and Dennis A. Shannon. 15 pp.

1995

27. **The effects of Leucaena Hedgerow Management on Maize and Hedgerow Biomass Yields over Two Years of Cropping.** by Lionel Isaac, Dennis A. Shannon, Frank E. Brockman and Carine Bernard. 69 pp.

26. **Plant Disease Problems in Banana and Plantain in Haiti.** by R.H. Stover. 21 pp.

25. **Further Assessment and Refinement of the PLUS M&E System.** by Steven Romanoff, Donald Voth and Malcolm Douglas. 162 pp.

24. **Gestion et Impacts des Haies Vives PADF/Camp-Perrin.** by Frishner Pierre, John Dale (Zach) Lea and Roosevelt St. Dic. 41 pp.

23. **Impact of Tree Planting in Haiti: 1982-1995.** by Glenn R. Smucker and Joel C. Timyan. 98 pp. (Also available in French. Summary and recommendations available in Creole)

22. **Rates of Adoption of PLUS Project interventions: Northwest Haiti, July 1994.** by John Dale (Zach) Lea. 23 pp.

21. **Consultancy Report: Integrated Pest Management in Vegetable Gardens in Haiti, October 1994.** by Keith A. Jones. 84 pp.

20. **Inventory of Crop Varieties in Haiti or with Potential Value in Haiti.** by Ariel Azaël. 147 pp.

1994

19. **Water Harvesting and Small-Scale Irrigation.** by Kyung H. Yoo. 22 pp.

18. **Project PLUS Baseline Information.** by John Dale (Zach) Lea. 48 pp.

17. **Initial Financial Evaluation of Hedgerows.** by John Dale (Zach) Lea. 26 pp.

16. **First Assessment and Refinement of the PLUS M&E System.** by Angelos Pagoulatos. 38 pp.

15. **Evaluation of Tree Species Adaptation for Alley Cropping in Four Environments in Haiti. B. First Year of Pruning.** by Lionel Isaac, Dennis A. Shannon and Frank E. Brockman. 56 pp.

1993

14. **Food Marketing in Northwest Haiti: CARE Regions I-IV.** by Curtis M. Jolly and Nelta Jean-Louis. 150 pp.

13. **Farmer Needs Assessment Exploratory Surveys: PADF Les Cayes Region 1.** by Richard A. Swanson, William Gustave, Yves Jean and Roosevelt Saint-Dic. 84 pp.

12. **Farmer Needs Assessment Exploratory Surveys: PADF Mirebalais Region 3.** by Richard A. Swanson, William Gustave, Yves Jean and Roosevelt Saint-Dic. 91 pp.

11. **Farmer Needs Assessment Exploratory Surveys: PADF Jacmel Region 2.** by Richard A. Swanson, William Gustave, Yves Jean and Roosevelt Saint-Dic. 84 pp.

10. **Farmer Needs Assessment Exploratory Surveys: CARE Northwest Regions 2, 3 & 4.** by Richard A. Swanson, William Gustave, Yves Jean and Roosevelt Saint-Dic. 76 pp.

9. **Farmer Needs Assessment Exploratory Surveys: PADF Cap Haitian Region 3.** by Richard A. Swanson, William Gustave, Yves Jean and Georges Condé. 75 pp.

8. **Farmer Needs Assessment Exploratory Surveys: Field Information Acquisition Guide and Methodology.** by Richard A. Swanson. 28 pp.

7. **Farmer Needs Assessment Exploratory Surveys: Executive Summary and Recommendations.** by Richard A. Swanson, William Gustave, Yves Jean and Roosevelt Saint-Dic. 53 pp.

6. **Evaluation of Tree Species Adaptation for Alley Cropping in Four Environments in Haiti. A. Establishment Phase.** by Dennis A. Shannon and Lionel Isaac. 90 pp.

5. **Guide to the Literature and Organizations involved in Agribusiness Research and Agribusiness Development in Haiti.** by Henry Jude Bélizaire and John Dale (Zach) Lea. 46 pp.

4. **Rapport sur les Recherches d'Opportunités de Commercialisation pour les Produits Agricoles dans les Aires d'Intervention du Projet PLUS.** by Henry Jude Bélizaire and John Dale (Zach) Lea. 61 pp

3. **Monitoring and Evaluation System for PLUS.** by Angelos Pagoulatos. 53 pp.

2. **A Review of PDAI and ADS II Project Technologies.** by Marianito R. Villanueva. 31 pp.

1. **Status of Seed Orchards and Tree Improvement Trials in Haiti and Plan of Activities 1993-1994.** by Joel C. Timyan. 72 pp.

PLUS Special Report

Intervention Success Stories: Productive Land Use Systems Project. by J.D. (Zach) Lea, Roosevelt Saint-Dic and Frank Brockman. 1993. 39 pp.

SECID/Auburn Agroforestry Reports

Report No.

1991

33. **Economic Indicators of Agroforestry II Strategy Implementation: Farm Income Analysis to Agricultural Project Analysis.** by Kent D. Flemming and G. Edward Karch.

31. **Development of Stock Quality Criteria.** by R. Kent Reid. 30 pp.

30. **The Effects of Alley Cropping and Fertilizer Application on Continuously-Cropped Maize.** by Dennis A. Shannon, Wolfgang O. Vogel and Kapinga N. Kabaluapa. 24 pp.

