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Executive Summary

Jamaica's agriculture sector has not been performing well. Its contribution to the national economy has fallen far below expectation and potential. The poor performance of Jamaican agriculture is reflected in its low productivity. Crop yields are below those of most developing countries and even below neighboring countries in the Caribbean region.

Recognizing that increases in productivity almost always require infusion of improved technology and that agricultural research in Jamaica was at a low level, USAID/Jamaica entered into a Cooperative Agreement in 1986 with the Jamaican Agricultural Development Foundation (JADF) to begin a research program aimed at:

- increasing small farm productivity by introducing or developing new methods, techniques, and materials
- strengthening local research capability.

The Jamaican Agricultural Research Program (JARP) was created and began operating in 1987. This report contains findings and recommendations developed by a Mid-term Evaluation conducted September-October, 1990.

The terms of reference for the mid-term evaluation required an assessment of: 1) progress toward addressing project objectives; 2) capabilities of national, regional, and international institutions to carry out relevant agricultural research in Jamaica; 3) future agricultural research needs in Jamaica; and 4) how the Project can best address these needs.

The evaluation confirmed that production and productivity of Jamaican agriculture is low, and that agricultural research in Jamaica needs to be revitalized to provide personnel and technology required to improve overall production.

The research capability and level of effort in the Research and Development Department of the Ministry of Agriculture is extremely low and, with the exception of sugar, little research is being conducted by export-crop commodity boards.

Regional research organizations, CARDI and IICA, each have small research programs in selected areas. The University of the West Indies (UWI) is conducting some relevant research, mostly in the Departments of Botany and Zoology.

Research is mostly concentrated in the JARP Program which currently sponsors 42 discrete grant-funded research efforts. Most individuals conducting research are graduate students supervised by JARP leaders and other experienced individuals. Research efforts begun and supported by JARP include projects in the following categories:

- ethnic/local food crops
- ornamentals and flowers
- fruit production
- plant protection and biological control
- food legumes
- animal forages and feed
- farming systems and aquaculture.

In addition, JARP is emphasizing training. Almost all grants for research include a training component to strengthen research capacity. Progress in most research projects is good to excellent. In addition, JARP has contributed to the overall research effort in Jamaica, and is improving research policy and programs in the MOA, Commodity Boards, Regional Institutions, and the UWI.

Several international agricultural research and regional centers have research programs relevant to Jamaica. Linkages between scientists in the Centers and in Jamaica would accelerate research progress; however, at this time, there are few scientists in Jamaica, other than those stationed in Jamaica by UWI and CARDI, with whom effective linkages can occur. Several U.S. institutions (ARS/USDA, APHIS/USDA, Land Grant Universities, University Consortia) can assist research through collaboration among scientists.

Improving the current state of agricultural research in Jamaica will require major infusions of trained personnel, more competitive salaries, improvement of facilities, and greatly increased operating funds. In addition, a National Agricultural Research Institute (NARI) should be established to revitalize research and to attract international donor support. A NARI would provide a focus for agricultural research, and provide leadership, coordination, supervision and visibility to agricultural research in Jamaica. This review report includes suggested steps required to revitalize research in Jamaica, including the formation of NARI.

JARP is effectively carrying out its objectives, and this review recommends that the project be continued to normal termination. After termination, USAID should support research through NARI, if it has been created and is functioning effectively. Finally, this review has identified essential steps to strengthening agricultural research in Jamaica, and some time-phased high-priority research needs.

List of Abbreviations

APHIS	Animal and Plant Health Inspection Service
ARDD	Agricultural Research and Development Division (MOA)
ARDO	Agriculture and Rural Development Office - USAID
ARS	Agriculture Research Service - USDA
AVRDC	Asian Vegetable Research and Development Center
CARDI	Caribbean Agricultural Research and Development Institute
CARICOM	Caribbean Economic Community
CaIB	Cocoa Industry Board
CGIAR	Consultative Group for International Agricultural Research
CIAT	Centro Internacional de Agricultura Tropical
CIB	Coffee Industry Board
CIP	Centro Internacional de la Papa
COA	College of Agriculture
CoIB	Coconut Industry Board
CRI	Cocoa Research Institute
CRSP	Collaborative Research Support Project
FAO	Food and Agricultural Organization of the United Nations
GDP	Gross Domestic Product
GOJ	Government of Jamaica
ICRISAT	International Crops Research Institute for Semi Arid Tropics
IDB	Inter-American Development Bank
IDRC	International Development Research Center - Canada
IFDC	International Fertilizer Development Center
IICA	Inter-American Institute for Cooperation on Agriculture
IITA	International Institute for Tropical Agriculture
ILCA	International Livestock Center for Africa
INIBAP	International Network for Improvement of Bananas and Plantains
ISNAR	International Service for National Agricultural Research
JADF	Jamaica Agricultural Development Foundation
JAGRIST	<i>The Jamaican Agriculturalist</i>
JARP	Jamaica Agricultural Research Project
JBPA	Jamaica Banana Producers Association
MIC	Ministry of Industry and Commerce
MINAG	Ministry of Agriculture (referred to herein as MOA)
MOA	Ministry of Agriculture
MPS	Ministry of the Public Service
NARI	National Agricultural Research Institute
R&D	Research and Development
RAC	Research Advisory Committee
RADA	Rural Agricultural Development Authority
SECID	South East Consortium for International Development
SIRI	Sugar Industry Research Institute
SPID	Storage and Prevention of Infestation Division (MIC)
SRC	Scientific Research Council
S&T/AGR	The Office of Agriculture-Science & Technology Bureau, USAID
USAID	United States Agency for International Development
USDA	United States Department of Agriculture
UWI	University of the West Indies

1.0 Introduction

Numerous studies have confirmed that productivity of Jamaican farms declined during the 1980s. These reports make many recommendations to alleviate problems and restore productivity and profitability to Jamaican agriculture.

Several studies identified high interest rates and shortage of available capital as important factors hampering agricultural development in Jamaica. Others have indicated that inadequate policy and fiscal support for agricultural research has contributed to an ineffective agricultural research program. This resulted in a flight of talent from agricultural research in the MOA, and a dissipation of the research staff that existed in the 1970s. Few competent scientists were conducting agricultural research in Jamaica, and few young people were being trained for careers in agricultural research prior to the creation of the Jamaica Agricultural Research Project (JARP).

During the 1980s and prior to the formation of JARP, little meaningful agricultural research was conducted by the MOA commodity boards for export crops, except the Sugar Board which maintains a vigorous program. The 80% of the farmers that earn livelihoods from small acreages was benefiting little from research findings. The extension system was ineffective, partly because little was coming from research worthy of extending. The Agriculture Ministry's Research and Development Division had inadequate budgets and inadequate resources for maintaining the considerable physical infrastructure developed during 1983-1985 with funds from the IDB.

Recognizing the need for revitalization of agricultural research in Jamaica, USAID/Jamaica entered into a cooperative agreement with the Jamaica Agricultural Development Fund (JADF) in 1986 to establish and operate a mechanism (JARP) through which USAID could provide financial resources through the private sector to:

- increase small farm productivity by introducing or developing new methods, techniques, and materials
- strengthen local agricultural research capability.

This report contains the findings and recommendations of a team fielded by Winrock International under contract from USAID/Jamaica to conduct a mid-term examination of the JARP during the period September 17-October 6, 1990.

Specifically, the study:

- **assessed progress toward addressing project's purpose**
- **assessed capabilities of national, regional, and international institutions to conduct relevant agricultural research in Jamaica**
- **identified future agricultural research needs in Jamaica**
- **evaluated how project can most effectively address future research needs.**

The findings, conclusions, and recommendations in this report resulted from 18 working days (September 17 - October 6, 1990) by the team in-country. Three days were spent attending the Second Annual Seminar on JARP activities. Thirty-one progress reports on projects sponsored by JARP were presented by persons conducting the studies. In addition, 4 days were spent visiting farms, research sites, and agrobusinesses throughout the nation.

Discussions were held with administrators and research leaders in each of the following organizations: UWI (Mona Campus), Jamaica Agricultural College, Caribbean Agricultural Research and Development Institute (CARDI), Inter-American Institute for Cooperation on Agriculture (IICA), Ministry of Agriculture (MOA), Jamaica Agricultural Development Foundation (JADF), Rural Agricultural Development Authority (RADA), ADC, Cocoa Industry Board (CaIB), Coconut Industry Board (CoIB), Scientific Research Council (SRC), Jamaica Banana Producers Association (JBPA), Coffee Industry Board (CIB), JAS, the Banana Board and personnel at research stations at Bodles and Montpelier. Discussions were also held with the Chair and several members of RAC.

2.0 Background

Jamaica has a total land area of 10,989 km². The island is 235 km long and ranges in width from 35.4 km to 82 km. The topography is rugged with 38% of the land having slopes of 10% or less, 33% with slopes ranging from 11% to 30%, and 29% with slopes greater than 30%. More than half of Jamaica has an altitude greater than 300 m.

Jamaica has a favorable climate and a wide variety of resources for agricultural production. Many different species of domestic plants can be grown.

For agricultural development purposes, the island is divided into four main regions: northern, western, southern, and eastern. The northern region is not served by an agricultural research facility; however, the College of Agriculture (COA) is located at Port Antonio. In the western region, the three main crops are sugarcane, bananas, and pimento. Cattle are also being raised. The Montpelier research site is located in the western region.

The southern region is the country's principal agricultural region with sugarcane, bananas, cocoa, coffee, coconut, and citrus as main crops. Yams, beans, and cassava are grown on small holdings on marginal lands. Vegetables, root crops and, to a limited extent, cereals are also grown. Cattle raising is important in the southern region where the Bodles Research Station and two other smaller research stations, Orange River and Grove Place, are located. A research station is not located in the eastern region.

During most of Jamaica's history, agriculture has been the dominant source for providing foreign exchange, raw materials, wealth, income, employment, and food. Recently, agriculture's contribution to Gross Domestic Product (GDP) has declined, with the ascent of mining and tourism. Agriculture currently accounts for about 20% of exports. Almost 30% of Jamaica's work force is employed in agriculture, and about 40% of Jamaica's 2.4 million people live in rural areas.

Jamaica's agriculture has traditionally consisted of two major sectors: export-oriented plantation production and small-scale production of food crops and livestock largely for domestic use. Recently, there has been a rapid growth of small to medium-sized commercial farms.

The most important agricultural products in terms of value are sugarcane, yams, and beef. Sugarcane products remain predominant export commodities. Additional export earnings come largely from coffee, bananas, and pimento. Export of tropical fruits, flowers, and other specialty crops appears to have potential. Cereals, meat, and dairy products are the main agricultural imports.

Jamaica has potential for increasing its agricultural production. Favorable climate, varied terrain, soils, micro-climates, and water resources along with an adequate labor force provide essential components for a healthy and expanding agriculture. However, much agriculturally suitable land is not productively used, and much that is used is producing far below potential. A widely recognized fact is that agricultural productivity is declining.

The poor performance of agriculture in Jamaica can be attributed largely to obsolete technology and an ineffective research system. Other constraints are: high cost of capital, poorly trained labor, land-tenure practices, poorly funded and staffed public-sector support, underdeveloped markets, thefts of farm products, and a weak extension system.

In response to a request for technical cooperation, the Inter-American Development Bank (IDB) assisted in reorganizing Jamaican agricultural research from 1979 to 1983. This project greatly improved the infrastructure and facilities for agricultural research, but the organization, management, fiscal base, and policy structure remained essentially unchanged.

Failure to provide for agricultural research to function with administrative autonomy in identifying and carrying out needed research, within the policy framework of the MOA, has led to a gradual decline in agricultural research and research capability in Jamaica. The decline continues in spite of numerous advisory missions which have indicated that stopping the decline and improving research capability require increased operating funds, higher salaries for research personnel, and a major increase in the number and level of research-competent personnel.

Although some improved technologies can be borrowed from other countries, Jamaica must expand efforts in applied research and technology transfer. Major efforts must be made to develop indigenous capacity to conduct applied agricultural research, and to keep abreast of and adapt scientific breakthroughs developed elsewhere. This has been substantiated by numerous studies which have examined Jamaica's agricultural sector during the past 10 to 15 years. (See **Appendix B, List of Documents Examined.**) The unifying theme throughout these reports is Jamaica must develop and adequately support vigorous applied agricultural research and technology transfer systems.

Recognizing the great deficiency of significant agricultural research in Jamaica, with the exception of some research being carried out by UWI, CARDI, and commodity organizations in support of export crops, USAID/Jamaica entered into a cooperative agreement with JADF to establish and operate an agricultural research program. The Cooperative Agreement was signed on July 30, 1986 and expires on July 29, 1993.

The estimated amount of funds for support of the Cooperative Agreement was US\$7,600,000, and US\$500,000 was made available by USAID on July 30, 1986.

In accordance with the agreement, JARP was formed and has a portfolio of ongoing research activities described in **Section 3.2** of this report and in **Appendix D**.

3.0 Progress Toward Project Objectives

In the absence of a dynamic and viable agricultural research effort, the JARP initiative has been timely. It has also been somewhat unconventional in using public funds to support two private entities to conduct research usually conducted in the public sector. It is also unusual with respect to the freedom the executing organization has in shaping and carrying out the program. An assessment of the environment established by JARP is critical in understanding how a corporate research structure can shape the vision of future research in Jamaica. It is evident that the JARP corporate culture includes the following key characteristics: commitment to relevant research; sense of urgency; mutual respect and trust; cost consciousness; commitment to excellence and a high standard of performance; and client-oriented research.

The project was established under the Jamaican Agriculture Development Foundation (JADF), a tax-free autonomous nonprofit organization. The Foundation assisted in the immediate formation of the Research Advisory Council (RAC) set up to determine policy and identify priority research areas.

JARP first emphasized identifying problem areas and establishing priorities. Once priority constraints were identified, the next step was to conduct applied agricultural research to seek solutions. When JARP began, the existing research infrastructure and equipment had deteriorated in Jamaica, and skilled research personnel was scarce. Therefore, an environment existed which could not adequately support applied research. Early efforts were, consequently, directed at correcting deficiencies and in laying the proper foundation for effective research.

In general, the project's progress since inception has been good. Top-level project management is excellent, and has carried out the project's mandate. The RAC has acted in an advisory capacity, and RAC subcommittees have reviewed projects and proposed areas of research.

Prior to the formation of JARP, effective agricultural research had stalled with the exception of one or two commodity boards. As would be expected, there was a slow period in the beginning of the JARP project in determining what research should be begun and in actually getting individual projects underway. Having no research personnel of its own, JARP had to identify institutions and individuals which could conduct well-planned, well-executed research applicable to the reasonable future in Jamaica. Obviously, a special effort was necessary to inform various institutions and individuals of JARP's intentions and ability to support research. In addition, due to the shortage of in-country research personnel, JARP had to identify students who would respond to further academic training for

careers in agricultural research. Over time, JARP's program and utilization of resources have accelerated.

3.1 Organization of the Jamaica Agricultural Research Program (JARP)

Under the USAID Cooperative Agreement No. 532-0128-A-00-6099-00, dated July 30, 1986, USAID entered into a cooperative agreement with the Jamaica Agricultural Development Foundation (JADF) for an estimated amount of US\$7,600,000 to undertake the Jamaica Agricultural Research Project. As mandated in the above authority, the organizational structure of the project consists of:

- research program management
- research advisory committee
- research advisory executive committee.