29. **Agroforestry Knowledge, Attitudes and Practices in Northwest Haiti.** by Paul D. Starr, Sigrid d'Aquin and Kathleen L. Rorison. 75 pp.

28. **Alternative Techniques for Propagating Planting Stock: II. Small Plastic Bags.** by R. Kent Reid. 15 pp.

27. **A Financial Analysis of Selected Hedgerow Operations in Haiti's Southern and Northwestern Regions.** by Philippe Bellerive. 31 pp.

26. **First-Year Seedling Field Survival and Growth as Influenced by Planting Stock Type.** by R. Kent Reid. 65 pp.

1990

25. **Time Rate of Discounting and Decisions of Haitian Tree Planters.** by Donald R. Street. 17 pp.

24. **Effects of Seed Treatment Methods on Germination of *Simarouba glauca* var. *Latifolia* Cronq.** by Fritz Vaval and Joel C. Timyan.

23. **A Geographical Information System (GIS) Approach to Locating Potential Planting Sites for *Catalpa longissima* Species (Chêne) in Haiti.** by Fritz Vaval and Douglas C. Brown. 37 pp.

22. **Agroforestry Research in Haiti: An Overview.** by Paul D. Starr, Donald R. Street, R. Kent Reid and Fritz Vaval. Contains 4 papers: The Social Foundations on Haiti Agroforestry; The Economics of Haiti Agroforestry; Forest Tree Nurseries in Haiti; and The Genetic Conservation of Native Tree Species.

21. **Factors Affecting Seedling Mortality in Haitian Agroforestry.** by Harry Elver. 36 pp.

20. **Storage Conditions and Pre-Germination Methods for Seed of Selected Tropical Tree Species.** by Joel C. Timyan. 23 pp.

19. **Biological, Physical and Environmental Factors Affecting the Health of Trees Important to Haiti.** by G. Brett Runion and Walter D. Kelley. 101 pp.

18. **Results of a Survey of Farmers in Selected CARE and PADF Intervention Areas.** by Marie-Paule Enilorac and Pierre M. Rosseau.

17. **Assessment of Hedgerow Performances in the Haitian Context.** by Pierre M. Rosseau, Arthur G. Hunter and Marie-Paule Enilorac. 41 pp.

16. **Soil Profile Description for Selected Sites in Haiti.** by Richard L. Guthrie, Pierre M. Rosseau, Gene A. Hunter and Marie-Paule Enilorac. 72 pp.

15. **An Explorative Approach for assessing Soil Movement in Hillsides: Applications for Hedgerow Performance.** by Marie-Paule Enilorac, Pierre M. Rosseau and Arthur G. Hunter. 20 pp.

14. **Financial Analysis of Selected Tree Operations in Haiti's Northwest and Central Plateau.** by Donald R. Street, Arthur Gene Hunter and Philippe A. Bellerive. 36 pp.

12. **Pathology of Nursery Seedlings in Haiti: Diseases, their Etiology and Control.** by G.B. Runion, R. Kent Reid and Walt D. Kelley. 1990. 29 pp.

1989

13. **Technical Constraints in Haitian Agroforestry: Research on Tool Use and Need in Two Regions.** by Paul D. Starr. 51 pp.

11. **Outline of Techniques for Use in Studying Agroforestry Hedgerows and Alley Cropping Systems in Haiti.** by A.G. Hunter, Pierre M. Rosseau and Marie-Paule Enilorac.

10. **Impact des Haies Vives sur la Production Agricole.** by Pierre M. Rosseau, Gene A. Hunter and Marie-Paule Enilorac. 14 pp.

9. **Socio-Cultural Factors in Haitian Agroforestry: Research Results from Four Regions.** by Paul D. Starr. 61 pp.

8. **The Pole Market in Haiti: Southwest to Port-au-Prince.** by Donald R. Street and Philippe A. Bellerive. 21 pp.

7. **Haiti Regional Tree Nursery Cost Study.** by S. Goodwin, R. Kent Reid and Donald R. Street. 19 pp.

6. **The Charcoal Market in Haiti: Northwest to Port-au-Prince.** by Donald R. Street. 26 pp.

5. **Microsymbiont Colonization and Seedling Development as Influenced by Inoculation Method: *Rhizobium* and *Frankia*.** by R. Kent Reid. 15 pp.

4. **Seedling Growth and Development in Different Container Types and Potting Mixes.** by R. Kent Reid. 15 pp.

3. **Short-Term Seedling Field Survival and Growth as Influenced by Container Types and Potting Mix.** by R. Kent Reid. 46 pp.

2. **An Interim Report on Influences of Inoculation with Nitrogen-Fixing Symbionts on Reforestation Efforts in Haiti.** by R. Kent Reid. 13 pp.

1. **Tree Planting in Haiti: A Socio-Economic Appraisal.** by Donald R. Street. 48 pp.

Reports may be obtained by contacting the SECID or USAID/CDIE by contacting:

SECID	USAID
1634 Eye Street NW, Suite 702 Washington, D.C. 20006 Tel. 202.628.4551 Fax 202.628.4561 Email info@secid.org	Document Acquisitions USAID Development Experience Clearinghouse 1611 N Kent St Ste 200 Arlington VA 22209-2111 USA docsubmit@dec.cdie.org Tel. 703-351-4006 x109 Fax 703-351-4039 *or download at:* http://www.dec.org/partners then choose "Search USAID Documentation"