In addition to specifying organizational structure, the cooperative agreement authorized JARP to offer research grants/contracts, and it outlined disbursement and procurement procedures. The project conducts formal quarterly project reviews which assess progress in implementing the project and in identifying and resolving constraints. The authority also required that internal assessments be conducted in March 1989 and 1991, with an evaluation scheduled for the final year of the project to determine its impact. However by agreement with USAID/Jamaica, a mid-term evaluation was conducted in mid-1990, rather than the two interim assessments scheduled for 1989 and 1991.

3.1.1 Research Program Management

As agreed to in the Cooperative Agreement, research program management consists of a Program Director and an Assistant Program Director with responsibility for overall project implementation. Both posts have been filled in accordance with authority requirements. Both the director and the assistant director have considerable international experience as well as research responsibility within Jamaica. Both have demonstrated outstanding ability in project management and research direction during their tenure in the JARP. The Director and Assistant Director are responsible for:

- program management
- carrying out research priorities identified by the RAC
- developing project proposals
- executing grants and contracts
- developing linkages with national, regional, and international organizations

- preparing annual reports and budgets for presentation to the RAC and the JADF.

In addition to the Director and Assistant Director, the management consists of a Research Associate, Executive Secretary, Assistant Secretary, and a Driver/Messenger.

3.1.2 Research Advisory Council

As prescribed by the project authority, a Research Advisory Council (RAC) was set up by a selection committee composed of individuals jointly identified by JADF and USAID. The life of the council was expected to be 6 years. A provision was made in the authority that subsequent selection of individuals for membership to RAC will be the responsibility of RAC subject to USAID and JADF approval. To assure stability of the RAC, individual terms are staggered with one-third of the members selected every 2 years. Membership of the Council has been increased to 22. The Council has, in the past year, appointed a new chair following departure of the first chair. The Council meets four times each year, in addition to participating in one retreat where in-depth discussions on selected topics take place. Attendance at council meetings has been good. Discussions with the RAC chair and a review of Council deliberations and actions confirmed that it is fulfilling its role adequately and has offered sound direction and guidance. It continually addresses national research issues and priorities.

3.1.3 RAC Executive Committee

The RAC Executive Committee has been selected by RAC from among its members. In the past year, membership on the Executive Committee expanded from eight to ten. The Program Director acts as permanent secretary to the Executive Committee. The Executive Committee meets four times a year, and has had at least one emergency session to review and determine a course of action to be taken for securing technical assistance for a major program of support for forage research.

Selected grant/contract proposals are submitted by JARP staff to the Executive Committee for advice concerning relevance to policies, priorities, and goals established by the full Research Advisory Council. However, authority to select proposals for funding resides with the Program Director with the Executive Committee's concurrence. The Program Director has the responsibility for negotiating and finalizing contracts and agreements with other institutions for support and services such as research and training. In discussions with the Program Director as well as with the Chair of RAC, it has been determined that the Executive Committee has taken its responsibility seriously and functions within its authority.

3.1.4 Production Subcommittees

The RAC decided to appoint subcommittees in the fields of crop-production research and livestock-production research. Each committee has members from RAC and from outside the RAC. It was recognized that expertise for each field of research was required to adequately review project proposals and to set priorities. The subcommittees review project proposals in their fields and recommend to RAC which proposals are to be funded.

The **crop-production research committee** has focused on food crops and floriculture. Floriculture has been emphasized because of its rapid and expanding importance to the Jamaican economy. After highlighting the importance of anthurium production, deficiencies in the industry, including the absence of production specialists to assist in resolving problems, the committee recommended the formation of an association of ornamental horticulturists including industry representatives. Several projects in the culture of anthuriums have been undertaken by JARP.

The **livestock-production research committee** has determined that research on forage production should be emphasized. Several projects are now being supported by the project. In addition, focus has been directed to goat and sheep production. The committee is considering supporting research in areas recommended by a workshop on small ruminants held jointly with CARDI.

3.2 JARP Research

The JARP program aims at developing solutions to constraints to agricultural production and productivity by conducting applied agricultural research in priority areas.

Out of 92 projects submitted to JARP for funding, 42 have been funded after careful scrutiny by RAC (see **Appendix E**). Twelve projects had just started at the time of the review. Progress reports were presented on 31 ongoing projects at the Second Annual JARP Seminar for Presentation of Progress Reports (see **Appendix D**). One project was terminated for failure because of lack of follow-through and interest on the part of the designated scientist.

The projects are grouped by JARP into several categories: ethnic/local food crops; ornamental/flowers; fruit production; plant protection/biological control; food legumes; animal forages and feeds; farming systems; and aquaculture. All areas have received high-priority from RAC because of the emphasis on commodities of importance to the small-farm sector; on crops with high foreign exchange earning

potential, such as ornamentals/flowers; and on ethnic foods and other commodities, such as fruits with large and expanding market prospects.

In addition, RAC has concerned itself with natural resource conservation and management, and indicated that it should be an area of priority attention. After reviewing projects submitted for consideration by JARP, there appears to be a balance between projects which resulted from JARP initiatives and those in which JARP was essentially reactive or responsive.

The JARP Director continually emphasizes that projects must be relevant. Special efforts are made to consistently follow project progress to ensure that satisfactory results are achieved. In this regard, most projects reviewed have an adequate project design under which clear results can be obtained. There is some variability, which is to be expected, but the Project Director insists on a complete literature review, good experimental design, and complete analysis of results followed by publication of results. Some researchers are young and have had little experience in analyzing and presenting results; consequently, there is room for continued improvement.

Although applicability of research results is emphasized, the research program is not limited to adapting technology and methods proven elsewhere. Some projects have basic research implications, but with expectation that forthcoming results will have almost immediate application. For example, several studies are being conducted on insect pests of escallion and ways to control them effectively through either chemical or biological methods. Following similar lines of investigation are experiments on development of biological controls for root weevils. If successful, both research areas could have a dramatic impact on production of escallions, bananas, cassava, citrus, and sugarcane. In addition, an economic analysis of farm-system constraints to vegetable production on small farms is reaching the stage where factors which limit increased production are being identified. The above projects are conducted in cooperation with CARDI and the University of Florida.

Considerable research emphasis is being put on **ethnic/local crops**. One such crop important to Jamaica is the yam (*Dioscorea cayenensis*). Yams are in high demand, but production is restricted by the conventional production method. Two projects are aimed at introducing the minisett technique aimed at alleviating problems associated with the traditional method of yam production. There has been promising varietal response to the minisett method of propagation in Nigeria; however, in Jamaica the technique has not had the success anticipated. Both studies are in the early stages of research. A project on evaluation of sprouting and yield of yam using the minisett technique of propagation is being conducted at Bodles by a member of the Faculty of Agriculture, UWI.

Two crops which are important locally are dasheen (*Colocassia esculenta*) and ackee (*Blighia sapida*). A **study on dasheen** is aimed at methods to prolong storage life of dasheen. This study is carried out by a member of the MOA staff. Considerable quantities of dasheen are exported annually to the United Kingdom, the United States, and Canada. Preservation of dasheen is important in maintaining the high-quality necessary for the export market.

The **ackee study** is developing techniques for improving and propagating the food crop. This 2-year study is aimed at providing the basis for commercialization of the ackee. Weekly observations of 19 selected trees in three observations sites have shown that previous estimates of ackee yields were excessive and that descriptions of both the male and the hermaphrodite flower were inadequate. Since ackee is an important Jamaican food both for local use and export, the improvement of production is viewed as an important endeavor.

The Irish potato continues to be an important staple in the Jamaican diet and, with the introduction of fast-food chains into Jamaica, studies on the **agronomic and culinary assessment of potato varieties** have been initiated. Two studies are in progress by personnel at the MOA Station at Bodles. One study is on fertilizer management requirements for Irish potato, and the other is testing different cultivars for their acceptability in the making of French fries. The importance of these two studies might be questioned since undoubtedly similar work has been carried out in other countries. However, soil conditions in Jamaica are different than those in the other countries. This may affect the cooking ability of potatoes.

Due to **low yields of potatoes** in Jamaica, producers have encouraged research in this area. Discussions are being held with CIP regarding cooperative work. Seed has been received, but plantings are being delayed until a good project outline is received from prospective researchers.

Anthurium production is important in Jamaica because of its increasing export potential. JARP is funding three projects on **anthurium production**:

- one on developing **alternative media for anthurium** production in cooperation with the JAFLEX farm
- one on **anthurium bacterial blight** in cooperation with MOA at Bodles Agricultural Research Station
- one on ***in-vitro* techniques for rapid multiplication** of anthurium.

All three projects are well-designed and should produce results of importance to the industry.

Two additional projects on **production of ornamentals/flowers** are being funded by JARP. The project on evaluation of a loan in kind and technical services for introducing orchid production is aimed at small farmers. This project was set up to determine the feasibility of producing orchids for both the local market and export market by small farmers. The project is still in progress, but initial results indicate that the quantity and quality of production is high, and that the proceeds from orchid sales have been adequate to repay loans with additional profits going to the small farmer.

A project at Bodles on the performance of gladiolus for cut flower and corm production at high altitudes in Jamaica has indicated that plastic mulch and hot water and fungicidal treatments of freshly harvested corms reduce disease incidence. Six cultivars have been identified which show promise at high altitudes. Project results are now being tested on small farms.

JARP is funding two projects on **fruit production**. Although conditions seem to be present in Jamaica for the production of passion fruit, the crop has never attained commercial status. A project at the Bodles station on evaluating trellising methods and observing production problems is identifying reasons for the slow progress in technology and developing suitable production techniques for the Jamaican farming situation. In order to improve mango production, observations are being taken on 24 selected cultivars. The export potential for mangos appears to be quite good. The results of the project are still forthcoming; consequently, no recommendations can yet be made.

Four projects are being undertaken on **plant protection**. Two projects in cooperation with CARDI at the Bodles station are on development of biological controls for root weevils. Current control measures are inadequate; therefore, an integrated pest management strategy is imperative. Several pests have become resistant to available chemicals. A new strategy is oriented toward biological controls. Both projects are in initial stages but show promising results.

A project at UWI, Mona Campus, on breeding red peas for disease resistance and enhanced biological nitrogen fixation has only just begun, and results have not been obtained. A project on the effect of organic soil amendments on the population dynamics and control of plant parasitic nematodes and the nutrient status of various crops has indicated that the soil amendments were more effective in combination with an inorganic fertilizer. When the inorganic fertilizer was used, vigorous plant growth occurred and the effects of nematode damage were mitigated. This project is being undertaken at the UWI, Mona Campus.

Five projects are underway on **livestock forages and feeds**. One project near Mandeville emphasizes on-farm evaluation of leucaena and gliricidia as high-protein forages in dairy cattle rations. In addition, a project at Bodles on the yield,

digestibility, and nutritive value of African Star Grass as influenced by level of nitrogen fertilizer and defoliation frequency is showing promise. A project on the comparative agronomic performance of napier, hybrid napier (N69), and King grass is underway at the Bodles Research Station. The hybrid napier and King grass have only recently been introduced to Jamaica. Results in other Caribbean countries have shown promise. Following these studies, further in-depth investigations will be conducted. Since leucaena and gliricidia are high-protein feeds, it will be necessary to find the proper mixtures with local energy feeds for dairy cattle rations. The napier and King grass comparisons should be followed by grazing trials and studies on proper management techniques.

Five projects are underway relating to **farming systems**. These include a comparative study of soils in western Jamaica, a study of soil characteristics as developed in grass-mulch systems of vegetable cultivation, the testing of micro-irrigation systems for small-scale farmers, a study of factors influencing credit use on small farms in selected areas of Jamaica, and cross-protection techniques for controlling papaya ringspot virus in Jamaica. All studies are in progress.

JARP management sees a need for greater input and assistance in biometrics and is searching for a solution. From the presentations at the Second Annual JARP Seminar for Presentation of Progress Reports, it is obvious that some short training on scientific research methodology and report writing and presentation would be most useful to those conducting research. One such workshop has been held, but it would appear that perhaps this should be a continuing effort. The program management is to be commended for holding annual seminars where research results are reported orally as it informs the Jamaican scientific community of what is going on in the program, and gives a chance for constructive criticism by peers and exchange of ideas. It is suggested that in the future, an effort be made to get wider attendance from the research and extension community.

Having reviewed the JARP projects, the project management is to be commended on the breadth of the investigations as well as the number of projects underway. All projects address priority research topics and subjects of economic importance to Jamaican farmers. Recognizing the limited size of the project management staff, it appears that the number of projects currently underway are nearing the limit of the staff's capabilities. Rather than increasing the number of projects in other research areas, the staff should concentrate efforts in areas presently being studied. It is recognized that time spent on review of proposals, suggesting improvements, monitoring progress, assisting in analyses, and report writing is taxing; therefore, it is suggested that the peak of the effort has been reached. Considerable time will now have to be spent on efforts to get NARI approved and implemented. The project, in this endeavor, must address future agricultural

research needs outlined in this report, and address plans to cover these needs through NARI or an extension of JARP.

In order to inform the Rural Agricultural Development Authority (RADA) and other users of research results produced by JARP, the project will produce bulletins for dissemination and articles for JAGRIST. In addition, the JARP management will encourage RADA subject matter specialists to monitor progress of individual projects. The research will be more meaningful to the researcher as well as the extension officers if this close relationship exists.

3.3 Capabilities of Researchers

Some researchers have limited research training and experience. The project management recognizes this, and constantly reviews research progress. Because agricultural research in Jamaica had not received the attention and support required up to the beginning of the JARP, it is obvious that the level of research capability in Jamaica is not as high as is desired. Probably the most acute constraint on agricultural research is shortage of qualified research personnel. Recognizing this, the project began a strong program of training potential researchers which is reported in the following section.

3.4 Training Program of JARP

Training is being emphasized to develop and motivate future research scientists and to improve research capability while conducting important applied research. The project has advertised for additional students who wish to obtain M.Sc. or Ph.D degrees. Response to announcements has not been as great as desired, but project management continues to search for interested candidates.

At present, 20 Jamaican students are conducting research and taking additional training at the UWI: 18 for M.Sc. and 2 for Ph.D. degrees. Some are at the Mona Campus near Kingston while the rest are at the St. Augustine campus in Trinidad. All students are working on problems of interest to the project. If M.Sc. students do well in their fields, they can request an extension to go on for a Ph.D.

At least half of those being trained are expected to pursue research careers and make significant contributions to agricultural research in Jamaica. In addition, seven American students registered in graduate schools in the U.S. are doing thesis work in Jamaica on problems of local importance.

Short-term training is aimed at assisting students and researchers in attending international meetings and conferences. Also, local seminars and workshops on specific subjects have been held.

JARP has established collaborative work relationships with three U.S. universities: University of Florida, Cornell University, and Michigan State University. Personnel from these universities have visited Jamaica to discuss subjects of importance to Jamaican agricultural research. Rapport has been established for free exchange of ideas. If a research problem arises, assistance is often sought over the telephone. JARP has also had exchanges with Prairie View A&M University, Lincoln University, Florida State University, and the Small Ruminant CRSP at the University of California, but, to date, no substantive cooperation has been established.

3.5 Communication and Publications

This section discusses communication and publication opportunities available to agricultural scientists and researchers in Jamaica.

3.5.1 Jamaican Society for Agricultural Sciences

Under the auspices of JADF, the JARP program has formed the Jamaican Society for Agriculture Sciences. The society allows membership for agriculturists, agricultural scientists, and agri-business practitioners. The society provides an opportunity for scientists to have their research reviewed by peers. Such interactions contribute to research productivity.

3.5.2 Jamaican Agricultural Research Publications

The MOA Research and Development Division has published its research as project summaries of work completed or in progress. Although reports reflected activities within departments, the effort was only fairly good at best. Two major reporting sessions are:

- Proceedings of the First Inter-disciplinary Research and Development Committee Meeting 1985
- Summary of Activities 1986-1987 Research and Development Division, 1988.

Work reported within UWI Faculty of Natural Science relating to agriculture was satisfactory but few in number during this period.

The recent initiative by JARP to stimulate research work, and to report and make presentations at two meetings since 1987 has yielded encouraging results. At the 2nd Annual Seminar for Presentation of Progress Reports on JARP Projects September 1990, 31 abstracts were presented. These abstracts represented the major discipline areas and were relevant. Quality varied from fair to excellent. The exercise was encouraging because of the youthfulness of the presenters and the resurgence of research leadership.

JARP has initiated JAGRIST -- *The Jamaican Agriculturalist*, to disseminate information from the project and to invite papers of current importance. Well-received by the research community, it is sponsored by the project and, therefore, at present has a finite life. However, it is anticipated that the Jamaican Society for Agricultural Sciences will assume publishing responsibility at the end of JARP.

Summary

JARP began in 1986 under a cooperative agreement between USAID and the Jamaica Agricultural Research Foundation (JADF). It is managed by a Director and Assistant Director under the guidance of a Research Advisory Council (RAC). Having no research staff, JARP contracts with institutions and organizations to carry out experiments in high-priority areas selected by the RAC. Of 92 projects submitted to JARP, 42 have been funded, 29 are ongoing, 12 have just started, and one has been terminated in failure. The projects so far accepted are in the following areas: ethnic/local food crops; ornamental/flowers; fruit production; plant protection/biological control; food legumes; animal forages and feeds; and farming systems. No projects have yet undertaken in aquaculture.

Projects are accepted on the basis of:

- their importance to small farmers
- their foreign exchange potential
- their ability to expand markets in areas such as ethnic foods, ornamentals, and fruit.

RAC is also concerned with natural resource conservation and management. Most project results are highly applicable to farmers. Some research is applied while some is basic although still quickly adaptable to farmer needs.

Some researchers have limited research training and lack experience, but the JARP management constantly reviews all projects and assists where needed. Another important segment of the JARP project is in offering advanced training to interested graduates. At present, 20 Jamaican students are conducting research and taking additional training at UWI. In addition, seven American students registered in U.S. graduate schools are doing their research work in Jamaica on problems of local importance.

4.0 Matrix of the Focus, Status of Research and Capabilities of Some Relevant Institutions

This section reviews the research focus, status, and capability of agricultural institutions in Jamaica.

4.1 Jamaican Institutions

Agricultural research in Jamaica is undertaken or contracted out by several institutions and agencies, most linked with the government. In this presentation, the various institutions and agencies are grouped as follows: Ministry of Agriculture, statutory bodies/commodity agencies, and regional organizations. This section briefly summarizes their support, focus, current capabilities, and potential contribution to research in Jamaica.

4.1.1 Ministry of Agriculture (MOA)

The MOA operates by a subvention from the Government of Jamaica (GOJ) and through grants. It functions as a regulatory agent, and concentrates its activities on small-farm agriculture, forestry, soil and water management, veterinary, farm mechanization services, and plant and animal care.

Investigative work and(or) research started as early as 1910 at Hope Farm in the area of cattle selection and breeding. Increasingly, the major responsibility for agricultural research in livestock, soils, crops, forestry and fisheries became vested in the MOA. Simultaneously, commodity boards and grower organizations became the major executors of applied research for their crops or commodities which were associated with immediate and specific short-term problems.

GOJ policy for the MOA in recent years has been to reduce its overall responsibility and activities for the export sector in order to support small farmers and domestic food production. A pivotal development in agricultural research occurred in 1979 through the Agricultural Research Services project, funded by the IDB, which sought to redress the imbalance of research between export crops and domestic food commodities and small-farmer agriculture. In the process, several MOA facilities, including former research stations and farms, are being or have been abolished, and staff and budgets have been reduced. Furthermore, there has been a loss of program direction which has created a need for the rationalization of all agricultural research.

The current focus of research work and the capabilities of the MOA are reflected in the following description of the agricultural research stations and their activities.

The MOA has three research stations: Bodles Agricultural Station, Old Harbour, St. Catherine, representing the Southern Region; Grove Place Agricultural Station, Mile Gully, Manchester, representing the Central Region; and Montpelier Agricultural Research Station, Montpelier, St. James, representing the Western Region. These stations operate under the Research and Development Division of the MOA.

4.1.1.1 Bodles Agricultural Research Station is the main MOA research initiative and serves as the headquarters of administration and field operations in research. It conducts three major areas of activities: livestock improvement, crop research, and crop protection, which includes research in production and regulatory work.

The Bodles Station consists of approximately 1,270 acres. All experiments are conducted under irrigated conditions. Approximately 540 acres are devoted to livestock research and 600 acres to crop experimentations.

Livestock research activities include:

- studies in dairy and beef cattle breeding, nutrition, and feeding systems
- pasture research in grass and legume forage trials
- small stock (pig, sheep and goat) reproduction.

Crop research activities include:

- a food-crop research program including studies on yams, sweet potatoes, cassava, red peas, Irish potatoes, pigeon peas, and onions
- chemical weed control.

Crop protection studies on a variety of crops involving the disciplines of entomology, plant pathology, and nematology.

Also included at Bodles is the Banana Board breeding program.

The physical facilities required to accommodate the schedule of research work are in-place through the US\$6.4 million IDB Project loan in 1979, augmented by support from a World Bank-funded Export Crop Project. Currently, facilities are grossly under-used and maintained in only fair to fairly good condition.

4.1.1.2 Montpelier Agricultural Research Station is primarily a livestock research station representing the peculiar climatic conditions of the Western Region livestock belt. More than 900 acres are involved under rain-fed conditions.

Research work is focused on evaluation of milk production of various crosses of Jamaica Hope cattle with introduced breeds. Only herd maintenance work is in

progress at this time. The milking parlor and ancillary facilities are quite modern but grossly under-used and poorly maintained. A herd of goats is also maintained in some good facilities with little or no research activity.

Field experiments are in progress with different varieties of grasses and legumes being tested for adaptability and production. Overall, plots are poorly maintained.

A crop research program is in progress which includes coffee and cocoa variety trials for production management under the control of the Cocoa Industry Board and Coffee Industry Development Company.

4.1.1.3 Grove Place Agricultural Research Station consists of more than 1,600 acres of which 700 acres, including hilly lands, are reserved for the nucleus herds of Jamaica Red and Jamaica Black cattle. These herds are maintained for performance-testing experiments. A nucleus herd of sheep is also maintained for joint sheep- and cattle-grazing trials for the evaluation of grass-legume mixtures.

Pasture research is conducted on 70 acres where adaptation studies of imported species of grasses and legumes are pursued and evaluated. Crop research is primarily with cassava variety trials conducted in collaboration with IICA. All field experimentations are done under rain-fed conditions.

4.1.1.4 Research and Development Division Professional Staff. Within the Research and Development Division of the MOA, agricultural research accounts for 50 of the 112 established professional posts, including top professionals and support staff. The distribution of filled positions to date is outlined in Table 1.

Table 1. Distribution of currently filled professional research and development positions.

Areas	Number of Posts	Number of Posts Occupied
Research Administration	10	4
Livestock Research	16	9
Crop Research	19	10
Regional Research	5	none
Total	50	23

This distribution of occupancy reflects a 54% vacancy which indicates a serious staff shortage, and inability to conduct programs and projects within the MOA research division.

Of the 23 professional staff members, 3 hold Ph.D. degrees, 5 hold M.Sc. degrees, and 15 hold B.Sc. degrees. Personnel with the higher degrees hold administrative posts. As a result, some research areas are without the quality leadership required.

Research activities and quality work on the stations reflect this shortage of professional capacity. JARP has been contributing to the research effort by assisting with procurement and maintenance of equipment and personnel management.

4.1.2 Statutory Boards/Commodity Agencies

The commodity boards promote the efficiency and development of their respective industries, work to secure favorable conditions for producers, and promote commodity-specific research. These boards are largely financed by cess (assessment) on exports and by the GOJ. They were established by statutes as follows:

Sugarcane farmers	Act 1941
Banana Board	Act 1953
Cocoa Industry Board	Act 1957
Coffee Industry Regulation	Act 1948
Coconut Industry Control	Act 1949

4.1.2.1 The Banana Board Research Department. Under the Banana Board, the Research Department was restored in 1987. Support for research and development activities is provided in Table 2.

Table 2. Funding and sources of R&D within the Banana Board Research Department.

Funder	Type and(or) Amount of Support
Banana Export Co.	\$500,000 per year
MOA	Permanent staff, the Breeding Station
IDRC	Occasional grants
INIBAP	Occasional grants
Jamaica Banana Producers Association	Occasional grants
Agricultural Credit Bank	Occasional grants
JARP	Specific research and development project support

The research program is monitored by a Research Advisory Committee. The major objectives of research programs are:

- Continue breeding and selection program for acceptable agronomic traits and resistance to major diseases
- Increase production per acre while maintaining the quality required for export
- Participate in International Musa testing and germplasm exchange
- Begin research projects in anticipation of the changing needs of the industry.

The current focus of research activities are:

- Maintenance of germplasm collection
- Evaluation of synthetic diploidies to reaction to Yellow Sigatoka, nematode and borer attacks as well as agronomic traits
- Back-crossing of tetraploids to produce triploids for selection of commercial varieties
- Performance of some Grand Nain mutants
- Monitoring of resistance to pathogens
- Forecasting for disease management
- Maintenance of excellent fruit quality for export market.

4.1.2.2 Cocoa Industry Board (CaIB). The CaIB functions primarily as a promotion, regulatory, marketing, and advisory organization. It has more than 24,000 growers producing from 30,000 acres of cocoa, with the board producing on 2,000 acres of its own farms. All revenues are derived from cess and commercial operations.

Research on cocoa is production-oriented and, therefore, carried out mainly on farms. The Board operates the Orange River Research Station and a plot at Montpelier Research Station where cultivars are maintained and evaluated. Some areas of interest are fertilizer trials, intercropping, and pruning regimes. In collaboration with the UWI, research is being pursued on Black Pod disease, a disease having most serious economic impacts. The CaIB research team includes 1 Ph.D., 1 M.Sc. and 1 B.Sc. graduate, supported by an extension staff of 6 extension officers headed by 1 Ph.D. graduate.

CaIB's research staff is weak and, currently, best suited for collaborative work. Qualified staff are primarily involved with administrative responsibilities.

4.1.2.3 Coffee Industry Board (CIB). The CIB and its subsidiary the Coffee Industry Development Company (CIDCO) are financed by a cess on coffee sales and returns from its own farms. The CIB also buys coffee to process and sell to finance operations.

This organization does not conduct scientific research and, therefore, does not have a research department. Current research efforts are in the areas of disease and pest control, and these are contracted primarily to the UWI and CARDI. The UWI usually conducts basic studies while CARDI pursues studies under field conditions.

Areas proposed for research include:

- Control of coffee leaf-rust
- Plant nutrition and fertilizer application
- More effective cropping system
- Pruning methods, shade management, weed control, and population densities
- Studies on residual effects of insecticides and soil-management practices.

4.1.2.4 Coconut Industry Board (CoIB). The CoIB is a combined government, grower organization. The association has more than 10,000 members, although not all are producing. The Board is financed by a cess on sales of coconut products, share of profits from coconut factories, interest and dividends, export of plant material, and a tax on imported coconut products.

The Board's research unit has a director, an agronomist, and a botanist, supported by School of Agriculture graduates in the research department. It has five field stations and access to MOA lands and private farms.

The research effort focuses on plant breeding and agronomy. The main objective is development of varieties resistant to Lethal Yellowing disease. Research in agronomy concentrates on development of efficient cropping systems. As such, much collaborative research is done with other commodity boards on tree crops that can be intercropped with coconut such as banana, cocoa, and coffee. Other research interests include studies with the UWI on coconut mite attack on leaves; nematode control and wilting disease; Lethal Yellowing disease with the University of Florida; and rodent control with the Storage and Prevention of Infestation Division of the Ministry of Industry and Commerce.

The UWI does pathology work for the Board through grants to the University. Currently, a Ph.D. candidate is pursuing research work on such a grant.

4.1.2.5 Sugar Industry Research Institute (SIRI). SIRI is a well-established organization located in Mandeville, Manchester, where there are laboratory facilities, greenhouses for evaluation and quarantine work in sugarcane. The major focus of SIRI includes soil-fertility research, varietal improvement, crop protection, cultural practices, irrigation and water management, plant physiology, harvesting, and transportation economics.

The organization has 23 qualified professionals to staff its program which are supported by the sugarcane industry along with grants from international agencies. SIRI's laboratory facilities are well-known for reliability and punctuality as a service agent to research work.

4.1.3 Other Local Institutions

Other local Jamaican institutions conducting agricultural research and development are the Scientific Research Council (SRC), the College of Agriculture (COA), the Rural Agricultural Development Agency (RADA), and the Jamaica Agricultural Development Foundation (JADF). These are described below.

4.1.3.1 Scientific Research Council (SRC). SRC is engaged in numerous research projects directly related to the agricultural sector in the areas of tissue culture, pesticide research and monitoring, mushroom cultivation, legume inoculant, biogas, and trace elements in soils island-wide. Research is also being conducted in meat-processing, food-dehydration and crystallization, and low-acid canned foods.

Research staff in agriculture consists of a project coordinator, two scientific research officers, and two technicians. Research work is done in collaboration with the UWI and IICA.

4.1.3.2 College of Agriculture (COA). COA is the tertiary agricultural institution of Jamaica located in Port Antonio, Portland. Operated under the Ministry of Education, it offers a 3-year Associate Degree program in agriculture. The COA is currently supported by a USAID project for an expansion of its program and facilities. Louisiana State University as the contracting agent.

No research activities are currently pursued, although there are staff members with professional capabilities to do collaborative work with other agencies. The facilities at the COA are not readily amenable to research work.

The institution has the potential to train and produce graduates with practical production and scientific background to pursue undergraduate and graduate degrees. The COA is a natural breeding ground for agricultural professionals for research, extension, and work in the production and service sectors. The program, however, has to be more predictable.

4.1.3.3 Rural Agricultural Development Agency (RADA). RADA is a recently formed statutory body (1990) which will subsume the responsibilities of the present Divisions of Production, Extension, Marketing, and Credit in the MOA. The new Authority will seek to increase agricultural production and stimulate

rural development through systematic transfer of relevant information to and from farmers, farm families, and rural communities.

The new system will:

- Provide technical agricultural extension advisory services to small farmers in rural Jamaica
- Train and develop extension personnel at all levels through in-service programs of education and training
- Administer farmer-training programs
- Mobilize agricultural credit and inputs for small farmers
- Help small farmers organize cooperative marketing ventures and disseminate timely marketing information to farmers
- Cooperate with agencies involved in development of rural infrastructure
- Develop and operate rural Agricultural Service Centres (ASC) at strategic locations
- Cooperate with agricultural research organizations to provide the research delivery link to small farmers
- Provide a channel for free flow of policy inputs from the bottom upwards, and the implementation of policy decisions from the top downwards.

The Authority has been formally launched, and is expected to be in full operation in 1991.

4.1.3.4 Jamaica Agricultural Development Foundation (JADF). JADF is an agricultural financial institution organized in 1984 as a nonprofit foundation. The main objectives are to provide venture capital and research grants for commercially viable projects ranging from J\$50,000 to \$1.0 million. The foundation monetizes PL480 bulk commodities donated to it by a USAID agreement for an initial period of 6 years, the proceeds of which will be used for venture capital.

Since its inception, the JADF has assisted several individuals and institutions involved in agricultural education with funds and technical assistance. The Foundation has also sponsored young farmers in a comprehensive dairy-training program in association with Land O'Lakes, Incorporated, USA.

Under a cooperative agreement between the JADF and the USAID, the Jamaica Agricultural Research Programme (JARP) was established in 1986. Through this agency, efforts are being made to resuscitate and sustain agricultural research in Jamaica. This is encouraged through postgraduate degree training and research funding for a wide range of projects.

4.2 Regional/International Institutions

This section summarizes the research focus and capabilities of four regional/international institutions: University of the West Indies (UWI), Caribbean Agricultural Research and Development Institute (CARDI), Inter-American Institute for Cooperation in Agriculture (IICA), and the Centro Agronomic Tropical de Investigación (CATIE).

4.2.1 University of the West Indies (UWI)

The UWI, Mona Campus in Kingston is a part of the regional institution which provides a wide range of under-graduate and graduate studies. The Faculty of Agriculture in Trinidad has a representative unit on the campus which liaises with the agricultural sector. However, five departments in the Faculty of Natural Science namely, Botany, Chemistry, Zoology, Biotechnology and Nuclear Science are directly involved in agriculturally related research activities.

This composite of departments allows access to a wide range of professional competencies and modern research equipment. The environment and cadre of professionals support both basic and applied research. Through the collaborative effort of JARP, numerous professionals are pursuing advanced degrees in the Faculty of Natural Science with attachments on farms or research stations.

Areas of focus include aquaculture, biological nitrogen fixation in legumes, biotechnology, conservation of endangered species, entomology, evaluation of herbicides, ground-water quality, insecticide efficiencies, nematode control, nuclear and non-nuclear technology, parasitology, pesticide residues, terrestrial ecology, and tissue culture.

4.2.2 Caribbean Agricultural Research and Development Institute (CARDI)

This regional agricultural research organization is funded by a subvention from the Caribbean Community Secretariate (CARICOM) supplied by member countries, external funding from international agencies for new and expanded programs, and national projects.

CARDI's main objectives are:

- To provide for regional research and development needs as identified by national plans and policies
- To provide and extend the application of new technology in agricultural production

- To provide for coordination and integration of the research and development effort of member countries where feasible.

The CARDI unit in Jamaica is located on the Mona Campus of the UWI, where there are greenhouses, laboratories, and field-plot facilities. Research activities are in pesticides, pest control, cropping systems, legumes, development of agricultural equipment suited to small farming, and large and small stock production.

CARDI has the capacity to access a variety of agricultural expertise from within its organization. The Jamaican unit hosts six professionals and 16 support staff (Table 3).

Table 3. Agricultural professionals and support staff within CARDI's Jamaica unit.

Type	Number
Forage specialist	1
Entomologist	2
Biometrician	1
Agricultural engineer	1
Animal scientist	1
Support staff	16

4.2.3 Inter-American Institute for Cooperation in Agriculture (IICA)

IICA is a specialized agency for agricultural cooperation of the Inter-American system. It focuses on:

- agricultural policy analysis and planning
- technology generation and transfer
- organization and management for rural development
- marketing and agro-industry
- animal health and plant protection.

In Jamaica until recently, IICA's research activities were directed toward technical and managerial support of the MOA's Farming System Research Project. Also of interest was small business management support for the rural development process, and research on food crops, roots/tubers, legumes, and cereals in the hillside agriculture program.

For the 1990s, research focus will change from "hands-on" farm research extension to strengthening of institutions such as MOA, NARI, and CARDI, through services in programming, monitoring, and evaluation. The competence of IICA in the near future will then shift from research to institutional support.

4.2.4 Centro Agronomic Tropical de Investigacion (CATIE)

CATIE is a regional research organization located in Costa Rica to serve the Latin American Area. It has developed a strong reputation as a small group of well-qualified professionals conducting solid research in relevant regional issues and supported by well-equipped and maintained facilities. However, it has limited financial resources.

Research activities focus on plant varietal evaluations, forage research, biotechnology for new varieties, and development of extension training programs and research methodologies.

This institution is virtually untapped by the Jamaican research community, and it could serve as an additional resource of excellent research results and relevant information as well as provide scope for collaboration between scientists.

4.3 International Research Institutions

This section summarizes the research being conducted at international research institutions of relevance to Jamaican agriculture.

4.3.1 The Consultative Group for International Agricultural Research (CGIAR)

CGIAR is a worldwide network of 13 internationally supported research centers. Each center has been given a specific mandate to conduct research on certain crops or specific problem areas, and has a highly trained international scientific staff. The aim at all centers is to develop solutions for problems that hamper production and productivity on farms in the mandated subject or region served.

USAID provides approximately 25% of the operating budgets for CGIAR centers and, together, with other donor nations, influences program content of each center.

Jamaican agriculture could benefit from a closer working relationship and more involvement with several CGIAR centers. Unfortunately, there are not many well-trained and adequately supported scientists in Jamaica to interact with the CGIAR scientists. When Jamaica's research capabilities are strengthened, such interactions should be encouraged since it will yield great dividends and increase

the flow of useful information into and from Jamaican agricultural research. CGIAR centers with programs of particular relevance to Jamaica are:

- International Service for National Agricultural Research (ISNAR)
- Centro Internacional de Agricultura Tropical (CIAT)
- International Potato Center (CIP)
- International Center for Arid and Semi-Arid Tropics (ICRISAT)
- International Institute for Tropical Agriculture (IITA).

4.3.1.1 International Service for National Agricultural Research (ISNAR) has the capability and mandate to assist nations to design effective and sustainable research systems. ISNAR has conducted case studies, and has produced publications on national agricultural research systems. Although considerable agricultural research system planning capability exists in Jamaica, the Jamaican Government may consider requesting assistance from ISNAR where needed.

4.3.1.2 Centro Internacional de Agricultura Tropical (CIAT) conducts research on many tropical crops important in Jamaica. There are opportunities for mutually beneficial collaboration between scientists in Jamaica and CIAT on such crops as forages, cassava, and beans. A system should be established so that scientists in Jamaica will regularly receive CIAT publications, and improved germplasm for inclusion in variety trials in Jamaica.

4.3.1.3 International Potato Center (CIP) continues to produce new and improved potato varieties that are higher yielding, and disease and insect resistant for a variety of microclimates. Because of the many and varied microclimatic situations found in Jamaica, Jamaican agriculture could benefit by linkages with CIP. Such linkages should result in new and improved germplasm as well as in improved cultural practices being included in the potato research program in Jamaica. CIP sponsors a potato research network which includes variety and cultural practice trials in several countries. Jamaica should participate in this regional network.

4.3.1.4 International Institute for Tropical Agriculture (IITA) conducts research on tropical crops, forages, and farming systems. Jamaican scientists, working on crop-production problems or farming systems, including alley cropping and other uses of trees in farming systems research, would benefit from regular contact with scientists doing similar work at IITA. IITA can supply literature and germplasm from plant breeding work for further testing in Jamaica. Such linkages would benefit both Jamaica and IITA.

4.3.1.5 International Center for Arid and Semi-Arid Tropics (ICRISAT), in India, conducts research using crops that are adapted to arid and semiarid

environments. Parts of Jamaica are semiarid during much of the year. Such crops as pigeon pea are grown in Jamaica as well as at ICRISAT. Jamaican scientists should establish linkages with scientists with similar interests at ICRISAT. An exchange of information and germplasm between Jamaican and ICRISAT scientists should benefit both research programs.

4.3.1.6 International Livestock Centre for Africa (ILCA). JARP management has indicated that in the small-farm community, there is a trend away from the use of mechanized equipment. Tractors are expensive, and often need repair for which parts are not readily available locally. Even pick-up trucks are not replaced when they become old or when they break down. Consequently, more use is being made of draught power, especially on farms. ILCA has conducted a considerable amount of research on draught power, types of equipment, and draught-load formulae and relationships. Although ILCA's mandate is particularly for Africa, there may be some possibility of cooperation, especially where a Jamaican student or researcher might spend some time at ILCA. In addition, ILCA has specialized in mixed livestock/crop farming systems and tropical forages and feeds, two areas where JARP has specific responsibilities. At the minimum, JARP should subscribe to the ILCA Newsletter and technical reports.

4.3.2 Other International Agricultural Research Centers (Non-CGIAR)

Among the seven non-CGIAR international agricultural research centers, three have programs of research highly relevant to Jamaican agriculture. They are:

- International Network for Improvement of Bananas and Plantains (INIBAP)
- Asian Vegetable Research and Development Center (AVRDC)
- International Fertilizer Development Center (IFDC)

4.3.2.1 International Network for Improvement of Bananas and Plantains (INIBAP) collects, evaluates, and distributes improved banana germplasm. One operating unit is the Central America and Caribbean Network, located in Costa Rica. This network supports a few research efforts, facilitates acquisition of improved germplasm, conducts research workshops, and facilitates communication among scientists in the region who conduct research on banana and plantain. Currently, little research is being conducted on banana in Jamaica. When more scientists are conducting research on banana, it will be highly advantageous to Jamaica banana production for banana scientists in Jamaica to belong to the regional network and gain access to literature and germplasm from throughout the world.

4.3.2.2 Asian Vegetable Research and Development Center (AVRDC) has an ongoing breeding program for vegetables for tropical regions. AVRDC also

selects and develops vegetable varieties for insect and disease resistance. Jamaican agriculture could benefit from strong linkages between Jamaican scientists and scientists at AVRDC. Scientists in Jamaica should receive publications and vegetable germplasm from AVRDC. Plant physiologists, entomologists, plant pathologists, and geneticists who work on vegetables at AVRDC can provide a continuing flow of information and plant material to Jamaican scientists if Jamaica's scientific efforts for vegetable research can be increased to a level that permits collaboration between scientists to be established and maintained. Research linkages are most effective between scientist and scientist.

4.3.2.3 International Fertilizer Development Center (IFDC) can assist Jamaican agriculture by helping to develop fertilizers from indigenous materials, and can help develop specialty fertilizers that may be needed for such uses as trickle irrigation. A Jamaican research effort aimed at reducing fertilizer inputs is needed. Effective linkages with IFDC could be established if fertilizer scientists were at work in Jamaica.

In summary, it can be stated with certainty that tremendous resources which could benefit Jamaica exist at the CGIAR and Non-CGIAR International Research Centers. Access to these resources which could benefit the production and productivity of Jamaican agriculture depends on the presence of active and competent scientists in Jamaica. Without this nucleus of scientists, which does not currently exist in Jamaica, the potential for benefiting from the International Research Centers is nil.

4.3.3 United Nations Organizations

The Food and Agriculture Organization of the United Nations (FAO) was formed in the mid-1940s. It has served as a forum for all member nations to express concerns about their agricultural problems and to seek technical assistance in solving these problems. FAO provides specific technical assistance and functions as the executing agency for the United Nations Development Program (UNDP) and occasionally for other world organizations such as the World Bank and funds-in-trust organizations. Two missions to Jamaica concerning agricultural research have been carried out by the FAO in recent years. Both have indicated a strong need for a well-qualified and efficient research organization. Through technical assistance, FAO can assist research development in particular areas. A representative of FAO resides in Kingston and should be kept informed of JARP's activities and future ideas and plans for agricultural research.

4.3.4 Other Nations

This section describes research and funding agencies in Canada and the United States of relevance to agricultural development in Jamaica.

4.3.4.1 Canadian Research and Development. Canada's International Development Research Center (IDRC) supports research and information systems in many developing countries. Canada has a long-standing interest in the development of agriculture in Jamaica. It is reasonable to view IDRC as an important contributor and collaborator in a revitalized agricultural research program in Jamaica.

4.3.4.2 Research and Development Agencies in the United States. Organizations in addition to the U.S. Agency for International Development have potential to assist agricultural research in Jamaica. Some of these are:

- U.S. Department of Agriculture (USDA)
- U.S. Land Grant Universities
- Consortia of U.S. Universities.

U.S. Department of Agriculture (USDA). The primary research agency within USDA is the Agricultural Research Service (ARS). ARS has about 3,000 scientists conducting research in the U.S. and in foreign countries that are major U.S. trading partners. Although ARS's mandate is for agricultural research to support U.S. farmers and consumers, it frequently collaborates with scientists in other countries to solve problems with potential benefit to U.S. agriculture. Examples of such collaboration include research on animal health, insect and diseases of both plants and animals, and food quality and safety. The ARS should be viewed as a potentially effective partner with Jamaica to solve problems of mutual interest. A request from a Jamaican scientist directly to potential collaborating scientists in ARS is usually the most effective method of beginning technical collaboration.

A second USDA agency with potential to assist agricultural research in Jamaica is the Animal and Plant Health Inspection Service (APHIS). APHIS is not a research agency, but many of its programs and concerns have implications for the research that will be required to increase export of agricultural products from Jamaica to the United States. Close working relationships should be developed and maintained between Jamaican scientists and APHIS program personnel.

U.S. Land Grant Universities. The U.S. has 67 universities with comprehensive agricultural research and extension programs. Several universities, such as Michigan State University, Cornell University, Louisiana State University, University of Florida, Texas A&M University, and the University of Hawaii, have institutional commitments to programs in tropical agriculture. These and other

land grant universities can assist Jamaica by training students and collaborating in research of mutual interest. Jamaican agricultural scientists would benefit by establishing and maintaining collaborative relations with scientists at land grant universities. In most cases, such collaboration results from professor-student relationships developed during study periods in the U.S. Such relationships should be encouraged.

Consortia of U.S. Universities. In recent years, several University consortia have been created to enable U.S. universities to respond effectively to opportunities to assist agriculture in developing countries. Five such consortia have been formed. Some consortia, such as the Southeastern Consortium for International Development (SECID), have special interest and capabilities in tropical agriculture. The five consortia are:

1. Southeastern Consortium for International Development (SECID)
2. Northeastern Consortium for International Development (NECID)
3. Consortium for International Development (CID)
4. Mid American International Agricultural Consortium (MIAC)
5. Midwestern University Consortium for International Agriculture (MUCIA).

These consortia can arrange for the collective talents of member universities to address important agricultural research problems in developing countries and regions. USAID is the principal supporter of these consortia; however, private industry and host-country funds are also used. Almost all consortia work involves collaboration between scientists in the member universities and host-country scientists.

Collaborative Research Support Projects (CRSP). A unique type of university consortium is the Collaborative Research Support Project (CRSP). USAID has created and funds, through the S&T Bureau, research projects which address specific subjects using scientists from several U.S. universities. These CRSP projects conduct discrete research activities in developing countries in collaboration with host-country scientists. CRSPs in the following subjects are being conducted: small ruminants, beans and cowpeas, peanuts, aquaculture, soil management, fisheries, sorghum, and millet. An additional CRSP will be established on sustainable agriculture in 1991. The CRSP programs can assist Jamaican agricultural research efforts by establishing collaborative projects in Jamaica using USAID, Jamaican, and, possibly, industrial and private funds.

USAID S&T/AGR World-wide Projects. The Office of Agriculture of the Science and Technology Bureau, USAID-Washington, D.C. has a portfolio of projects which use scientists from U.S. universities and the private sector to work with scientists in developing countries on applied agricultural research and development problems. Capabilities exist for assisting Jamaican agricultural programs in the

following areas: policy development, natural resource conservation, aquaculture and fisheries, animal production, crop production, postharvest physiology, insect and disease control, nitrogen fixation, and biotechnology. Acquisition of technical assistance from S&T/AGR by Jamaican scientists can be facilitated by USAID/Jamaica.

5.0 Agricultural Research Needs in Jamaica

This section defines short-, mid-, and long-term research needs as recommended by the evaluation team.

5.1 Short-Term Research Needs (1-5 Years)

Improvement in the effectiveness of agricultural research in Jamaica, in the short-run, will require that certain policy, organizational, and operational changes take place. Essential steps in this process that should be taken by GOJ are listed as items 1-10 in **Section 6.1 -- Strengthening Agricultural Research Over the Next 5-10 Years** of this report. Therefore, the priority research need in Jamaica during the next 1-5 years is for this action to occur to set the stage for research in subsequent years.

If funds become available, three research activities need early attention:

- Further in-depth research should be conducted to combine high-protein forages with local high-energy feeds for dairy cattle.
- Studies should be undertaken that evaluate the necessity of using animal power on small farms to determine what is new in animal drawn equipment and to evaluate the economies and acceptability of using animal power.
- Greater efforts should be made to discover and develop techniques for biological pest control.

5.2 Mid-term Research Needs (5-10 Years)

Research needs in the mid-term will depend on progress during the next 1-5 years. If research capacity is increased and research is underway within a well-staffed and supported NARI, and if NARI is addressing production problems on priority areas with potential to increase production and productivity of commodities that contribute to exports and reduce reliance on imported food, the research areas listed below will require emphasis. To sustain a vigorous agricultural sector, a phased growth plan will probably be necessary. **Maximal effort should be made to secure international donor support, and scientists should actively collaborate with regional and international research organizations.**

Based on the assumption that NARI is created, has a strong nucleus of scientists in key disciplines, has adequate core budget funded by GOJ, and has begun to

attract international donor support within 5 years, the following research areas will need emphasis during the Mid-term (5-10 year) period:

1. Plant and animal germplasm should be created and preserved to increase productivity and quality. Special emphasis should be given to forages for livestock feed and to improve through breeding efficient farm animals for Jamaica.
2. Research on plant and animal pest control should emphasize biological control.
3. Soil and water conservation research should emphasize erosion prevention and maintenance of water quality.
4. Research on the production and marketing of traditional and newly emerging export commodities should be conducted with emphasis on horticultural and floricultural crops, yams, and fresh-water fish.
5. The economies of production and marketing systems should be studied with emphasis on maximizing productivity and quality, both for local consumption and export.
6. Production, processing, and marketing of food crops and animals primarily for domestic consumption should be studied.
7. Research in postharvest technology should be undertaken to reduce losses and improve quality.
8. Research on inland fisheries (aquaculture) should be conducted including production, processing, and marketing.
9. Livestock feed and forage production and utilization are also important research topics.

5.3 Long-range Research Needs (10-20 Years)

In addition to research needs identified as medium-term, (which should be continued beyond 10 years), the following areas will need attention by the research community in Jamaica:

1. Research into **agroforestry practices** for conservation and animal feed
2. Continued research into ways to increase use of **indigenous products** for animal feed and human consumption

3. **Genetic research** including use of biotechnology techniques to develop unique characteristics of plants for export markets
4. Research into methods of **increasing indigenous energy sources** on farms
5. Research into the adaptability and feasibility of **nontraditional crops**
6. Research into ways to reduce further **environmental degradation**
7. Research on ways and means to develop a more satisfactory balance between **agricultural exports and food imports**
8. Research into ways and means for developing more attractive environments in **rural communities** including measures to improve living conditions and increase efficiency of energy inputs.

6.0 Strategies for Research Program Development

This section discusses strategies for strengthening agricultural research in Jamaica, outlines a research system, and discusses JARP's role in forming a National Agricultural Research Institute.

6.1 Strengthening Agricultural Research Over the Next 5-10 Years

The GOJ's 5-year (1990-1995) Development Plan indicates that the agricultural sector's contribution to GDP, expressed in constant 1974 prices, grew to J\$30.9 million between 1973 and 1978. Subsequently, there was a declining trend. In 1987, GDP was less than that of 1978, although agriculture employs approximately 30% of the labor force.

One broad objective for the agriculture sector, as stated in the plan, is to significantly increase production and productivity of the agricultural sector while improving the rural environment. The plan recognizes that accomplishing the goals for the agricultural sector requires that efficiency in production and competitiveness in the marketplace be increased. It further recognizes that appropriate technology be developed and disseminated, and that research and extension be increased. The policy climate in Jamaica would appear to present a window of opportunity for launching a newly invigorated national agricultural research effort to cope with the new world economic order.

Agricultural research in Jamaica is at an extremely low point. Buildings and land for agricultural research approach adequacy; however, buildings need repair, and offices, laboratories, and libraries require more equipment and supplies. Funding from the MOA is inadequate to provide essentials. Salaries are too low to be competitive; consequently, very few trained scientists are working in the MOA's Agricultural Research Division. Significant research, exclusive of that supported by limited funds provided from external organizations, is essentially nonexistent.

Early actions that must be taken by the GOJ to reestablish an effective agricultural research capability are listed below:

- 1. Although the 5-year development plan identifies agricultural research as needing increased attention, a clearly articulated policy statement aimed at re-establishing agricultural research as a national priority must also be developed.**
- 2. The MOA is to be commended for developing in 1987 a publication describing methodology for establishing priorities for research projects. This methodology was used to develop a "National Agricultural Research and**

Development Program" which identified specific activities to be included in the program. The effects of Hurricane Gilbert, economic stress, and shortages of trained human resources have caused this plan to be only partially implemented. **As soon as possible, the GOJ should take steps to develop a new 5-year National Agriculture Research Plan** which takes into account present and foreseeable conditions, identifies priority areas of emphasis, and clearly states what research is and is not responsible for.

3. **Financial support for research must be increased and sustained for at least 10 years at a level that permits an effective and comprehensive program to be carried out.**
4. **Trained personnel for agricultural research in Jamaica is extremely limited. Major efforts must be made to create and retain qualified personnel in the overall national research system.** This requires special and innovative training programs and competitive salaries.
5. To effect the GOJ's goal of increasing agricultural productivity through development of appropriate technology, and to focus agricultural research in Jamaica on national needs as well as on the needs of producers, especially small farmers, centralization of agricultural research in a National Research Institute (NARI) is highly desirable. The creation of NARI is on the agenda of the MOA. **A priority need is to establish NARI as soon as possible to conduct priority agricultural research for Jamaica.**
6. **Establishment of a National Agricultural Research Center of excellence is greatly needed.** Consolidation of research efforts at Bodles is logical, and would permit resources to be redirected and focused on priority research needs.
7. The establishment of a NARI and consolidation of national research efforts at Bodles could attract external funding. **A plan and an active program to attract international donor support will be essential.**
8. Some research is being conducted by UWI and CARDI and the crop commodity boards. **This research should be encouraged and coordinated with the research carried out by a NARI.**
9. **A national agricultural advisory council to oversee national research and development policy with membership including NARI, ADC, and RADA, will be required in order to minimize duplication, guarantee complete coverage of agricultural problems, and coordinate efforts.**

10. JARP has contributed funds, is supporting 42 research projects, and is training some young people for agricultural research. This effort is commendable. Critical research needs are being met partially by JARP. **A short-term need is for JARP to continue to emphasize the areas of research and activities in its current portfolio, and to continue support of other priority activities that become clearly identified.**

If the above suggested actions are promptly taken and are successful, the agricultural research program in Jamaica should be revitalized, and soon be making significant contributions to production and productivity. Ten years hence, Jamaica should have the research capacity required to sustain the production of a large portion of the meat, dairy, vegetable, and fruit products required for the nation's population along with a vigorous and profitable export business based on agricultural products.

6.2 Outline of a Research System for Jamaica

Since production and productivity of agriculture in Jamaica is low and declining, it is essential that this situation be ameliorated as soon as possible. The great diversity of microclimates, soils, terrain, and crop and livestock enterprises makes research priority setting and allocation of resources extremely complex. Also, GOJ cannot provide all financial and technical resources required for an adequate research system. Therefore, a well-established, internationally recognized agricultural research organization and program are required to attract well-qualified staff, external technical cooperation, and funding.

Serious consideration is being given to establishing a National Agricultural Research Institute (NARI). The concept of a NARI appears to have merit, and authorization to organize and implement a NARI is moving through the legislative processes in the GOJ and is likely to be authorized in mid 1991.

Critical to the success of NARI will be the policy framework under which it functions as well as the organization and financial support provided. Because of low salaries in direct government service, it is essential that NARI have maximum statutory and operational autonomy. NARI must be able to provide salaries above the standard government scale to attract and retain scientists. It also must be authorized to accept funding from government, and private and international sources. Without this degree of autonomy, NARI will be no improvement over the present ineffective MOA/R&D program.

Based on experience in other countries where a national agricultural system was established, it is apparent that effective research organizations should not also have developmental responsibility. It is, however, extremely important that scientists in the national research organization work closely with appropriate

subject-matter specialists in the country's extension or agricultural development organization. Therefore, it is essential that scientists in NARI work closely with specialists in RADA and ADC.

A revitalized agricultural research organization and program for Jamaica should make special efforts to:

- 1. Identify research areas relevant to needs and capabilities**
- 2. Conduct research that will increase productivity of agricultural commodities essential for domestic consumption as well as those with export potential**
- 3. Conduct research to facilitate marketing of agricultural products**
- 4. Conduct research to control agricultural pests using effective and environmentally safe methods**
- 5. Conduct research to use indigenous resources including unique plant and animal germplasm**
- 6. Conduct research to develop farming systems and practices that are economically and physically sustainable**
- 7. Provide for a sustained flow of new talent into agricultural research in Jamaica**
- 8. Provide adequate planning, supervision, facilities, and funding for a sustained program of research.**

An essential component needing to be addressed in NARI is the development, within its research competence, of a deep awareness of the rural setting, rural socioeconomic systems, and the role of agricultural enterprises in the network of the rural environment. As such, researchers should be encouraged to pursue projects within the context of scientific, technical, economic, and social research with respect to production, utilization, and processing of all agricultural produce.

The type of institute and location of NARI need to be discussed. It should be viewed as Jamaica's center of research excellence, where physical facilities, laboratories, and equipment are of the highest quality. However, facilities should not exceed the capacity of the scientists. The best scientists and technicians should also be available. It should start small, covering research areas of the highest priority to Jamaica. NARI should be allowed to develop and grow as priority research expands and competent staff and funds become available.

JARP has identified many of the high-priority areas of agricultural research. These appear to be realistic, but they should be constantly reviewed and re-prioritized as necessary. However, research facilities necessary to conduct high-priority research, even if priorities change somewhat, will remain more or less constant for the next 10 years. If new high-priority research endeavors become apparent needing additional facilities and equipment, they should be added at that point. In the beginning, there should be no attempt to furnish a facility which would meet all eventual requirements.

The national center for research should be located at the Bodles Research Station. It is centrally located in the country, and already has the necessary fundamental core facilities. In order to avoid expenditure on additional physical facilities in other geographic areas, which tends to reduce the amount of funds actually going into research, satellite or substations should be kept to a minimum. Research which needs to be conducted in specific environmental/climatic zones should be located in farmer's fields.

Over the years, the MOA has maintained large cattle herds at Bodles and other locations which have been mainly used as sources of bulls and semen and replacement heifers for farmers. This activity accounts for about 40% of the budget at Bodles. These herds have been used minimally for research, and strain the research budget. Keeping these foundation breeding herds is important to Jamaica but should be the function of the ADC. This is not to say that no animal-breeding research should be carried out by NARI. On the contrary, a nucleus herd, the size to be determined, should be kept for research as investigations on improving the Jamaica Hope, Jamaica Red, and Jamaica Black need to be conducted. Inbreeding seems to be affecting production levels of the Jamaica Hope; therefore, a research effort is necessary to determine the best methods of improving production. Larger production herds, if maintained by ADC, could be used in such a program but should be the responsibility of ADC, not NARI.

Living facilities at Bodles for research, technical, and management staff will necessarily have to be expanded and improved. These facilities are absolutely necessary to create a favorable environment for thinking and research. For those staff residing in Kingston, a reliable bus service to Bodles is imperative. In addition, adequate transportation will be necessary to allow researchers to visit their on-farm research sites and to keep in touch with farmers and RADA staff so that problem identification is constant and automatic.

It needs to be emphasized that NARI should be the research institute in Jamaica. It should not have responsibilities in development or extension except to furnish research results to ADC and RADA. Both ADC and RADA should have input to NARI in problem identification. Coordination of activities and responsibilities of

the three organizations is vital so that all aspects of research and development are covered, there is no duplication of effort, and farmers needs are met.

Just how a national agricultural research institute is established and what form it will take is hard to visualize, but several scenarios come to mind:

1. An autonomous national research institute not funded by the GOJ and under the aegis of JADF with its director controlled by a board
2. An autonomous national research institute with a core budget funded by the GOJ and with heavy financial support from external funding agencies under the aegis of JADF, with its director controlled by a board
3. A semi-autonomous national research institute with a core budget funded by the GOJ and with heavy financial support from external agencies under the aegis of the MOA, with its director controlled by a board
4. A national research institute with a core budget funded by the GOJ and with heavy financial support from external agencies under the aegis of the MOA, with the director being an MOA employee
5. A national research institute with its budget completely financed by the MOA with the director being an MOA employee.

There are many pros and cons for any one of the above alternatives. However, there is almost universal agreement on the need for creation of an institute which will attract and hold high-level capable scientists. Key to this is an organization which can pay salaries greatly above the present levels paid to MOA researchers, and where there is an environment where scientists can feel they will make a lasting contribution to Jamaica.

With this requirement in mind, it would appear that only alternatives (1) or (2) would be acceptable to the scientific agricultural community. Perhaps (3) could be used if the MOA could raise salaries to an acceptable level. Knowing the track record of agricultural research in Jamaica under the control of the MOA, alternatives (4) and (5) are probably non-starters as far as the scientific community is concerned and should be eliminated from further consideration.

Most likely, the GOJ should be involved in financially supporting a NARI. This eliminates alternative (1); therefore, alternative (2) seems the most likely scenario to be accepted. However, this does limit the control and influence of the MOA, this could be overcome by having the MOA appoint the director and, at least, some board members.

The implication of the GOJ funding the core budget of NARI does not necessarily constitute an additional allocation to the agricultural sector but rather a redirection and consolidation of resources presently going to MOA for research. Funds presently going to the Bodles Research Station would be absorbed by NARI, and funds going to outlying research stations which would be deleted would be redirected to NARI.

To have an excellent research program, external assistance will be necessary, recognizing the Jamaican government budget limitations. The formation of JARP under the stewardship of JADF outside the MOA indicates that external assistance provided in this way can be successful.

6.3 The Role of JARP in the Formation of a National Agricultural Research Institute (NARI)

As indicated earlier, JARP has been successful in promoting and financing agricultural research in Jamaica. It has established policies for reviewing, accepting, and rejecting project proposals, and for supervising ongoing research. The projects, for the most part, will contribute to increased productivity and, at the same time, are evaluated and monitored as to their effects on the environment. JARP has played a key role in bringing together the research community, and has helped stimulate the initiative for the formation of a national agricultural research institute.

For the successful formation of a vital and productive agricultural research institute, it is important that JARP continue to catalyze the process. It can do this by:

- Continuing to finance acceptable research projects through the end of its tenure
- Playing an active and critical role in discussions of a NARI
- Assisting in the creation of suitable agricultural research facilities through funding of necessary equipment, documentation, and materials which will be part of a NARI
- Continuing the training of an excellent scientific cadre of researchers.

Realizing that at this juncture, JARP has a finite existence, it is necessary to limit these activities to the life of the JARP project. However, all activities should be carried out with the expectation that an active and revitalized national agriculture research institute will come into being in the next 2-3 years. Whether JARP will

need to be extended or not depends on how quickly a NARI can be established and what form it will take.

USAID's track record has been established. If either alternative (1) or (2) is followed, USAID would have a possibility of an active and contributory role along with other external aid organizations.

Several other organizations and institutions outside the MOA conduct research in Jamaica (see **Sections 4.1 and 4.2**). JARP has been able to strengthen some of them by contracting out research to them. Examples of this are CARDI and UWI. Some of JARP's most interesting research projects are with them. If NARI is formed, such cooperation would very likely continue at least in the short term and NARI would become a part of this network, especially for the Caribbean region.

7.0 Recommendations

1. JARP is addressing and is effectively contributing to the objectives of the project. **Therefore, it is recommended that the JARP program be continued without major changes until normal termination in 1993.**
2. The importance of the creation and effective functioning of a National Agricultural Research coordinating entity has been well-established. **It is recommended that USAID support the formation and operation of NARI, including assisting with upgrading of physical facilities at Bodles, training of personnel for NARI, and financial support for administration and research activities as appropriate.**
3. Assuming that NARI will be operational before the JARP program terminates, **it is recommended that the JARP program be phased into the NARI program as feasible.** If NARI is not functioning when the current JARP Program will terminate, it is recommended that JARP be extended to keep up some research momentum and give the GOJ more time to develop an effective structure for managing and funding agricultural research.
4. Given the existence of RADA and the probable creation of NARI, **it is recommended that USAID take steps to ensure that research results produced by JARP, NARI, and elsewhere are used by RADA in working with agricultural producers.**

Appendices

Appendix A

Scope of Work

Jamaica Agricultural Research Project Evaluation

APPENDIX A - SCOPE OF WORK

JAMAICA AGRICULTURAL RESEARCH PROJECT EVALUATION

1. Activity to be Evaluated

Project Title : Agricultural Research Project

Project Number : 532-0128

	<u>Date</u>	<u>Loan</u>	<u>Grant</u>
Authorization:	07/25/86	-0-	\$7,600,000
Obligations	07/21/89 (last)	-0-	\$3,700,000
Original PACE*	07/29/93		

* Project Assistance Completion Date

2. Purpose of the Evaluation:

The evaluation will assess: 1) progress to address the Project purpose; 2) capabilities of national, regional and international institutions to carry our relevant agricultural research in Jamaica; 3) future agricultural research needs in Jamaica; and 4) how the Project can best address these needs.

3. Background:

Perceived Problem

Various institutions and agencies are carrying out agricultural research in Jamaica, but their efforts are under-funded, fragmented, not focused on priority problems and not coordinated with regional and international institutions. In this regard recent studies have examined the national agricultural research system and identified major constraints, including: 1) lack of coordination among public, quasi-public and private sector entities involved in research; 2) lack of clearly defined policies, priorities and operational objectives; 3) weak linkages between research, extension and farmers and 4) lack of adequate budgetary support.

The GOJ has received assistance from Inter-American Development Bank (IDB), Inter-American Institute for Co-operation on Agriculture (IICA), Food and Agriculture Organization (FAO), International Development Research Center (IDRC) and CARDI as well as other donors to strengthen the country's agricultural research capabilities.

This assistance has focused primarily on developing experiment station facilities as well as providing technical assistance. Unfortunately, today these facilities are under-staffed and inadequately funded to carry out a meaningful agricultural research program. Researchers in the national system are generally poorly paid, poorly supported, lack leadership and in some cases lack the necessary educational background to conduct research programs.

Summary Project Description

The Project purpose is to identify solutions to constraints to increased production and productivity by carrying out applied agricultural research in priority areas.

The Jamaican Agricultural Research Program (JARP) was established under the aegis of the Jamaican Agricultural Development Foundation (JADF), a tax-free, autonomous, non-profit organization. JARP's Research Advisory Council (RAC) determines policy and identifies priority research areas. The Executive Committee of the RAC provides advice to the Program Director concerning program content and recommends grant or contract funding for specific research proposals. The Program Director and the Assistant Program Director are responsible for: 1) Program management, 2) carrying out research priorities identified by the RAC, 3) developing project proposals, 4) executing grants and contracts, 5) developing linkages with national, regional and international organizations, and 6) preparing annual reports and budgets for presentation to the RAC and JADF.

JARP provides grant support to individuals and groups from public and private organizations that have the capability to design and implement priority research experiments. Individuals or organizations submit research proposals to the Director. The RAC Executive Committee reviews the proposals and provides advice to the Program Director concerning which proposals should be funded. The Project also provides funding for multi-year contract research with organizations such as Inter-American Institute for Co-operation on Agriculture (IICA), Caribbean Agricultural Research and Development Institute (CARDI), Consultative Group on International Agricultural Research (CGIAR), Institutions and Collaborative Research Support Program (CRSPs). The Project supports short and long-term training to strengthen the skills of national researchers as well as exchanges among Jamaican and international agricultural scientists. Limited funds are provided for upgrading facilities at the principal GOJ agricultural research center.

4. Statement of Work

The purpose of the Evaluation is stated in Section 2 of this Scope of Work. To achieve this purpose the Evaluation will be conducted in the following manner.

- a. Review completed and ongoing research activities funded under JARP and assess their capability to address the Project purpose. This review will include an assessment of the quality and relevance of written proposals and research activities. The capability of individual researchers also will be evaluated. In addition, the evaluation will assess the organizational role of the RAC and the RAC Executive Committee and analyze their capability to identify appropriate research priorities, determine program content and provide guidance to the JARP Director and staff. The evaluation will provide an appraisal of the JARP staff's capability to carry out current responsibilities. An assessment of future staff requirements and skills will be discussed.
- b. Review and assess the agricultural research capabilities of national (including the MOA and commodity boards), regional (including the Caribbean Agricultural Research and Development Institute and the University of the West Indies) and international institutions to carry out research programs in Jamaica. This portion of the evaluation will also assess the research capabilities of the College of Agriculture and its ability to develop students interested in pursuing professional careers in agriculture research. The evaluation will discuss the capabilities of RADA (Rural Agricultural Development Authority) to deliver new technologies to the farmer and whether RADA should have a research capability. The evaluation will also discuss the need for a National Agricultural Research Institute (NARI) currently being considered by the GOJ. A brief analysis will be made concerning the quality and quantity of published agricultural research papers produced in Jamaica during the past ten years.
- c. The evaluation will address Jamaica's short term (1-5 years), mid-term (5-10 years) and long term (10-20 years) agricultural research needs and assess the role of existing institutions to fill these needs. In this regard the evaluation will comment on factors which cause existing

Jamaican research institutions to be weak (e.g., low salaries, low morale, poor career opportunities, location of Bodels Research Station). The evaluation will also suggest possible ways that these institutions can be linked together to enhance Jamaica's agricultural research capabilities.

- d. Based on the findings developed in sections a, b and c above the Evaluation Team will outline an effective and sustainable research system suitable for Jamaica's short and long term needs. The Team will recommend ways in which the JARP can be reshaped if necessary to address these needs. The evaluation will also assess USAID/Kingston's short and long range role in agricultural research. Finally, the Evaluation Team will develop a series of specific recommendations designed to carry out the major findings of the evaluation. A brief narrative will be provided to support each recommendation.

5. Methods and Procedures

In order to conduct the evaluation discussed in the Statement of Work and develop relevant and workable recommendations the Evaluation Team will review project documents and reports developed by the USAID/Kingston, JARP and the MOA as well as external donor agencies such as FAO. In this regard the Agriculture and Rural Development Office (ARDO) has a current file of key documents which will be provided to team members prior to their arrival in Kingston. The Evaluation Team will also conduct a series of interviews with key administrators and researchers at the JARP, the Ministry of Agriculture (MOA), Caribbean Agricultural Research and Development Institute (CARDI), Rural Agricultural Development Authority (RADA), the College of Agriculture (COA), the University of the West Indies (UWI) and selected commodity boards. The Team will make on-site inspections of laboratories, field stations and farms where agricultural research is being conducted. The evaluation exercise is scheduled to commence on or about September 17, 1990. An agenda detailing activities will be developed by ARDO and provided to team members prior to their arrival in Jamaica.

6. Evaluation Team Composition

The evaluation will be conducted by a four person team consisting of a three person contract team and an AID/W representative. The team will work six days per week.

The contract team will have the following qualifications:

1. The Team Leader will have at least ten years experience in international agricultural research, both as an administrator and researcher in plant or animal sciences. This person will also have a Ph.D. in agricultural sciences and an in-depth understanding of the U.S. Land Grant University system.

2. The second team member will have at least five years experience in international agricultural research and a Ph.D. in agricultural sciences. This person will have a strong research background in animal or plant sciences to augment the team leader's background. Thus the Team's technical expertise will include competency in both plant and animal sciences.

3. The third team member will have an in-depth understanding of Jamaican agriculture as well as Jamaica's past and present agricultural research capabilities. This person will have at least ten years experience in agricultural development and a Ph.D. in agricultural research/education.

4. The AID/W team member will be familiar with AID policy and procedures as well as knowledgeable of AID's current and future direction in agricultural research. This person will also have a Ph.D. or equivalent in an agricultural science and have at least five years experience in international agricultural research and development.

7. Reporting Requirements

The Team Leader shall prepare a written report containing the following sections:

- Table of Contents
- Project Identification Face Sheet
- Executive Summary
- Body of the Report
- Appendixes

The body of the report will include: 1) the purpose of the evaluation; 2) team composition and study methods; 3) findings of the evaluation; and 4) conclusions and recommendations. The body of the report shall be not less than 20 pages and not more than 40 pages. Additional information should be included in annexes. Annexes should include a copy of the evaluation scope of work, a list of documents consulted, as well as individuals and agencies contacted.

The Team Leader shall submit a draft report no later than the day before departure. The entire Evaluation Team shall participate in a formal debriefing seminar no later than two days before departure. Principal conclusions and recommendations of the evaluation will be presented at that time. The Team Leader shall submit to USAID/Kingston the final report no later than three weeks after completion of the evaluation.

Appendix B

List of Documents Examined

APPENDIX B - LIST OF DOCUMENTS EXAMINED

- Jamaican Funds-in-Trust. Proposal for Establishment of the Rural Agriculture Development Authority. FAO Technical Report ESH:UTF/JAM/015/JAM. FAO, Rome, 1990.
- Report of the FAO/World Bank Cooperative Programme Investment Centre. Jamaica Agricultural Sector Policy Review. Vol I. FAO, Rome. September, 1986.
- Report of the FAO/World Bank Cooperative Programme Investment Centre. Jamaica Agricultural Sector Policy Review. Vol II. FAO, Rome. September, 1986.
- Hall, Marshall. Revitalizing Export Agriculture. MONEY INDEX. March 13, 1990.
- Minag. National Agricultural Research and Development Programme, 1988-89. November, 1988.
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- CARDI. Strategic Planning for Small-Country National Agricultural Research Systems. Proposed Programme for CARDI/FAO/IICA/ISNAR Seminar - September 24 -28, 1990.
- Patterson, P.J. The Economic Importance A Dyunamic Agricultural Sector in Jamaica in the 1990's. MONEY INDEX. March 20, 1990.
- MASI. Agricultural Research Project Jamaica, Final Report. September, 1983.
- Agricultural Resources. Overview of Agriculture. pp 259-288
- McDermott, Kenneth and E.T. York. Jamaica Agricultural Institutions and Recommendations for Improvement. A Report to the USAID Mission in Jamaica. Univ. of Florida, Gainesville. March, 1988.
- CDSS. Excerpt FY89-93. pp 9-38.
- Jamaica: Reorganization and Strengthening of the Agricultural Research System. Report of a FAO Mission TCP/JAM/6755(F). FAO, Rome. February, 1988.
- Minag. Country Environmental Profile. Prepared on behalf of International Institute for Environment and Development. Minag. Natural Resources Conservation Division. September, 1987.

- Maner, J.H. and Kenneth O. Rachie. A Brief Assessment of Agricultural Research in Jamaica and Recommendations of Approaches and Strategies for Improvement. Prepared under AID Contract No. 532-9103-0-00-6020-00. December, 1985.
- Minag. Department of Science, Technology & Research. Summary of Research Activities 1986-1987. Special Publication No. 2.
- Minag. Department of Science, Technology & Research. Summary of Research Activities 1985-1986. Special Publication No. 1.
- Minag. Department of Science, Technology & Research. Proceedings of the First Interdisciplinary Research and Development Committee Meeting Held on 15 November, 1985. Occasional Publication No. 1.
- Agriculture Sector Strategy Report. Volume I. Prepared for ARD/USAID Project No. 936-1406-7361013. October, 1987.
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- FAO. Plan of Action to Establish the National Agricultural Research and Development Institute (NARDI) of the Ministry of Agriculture in Jamaica. Technical Report, DRAFT, FAO, Rome. 1989.
- Planning Institute of Jamaica. Jamaica Five Year Development Plan 1990-1995. May, 1990.
- USAID. Attachments 1 & 2 to the Cooperative Agreement between the Agency for International Development and the Jamaica Agricultural Development Foundation. July, 1986.
- Jamaica Agricultural Development Foundation. Annual Report and Financial Statements 1989.
- Wilson, George F. Discussion Paper #1. The Jamaica Agricultural Research Programme Annual Retreat. October, 1989.
- McLaren, Lyndon E. and George F. Wilson. Discussion Paper #2. Projected Programme Activities 1990. The Jamaica Agricultural Research Programme Annual Retreat. October, 1989.
- Jamaica Agricultural Research Programme. JARP Initiatives and Their Consequencies. Agenda Item: 11a.

- Jamaica Agricultural Research Programme. Agricultural Research System Reorganisation. Agenda Item: 11b.
- Jamaica Agricultural Research Programme. JADF/JARP's Commitment to Such a System. Agenda Item: 11c.
- Jamaica Agricultural Research Programme. Project Status Report. August, 1990.
- Jamaica Agricultural Research Programme. Information brochure.
- Jamaica Agricultural Research Programme. JAGRIST. Proceedings of the Workshop on Agricultural Research strategies for Jamaica. Vol. 1, No. 2. October, 1988.
- Jamaica Agricultural Research Programme. JAGRIST. The Bulletin of The Jamaica Agricultural Research Programme. Vol.2. No. 2. April, 1990.
- Dixon, Jean. Research Programme: Banana Board. Present Activities of the Research Department and Programme for the 1990-1993 Period. September, 1990.
- Coffee Industry Development Company Limited. Status of Research Projects approved for Funding under the JARP. September, 1990.
- MINAG - IICA. Livestock, Crop and Plant Protection Programme Development. A Methodology to establish priorities for Research Projects. Kingston. November, 1987.
- CARDI. Strategic Plan 1988/93. June, 1988.
- CARDI. CARDI ...An Update 1988-89. Presented to a meeting of Donor Agencies. Barbados. October 20, 1989.
- U.W.I. Aquaculture in the Department of Zoology. Mona. July 16, 1990.
- MOA. Science Technology and Research Department. Commemorative Brochure. Bodles Agricultural Research Station. Forty Years of Service to Jamaican Agriculture (1946 - 1986).
- CARDI. A brochure. May, 1990
- U.W.I. Official Statistics. 1988/89.
- MOA. Organizational Chart. Ministry of Agriculture & Commerce Research & Development Division. September, 1990.
- COA. Student Handbook, 1990-91. Revised July 15, 1990.

COA. Programme of the Associate of Science Degree. September,
1990.

COA. Catalogue, Academic Years 1990-91 & 1991-92. Draft May,
1990.

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Appendix C

Persons Interviewed

APPENDIX C - PERSONS INTERVIEWED

1. Dr. Mark Smith, Manager JARP Project, USAID, Kingston
2. Ms. Marilyn A. Zak, Deputy USAID Mission Director, Kingston
3. Dr. Barbara Ellington-Banks, Manager, COA Support Project, USAID, Kingston
4. Dr. Keith L. Roach, Managing Director, JADF, Kingston
5. Mr. Kenneth Newman, Chairman, RAC for JARP
6. Dr. George Wilson, Director, JARP, Kingston
7. Dr. Lyndon McLaren, Assistant Director JARP, Kingston
8. Mr. L. Walter Van Whervin, Consultant/Advisor, MOA, Kingston
9. Dr. Douglas Lantagne, Professor, Department of Forestry, Michigan State University
10. Dr. Paul Crowe, Head Office of Economics and Private Enterprise, USAID, Kingston
11. Dr. Lawrence Wilson, Dean of Agriculture, U.W.I., St. Augustine Campus
12. Mr. Donald Turner, Farmer
13. Dr. Huntington Hobbs, Senior Research Officer, ISNAR, The Hague, The Netherlands
14. Mr. Alwyn C. Allen, Regional Research Director, Eastern Region, Bodles
15. Mr. Jack Musehette, Assistant Regional Research Director, Eastern Region, Bodles
16. Dr. Muri Alam, Plant Protection Specialist, CARDI, Bodles
17. Mr. John Logan, Forage and Pasture Research, Bodles
18. Dr. Paul Jennings, Leader of Livestock Research, R & D Division, MOA
19. Dr. Janice C. Reid, Caribbean Agricultural Research and Development Institute (CARDI)
20. Dr. Renfrod Baker, Director Research and Development Division, MOA

21. The Honorable Harris Clark, Minister of Agriculture, Jamaica
22. Mr. Glen Henry, Livestock farmer
23. Mr. Steve Cook, Graduate Student from U. of Florida working on JARP supported entomology project
24. Miss Carolyn Tierny, Graduate Student from U. of Florida working on JARP supported farming systems project
25. Mr. Joe Suah, Manager Hillside Agriculture Project
26. Mr. Larry Chung, Resident Project Manager, Hillside Agriculture Project
27. Dr. Mark Nolan, Hillside Agriculture Project Manager, USAID
28. Mr. Richard Harrison, Soil Scientist and Area Director for RADA, Western Area
29. Mr. McCue, Resident Manager, Montpelier Research Station
30. Mr. Warren, Dairy Farmer
31. Dr. Gary Ruegsegger, U. of Florida Research Project Leader for Agro Forestry/Forage Project
32. Dr. Garnet Brown, Director RADA, Jamaica
33. Dr. Alvin Lynch, Leader for Food Technology Research, SRC
34. Mrs. Motley, Leader for Energy Research. SRC
35. Dr. Jean Dixon, Director of Research, Jamaica Banana Board
36. Ms. Janet Conie, Plant Pathologist, Jamaica Banana Board
37. Mr. Claude Stewart, Group Managing Director, ADC
38. Mr. Claude Barrant, Senior Director Agronomy, ADC
39. Mr. Joseph Hendrix, Senior Director Livestock Operations, ADC
40. Mr. William Morgan, Secretary, Jamaica Agricultural Society
41. Dr. Joyce Chang, Managing Director, Coffee Industry Development Company
42. Mr. Barrington Cameron, Manager, Agronomy and Extension Services, Coffee Industry Development Company

43. Mr. Alford Williams, Manager, Extension Services, Coffee Industry Development Company
44. Mr. Kenneth Horton, President, Jamaica Cocoa Board
45. Mr. Percy Miller, Managing Director, Jamaica Cocoa Board
46. Ms. Vivian Wright, General Manager, Jamaica Cocoa Board
47. Mr. Andrew Dunbar, Manager Extension Services, Jamaica Cocoa Board
48. "Dr. Arnolde Ventura, National Advisor, Science and Technology, Ministry of Planning Development & Production
49. Dr. T.P. Lecke, MOA, Retired
50. Dr. Leslie Robinson, Principal, U.W.I., Mona Campus
51. Dr. Kenneth Magnus, Dean of Natural Resources, U.W.I.
52. Dr. Dunbar Steele, Head, Department of Zoology, U.W.I.
53. Dr. Earle V. Roberts, Senior Lecturer, Department of Chemistry, U.W.I.
54. Dr. Tara Das Gupta, Professor, Inorganic Chemistry, U.W.I.
55. Dr. Lloyd Coke, Head, Department of Botany, U.W.I.
56. Dr. M.H. Ahmad, Centre for Biotechnology, U.W.I.
57. Dr. John Preston, Centre for Nuclear Sciences, U.W.I.
58. Dr. Gerald Lalor, Pro-Vice Chancellor, U.W.I.
59. Dr. Armando Reyes Pacheco, Representative, IICA
60. Dr. Terrance Thomas, Dean of the College of Agriculture, COA
61. Dr. William Smith, Associate Dean, Academic Affairs, COA
62. Dr. Desmond Hastings, Associate Dean of Research and Outreach Activities, COA
63. Mr. Donald Campbell, Administrative Assistant to Dean of the College of Agriculture, COA
64. Dr. Edmond Lewis, Head of Plant/Soil Sciences, COA
65. Ms. Vera Badre Singh, Head of Animal Science, COA

66. Mr. Roberto Robotham, Farm Manager, COA
67. Dr. Parul Sharma, Professor of Biological Sciences, COA
68. Mr. Ishmail ben Yahya, Head of Human/Social Science, COA
69. Mr. John Hoskins, FAO Representative for Jamaica and the Bahamas

Appendix D

2nd Annual Seminar Reports on JARP Projects

APPENDIX D - 2nd ANNUAL SEMINAR REPORTS

ON JARP PROJECTS

September 18 - 20, 1990
9:00 a.m. - 5:00 p.m.

Tuesday, September 18, 1990

OPENING

Welcome and Opening Remarks: Mr. Kenneth Newman, Chairman
RAC

Greetings from the JADF: Dr. Keith Roache, Managing
Director, JADF

Overview of the Research Programme: Dr. George Wilson,
Director, JARP

Report on JARP's Activities, 1989-1990: Dr. Lyndon McLaren,
Asst. Director, JARP

SESSION 1

"ETHNIC/LOCAL CROPS"

Presiding: Mr. Kenneth Newman

Modification of the Minisett Technique for the Production of
Ware Tubers Yellow Yam. *Dioscorea cayenensis*. Hyacinth
Campbell

Evaluation of Sprouting and Yield in *Dioscorea alata* Using
the Mini-Sett Method of Yam Production. Clifton Wilson

Effect of Blast Freezing and Vacuum Packing on the Shelf
Life and Quality of Breadfruits and Bammies. Juliette Newell

SESSION 2

ETHNIC/LOCAL CROPS COND.

Presiding: Dr. Renford Baker, R & D, Ministry of
Agriculture

Determination of Methods to Prolong Storage Life of Dasheen
(*C. esculenta*) Corms. Janet Lawrence

Developing Techniques for Improving and Propagating Ackee
(*Blighia sapida*, Koenig). Marjorie Stair

Preliminary Studies Towards the Development of a Pest
Management Programme for Escallion on Small Farms in
Jamaica. Steve Cook

Escallion Production in St. Elizabeth Parish, Jamaica: An Analysis of Constraining Factors. Carolyn Tierney

Fertilizer Management Requirements for Irish Potato Production in Jamaica. Winston Samuels

Agronomic and Culinary Assessment of Potato Varieties. Aubrey Dexter

CHAIRMAN'S CLOSING REMARKS

Wednesday, September 19, 1990

SESSION 3

ORNAMENTALS/FLOWERS

Presiding: Mr. Stafford Burrowes, JAFLEX Ltd.

Developing Alternative Media for Anthurium Production in Jamaica. Paulette Tai Chun

A Survey of Anthurium Bacterial Blight in Jamaica as a Base for Developing Research Strategies. Florence Young

In Vitro Techniques for Rapid Multiplication of Anthuriums. Gordon Lightbourn

Atmospheric Modifications for Disease Control and Improved Quality of Roses. Kelly Ogilvie

SESSION 4

ORNAMENTALS/FLOWERS COND.

An Evaluation of A Loan in Kind and Technology Services for Introducing Orchid Production (as a form of Intensive Horticulture) to Small Farmers. David Quale

The Performance of Gladiolus for Cut-Flower Production under Top Mountain Climatic Conditions, Corm Production of Gladiolus, and The Transfer of Technology to Farmers. A.W. Ramdon

International Forestry Programme at Michigan State University. Douglas Lantagne

SESSION 5

FRUIT PRODUCTION

Presiding: Dr. Hugh Payne, President Elect. JSAS

Passion Fruit Production in Jamaica: Evaluating Trellising Methods and Observing Production Problems. Phyllis Harvey

Some Observations on Twenty-four Selected Mango Cultivars
Establishment at Adelphi, St. James. Dr. H. Hamilton

SESSION 6

PLANT PROTECTION/ENHANCEMENT

Presiding: Mr. Joseph Suah, Director, Hillside Agri.
Project

Natural Enemy Complex of Root Weevils and Potential for
Biological Control. D.O. Clarke

Bioassay of the Effectiveness of Two Species of Nematodes
Against RW larvae in Five Soil Types at Three Moisture
Levels. David Smith

Selection of Effective Strains of *Rhizobium phaseoli* for
Enhanced Nitrogen Fixation of *Phaseolus vulgaris*, L. in
Jamaica. Paul D. Brown

Breeding Red Peas (*Phaseolus vulgaris*) for Disease
Resistance and Enhanced Biological Nitrogen Fixation. W.
McLaughlin

Effect of Organic Soil Amendments on the Population Dynamics
and Control of Plant Parasitic Nematodes and the Nutrient
Status of Various Crops. Dave Hutton

CLOSING REMARKS

Thursday, September 20, 1990

SESSION 7

Relative Influence of Socio-Economic and Attitudinal
Variables on Technology Use and Production in Small Farm
Systems. Dr. T. Thomas, Dean, College of Agriculture

LIVESTOCK/FORAGES

On-farm Evaluation of Leucaena, Gliricidia and Legume/Grass
Hay as High Protein Forages in Dairy Cattle Rations. Gary
Ruegsegger

Determination of Yield, Digestibility and Nutritive Value of
African Star Grass (*Cynodon niemfuensis*) as Influenced by
Level of Nitrogen Fertilizer and Defoliation Frequency. Paul
Jennings

Comparison of the Agronomic Performance of Napier, Hybrid
Napier (N69) and King Grass. John Logan

Indigenous Knowledge Relating Silvo-Pastoral Management
Systems of Small Farmers in Jamaica. Bruce Morrison

Fodder Tree Establishment in Jamaican Pastures. James Roshetko

SESSION 8

FARMING SYSTEM/MISCELLANEOUS

Presiding: Mr. Ivan Tomlinson, Chairman, Jam. Citrus Growers Assn.

Comparative Study of Soils on a Part of the Marchmont Inlier, Western Jamaica. Richard Harrison

Study of the Soil Characteristics as Developed in a Grass Mulch System of Vegetable Cultivation in Jamaica. Malcolm Davis

Testing Micro Irrigation Systems for Small-Scale Farmers in the Rio Cobre Basin Area of Jamaica. Mark Moynihan

A Study of the Factors Influencing Credit Use on Small Farms in Selected Areas of Jamaica. Jean Shand

Cross Protection Techniques: Potential for Controlling Papaya Ring-Spot Virus in Jamaica. Paula Tennant

Selection and Breeding of Loofah (Strainer Sponge). Burrell Scarlett

Evaluation of Grain Amaranth in Jamaica. Margaret Young

COMMENTS BY EVALUATION TEAM

Appendix E

List of Projects and Locations

APPENDIX E - LIST OF PROJECTS AND LOCATIONS

June, 1990

No:	PROJECT #	PROJECT TITLE	MANAGEMENT ENTITY	DURATION	PRINCIPAL INVESTIGATOR(S)	LOCATION of PROJECT ACTIVITIES	CONTACT ADDRESS
1	11-87/13	Agronomic and Culinary Assessment of Potato Varieties.	MINAG	3 Yrs			
2	12-87/15	A Study of the Factors Influencing Credit Use on Small Farms in Selected Areas of Jamaica.	Data Resource Systems Int'l Ltd.	15 Mo	D.Manhertz J.Shand	Selected Locations c/o Data Resource Systems	7 Oxford Park Ave Kingston
3	12-87/16	Chemical Treatment of Mango to Induce Off-Season Flowering and Cropping.	AGRO 21	2 Yrs	TERMINATED		
4	1-88/03	Evaluation of Loan in Kind and Technology Services for Introducing Orchid Production as a form of Intensive Horticulture to Small Farmers.	JARP	5 Yrs	MINAG/JARP	Heartease, St. Thomas and Locations in St. Andrew and St. Catherine	Mrs. E.Richards c/o Yallahs Agricultural Store Yallahs, St. Thomas
5	1-88/04	Evaluation of Grain Amaranth in Jamaica.	U.W.I.	2 Yrs	M.Young K.Vaidya	Botany Dept. Mona Campus, U.W.I.	Botany Dept. Mona Campus, U.W.I.
6	1-88/05	On-farm Evaluation of Leuceana, Gliricidia and Legume/Grass Hay as High Protein Forages in Dairy Cattle Rations.	St. Elizabeth Dairy Cooperative	2 Yrs	G.Ruegsegger	Cabbage Valley and Luana Dairy Farms	c/o Bodles Research Station, Old Harbour, St. Catherine
7	2-88/17	Effect of Organic Soil Amendments on the Population Dynamics and Control of Plant Parasitic Nematodes and the Nutrient Status of Various Crops.	U.W.I.	3 Yrs	Coates-Beckford D.Hutton	Botany Dept. Mona Campus, U.W.I. and Christiana	Botany Dept. Mona Campus, U.W.I.
8	2-88/18	Effect of Blast Freezing and Vacuum Packing on Shelf Life and Quality of Breadfruit and Bannias.	TIJULE Company	1 Yr	Juliette Newell	TIJULE Company 30 Paislely Ave. Palmers Cross Claredon	TIJULE Company 30 Paislely Ave. Palmers Cross Claredon
9	2-88/20	Investigating Spray Technology and Calibrating Equipment for Coffee Leaf Rust Control.	CARDI	Final report received.	Janice Reid	Selected coffee farms islandwide	c/o CARDI Mona Campus, U.W.I.
10	2-88/21	Germplasm Evaluation in Jamaica of ICRISAT Varieties of Pigeonpea.	MINAG	1 Yr	Aubrey Dexter	Bodles Research Station	Bodles Research Station, Old Harbor St. Catherine

No:	PROJECT #	PROJECT TITLE	MANAGEMENT ENTITY	DURATION	PRINCIPAL INVESTIGATOR(S)	LOCATION of PROJECT ACTIVITIES	CONTACT ADDRESS
11	2-88/22	Determination of Methods to Prolong Storage Life of Dasheen (<i>C.esculenta</i>) Corms.	MINAG	2 1/2 Yrs	Janette Lawrence	Windsor, Portland Parnassus, Clarendon Storage & Prevention of Infest. Div., Papine	Food Storage & Prev. of Infest. Division of the Min. of Ind. and Commerce Papine, St. Andrew
12	3-88/24	Atmospheric Modification for Disease Control and Improved Quality of Roses.	Rose Hill Farms	2 Yrs	Richard Khouri Kelly Ogilvie	Rose Hill Farm Spur Tree, Manchester	c/o Dept. of Botany U.W.I. Mona Campus
13	4-88/25	Developing Techniques for Improving and Propagating Ackee (<i>Blighia sapida</i> Koenig).	U.W.I.	2 Yrs	G.Sidrak M.Stair	Botany Dept., U.W.I. Mona Campus Selected locations islandwide	Botany Dept., U.W.I. Mona Campus
14	6-88/27	Determination of Yield, Digestibility and Nutritive Value of African Star Grass (<i>Cynodon nlemfuensis</i>) as influenced by Level of Nitrogen Fertilizer and Defoliation Frequency.	MINAG	2 Yrs	P.Jennings	Bodles Research Station	Bodles Research Station, Old Harbour St. Catherine
15	7-88/29	A Survey of Anthurium Bacterial Blight in Jamaica as a Base for Developing Research Strategies.	MINAG	2 Yrs	Florence Young	Anthurium Farms islandwide and Bodles Research Station	Bodles Research Station, Old Harbour St. Cather.
16	7-88/32	Bibliography and Summarization of Agricultural Research in Jamaica (1960-1988).	MINAG	1 Yr	R.Russell	Bodles and Grove Place Research and MINAG, Hope	
17	8-88/34	Effects of Selected Treatments on Mini-Sett/ Seed Yam Technique.	MINAG	2 Yrs	R.Blake	Bodles Research Station	Bodles Research Station, Old Harbour St. Catherine
18	9-88/36	Breeding Red Peas (<i>Phaseolus vulgaris</i>) for Disease Resistance and Enhanced Biological Nitrogen Fixation.	Scientific Research Council	3 Yrs	W.McLaughlin J.Baker D.Marsh	Biotech. Centre, U.W.I. and locations in Christiana Univ. of Puerto Rico, Lincoln Univ., Jefferson City, Missouri, U.S.A.	c/o Biotech. Centre U.W.I. Campus Mona, Kgn. 7/ Scientific Research Council, Hope, Kingston 6
19	9-88/37	In Vitro Techniques for Rapid Multiplication of Anthuriums.	U.W.I.	2 Yrs	P.Devi Prasad G.Lightbourn	Botany Dept., U.W.I. Mona Campus	Botany Dept., U.W.I. Mona Campus Kingston 7

No:	PROJECT #	PROJECT TITLE	MANAGEMENT ENTITY	DURATION	PRINCIPAL INVESTIGATOR(S)	LOCATION of PROJECT ACTIVITIES	CONTACT ADDRESS
20	1-89/44	Studies on the Bionomics and Control of Foliar Caterpillars on Onion and Escallion in South St. Elizabeth.	MINAG	3 Yrs	David Ellis	Cancelled	
21	2-89/45	Selection and Breeding of Loofah (strainer sponge).	Jamaica Floral Products Ltd.	3 Yrs	Burrell Scarlett	Caymanas Hort. Park	Jamaica Floral Prod. Ltd. 32 Federal Road, Sydenham, Spanish Town P.O.
22	2-89/46	Cooperative Study of Soils on a Part of the Marchmont Inlier, Western Jamaica.		1 Yr	Richard Harrison	Faculty of Agric. U.W.I. and sites in St. James and Westmoreland	c/o MINAG/RADA Montego Bay
23	4-89/47	Studies Aimed at Developing Biological Control for Root Weevils in Jamaica.	U.W.I. CARDI	3 Yrs	David Smith Munir Alam	U.W.I. and CARDI, Mona Campus, United Estates, Worthy Park Estates, Morgan's Pass, Water Valley	Zoology Dept. and CARDI, U.W.I. Campus Mona, Kgn.7
24	2-89/48	Study of Soil Characteristics as Developed in a Grass Mulch System of Vegetable Cultivation in Jamaica.	Univ. of Florida	1 Yr	Malcolm Davis	Top Hill, St. Elizabeth	c/o St. Elizabeth Land Authority Santa Cruz, St. Elizabeth
25	3-89/49	Fertilizer Management Requirements for Irish Potato Production in Jamaica.	MINAG	3 Yrs	R.Baker	Christiana, Guys Hill Watermount and Watchwell	c/o MINAG Hope, Kgn.6
26	5-89/51	Comparison of the Agronomic Performance of Napier, Hybrid Napier (N69) and King Grass.	MINAG	2 Yrs	J.Logan	Bodles, Grove Place Luana and Montpelier	c/o Bodles Research Station Old Harbour, St.Catherine/Grove Place, Mile Gully
27	5-89/52	Experiment on Loan in Kind for Production of Gladiolus and Kalla Lillies.	Ornamental Div., MINAG	3 Yrs	R.Malik	Top Mountain, St. Andrew	c/o MINAG Ornamental Division Hope, Kgn. 6
28	6-89/55	Plant Identification Guide for the Blue Mountain.	U.W.I.	1 Yr	S.Iremonger	Blue Mountain Region	c/o Botany Dept. U.W.I., Mona, Kgn. 7
29	7-89/57	A Study of the Floristics and Structural Dynamics of a High Altitude Forest in the Blue Mountain Range.	U.W.I.	1 Yr	S.Iremonger	Blue Mountain Region	c/o Botany Dept. U.W.I., Mona, Kgn. 7
30	10-89/61	Indigenous Knowledge Relating to Silvo-Pastoral Management Systems of Small Farmers in Jamaica.	Michigan State Univ.	4 Mo	M.Gold B.Morrison	Green Park Falmouth, Trelawny	c/o Trelawny Land Authority, Valmouth, Trelawny/MSU, East Lansing, MI U.S.A.
31	10-89/62	A Study of Resource Availability and Use by Selected Small Farmer Groups in Selected Jamaican Villages.	U.W.I.	3 Yrs	L.Rankine K.Dunbar G.Ennis	Selected locations (being finalised)	Faculty of Agric. U.W.I., St.Augustine Trinidad, W.I.

No:	PROJECT #	PROJECT TITLE	MANAGEMENT ENTITY	DURATION	PRINCIPAL INVESTIGATOR(S)	LOCATION of PROJECT ACTIVITIES	CONTACT ADDRESS
32	10-89/63	Fodder Tree Establishment in Jamaican Pastures.	Michigan State Univ.	1 Yr	M.Gold J.Roshketo	Rio Hoe, St. Ann	Alcan, Moneagule, St. Ann/MSU East Lansing, MI USA
33	10-89/65	Developing Rapid Multiplication Techniques for Yam.	U.W.I. and JAMPRO	3 Yrs	T.Ferguson Clifton Wilson Hyacinth Campbell	Bodles Research Station	c/o Bodles Research Station, Old Harbour St. Catherine
34	10-89/66	Developing Alternative Media for Anthurium Production in Jamaica.	JAFLEX	2 Yrs	P.Tai Chun	Orange Hall Farm, St. Ann	Jamaican Floral Exports, Orange Hall, St. Ann
35	10-89/67	Preliminary Studies Towards the Development of a Pest Management Programme for Escallion on Small Farms in Jamaica.	Univ. of Florida	1 Yr	P.Hilderbrand S.Cook	Southern St. Elizabeth	c/o St. Elizabeth Land Authority Santa Cruz, St. Eliz. c/o Univ. of Florida Gainesville, FL U.S.A.
36	10-89/68	Escallion Production in St. Elizabeth Parish, Jamaica: An Economic Analysis of Constraining Factors.	Univ. of Florida	1 Yr	P.Hilderbrand C.Tierney	Southern St. Elizabeth	c/o St. Elizabeth Land Authority Santa Cruz, St. Eliz. c/o Univ. of Florida Gainesville, FL U.S.A.
37	2-90/72	Passion Fruit Production in Jamaica: Evaluating Trellising Methods and Observing Production Problems.	U.W.I.	2 Yrs	L.Nkrumah P.Harvey	Bodles Research Station and other selected locations	Faculty of Agric. U.W.I. Campus, St. Augustine/Bodles Research Station Old Harbour, St.
38	2-90/74	Investigation into the Decline of the Breadfruit (<i>Artocarpus altilis</i>) Islandwide.	MINAG	1 Yr	M.Mais	Bodles Research Station and other selected locations	Bodles Research Station, Old Harbour St. Catherine
39	8-89/60	A Breadfruit (<i>Artocarpus altilis</i>) Improvement Project for Jamaica.	U.W.I.	3 Yrs	Theo Ferguson L.Nkrumah	Bodles Research Station and other selected locations	Faculty of Agric. U.W.I. Campus, St. Augustine/Bodles Research Sta. Old Harbour, St. Catherine
40	6-89/54	Growth and Yield of Sunrise Solo Papaya in Relation to Fertilizer Management.	MINAG	3 Yrs	Glennor Robinson	Bodles Research Station Wales, Trelawny Green Wales, St. Mary	Bodles Research Station, Old Harbour St. Catherine
41	40-90/77	Testing Trickle Irrigation Systems for Small-Scale Farms in the Rio Cobre Basin Area of Jamaica.	Univ. of Florida	3 Yrs	M.Moynihan	Selected Small Farms in the Rio Cobre Basin/Grove Farm, St. Catherine	Univ. of Florida Gainesville, FL/ National Irrigation Commission, Kingston
42	4-90/81	Improved Sigatoka Management: One Factor to Increase Banana Productivity for the Banana Farmers in Jamaica.	Banana Board	1 Yr	Jean Dixon	Islandwide	c/o Banana Board 10 South Avenue Kingston 3

Appendix F

Biosketches of Team Members

Anson R. Bertrand

Proposed Project Role: Agricultural Project Design/ Evaluation Specialist

Education:

- Ph.D. Purdue University (soil physics), 1955
- M.S. University of Illinois (agronomy), 1949
- B.S. Texas A&M University (agricultural education), 1947

Summary of Qualifications:

Dr. Bertrand possesses more than 40 years' experience in agronomy and agricultural research and over 25 years' experience as an administrator of agricultural programs. He is a member of 7 professional societies, including the American Society of Agronomy, Soil Conservation Society of America, and American Association for the Advancement of Science. Dr. Bertrand has travelled extensively as Agency Director for Food and Agriculture, Bureau for Science and Technology, U.S. Agency for International Development, and as an international consultant in the field of program and project evaluation and review.

Leadership in administration and management. While Agency Director for Food and Agriculture/AID/W, coordinated and managed agriculture and nutrition programs for bureau. Also acted as liaison with regional bureaus, missions, U.S. universities, contractors and international agricultural research centers. Currently, member of board of directors of International Banana and Plantain Research Network (INIBAP). As Director of Science and Education and Director of Science and Education Administration for U.S. Department of Agriculture, was chief policy officer for science and education. Led 8,300-employee department in-house research program, cooperative research and extension, human nutrition programs, and technical information systems; administered programs in every state, totalling more than \$1 billion annually.

Project review and recommendation. Since retirement from Agency for International Development, has completed more than 15 consultancies worldwide. As such, have prepared and presented critical analysis of AID natural resource management projects, conducted technical reviews, presented recommendations, evaluated and selected outstanding scientists for ARS/USDA, and reviewed AID agricultural projects. As team leader, reviewed AID-funded pest control project, prepared strategic plan for AID/university joint effort in sustainable agriculture, and is external examiner for faculty of agricultural sciences at University of United Arab Emirates.

Education and research. As dean of college of agricultural sciences, supervised teaching, research and public-service activities of 86 faculty members in 9 subject-matter departments. Conducted major research programs in each department using state, federal and private funding. While head of agronomy department, University of Georgia, supervised and coordinated teaching, research and extension activities for state. Also was instructor, assistant professor, and associate professor of agronomy department, Purdue University.

Work History

- 1986-Date **Examples of international consultant missions.**
- 1990 Member, Panel to select U.S. universities to receive higher education grants from CSRS/USDA.
 - 1990 Team Member to select outstanding scientists in ARS/USDA.
 - 1989-date Team Leader, Faculty of Agricultural Sciences, University of the United Arab Emirates. Leads panel of international scientists and educators who act as external examiners.
 - 1988-date Member, Board of Directors of International Banana and Plantain Research Network (INIBAP).
 - 1989 Team Leader, University of California-Fresno. Headed review of university agricultural research program.
 - 1989 Team Member, AID-funded project review, CATIE, Costa Rica, Chemonics Inc.
 - 1988-1989 Team Member, Strategic Planning Committee, BIFAD. Prepared strategic plan for AID/University joint efforts in sustainable agriculture.
 - 1988 Team Leader, Pest Control Project Review, OICD/USDA. Led review of multi-university multidisciplinary project.
 - 1987-1988 Conference Coordinator, International Dryland Farming Conference, Amarillo, Texas. Led fund raising, contacted speakers, arranged facilities for international conference; more than 1500 persons from 52 countries attended.

- 1988 Conference Coordinator, AID/W. Planned and conducted conference on sustainable agriculture involving persons from government agencies and private voluntary organizations.
- 1988 Panel Member, ARS/USDA review committee. Evaluated and selected outstanding scientists within ARS/USDA.
- 1988 Team Leader, AID Biotechnology Projects review.
- 1987 Technical Consultant, AID Water Harvesting/Aquaculture Project review, Checchi and Co. Served as technical member of team to review project carried out by Auburn University and PVOs in 11 countries.
- 1987 Team Leader, S&T/AGR/AID project review. Completed review of bean/cowpea CRSP project.
- 1986-1987 Consultant, Chemonics Inc. Prepared PID for AID/S&T natural resource projects.
- 1986 Consultant, AID/W. Conducted technical review of agricultural projects and presented forward planning recommendations.
- 1986 Technical Consultant, AID/W. Prepared and presented analysis of S&T/AGR/AID natural resource management projects and proposed strategy for combining projects and future directions.
- 1982-1986 Bureau for Science and Technology, U.S. Agency for International Development. 1986, Agency Director for Food and Agriculture. From 1982 to 1985, Director, Office of Agriculture.
- 1978-1982 Director of Science and Education and Director of Science and Education Administration, U.S. Department of Agriculture. Chief policy officer for science and education on staff of Secretary of Agriculture.
- 1971-1978 Dean, College of Agricultural Sciences, Texas Tech University, Lubbock, Texas.
- 1967-1971 Professor, head of Agronomy Department, University of Georgia and Chairman of Agronomy Division, University of Georgia system.

1961-1967 SWC, ARS, USDA. From 1961-1964, Director, Southern Piedmont Soil and Water Conservation Center, Watkinsville, Georgia. 1964-1967, chief, Southern Branch, USDA.

1949-1961 Agronomy Department, Purdue University.

Languages: English, French

Robert S. Temple

Proposed Project Role: Institutional Specialist

Education

- Ph.D. Iowa State University (1959), animal breeding
- M.S. Colorado State University (1956), animal breeding
- B.S. Colorado State University (1951), agronomy

Summary of Qualifications

Dr. Temple has 30 years' experience in international livestock production in the development and evaluation of agricultural institutions. This includes ranching, teaching, research, and administration of research and extension programs in North and South America. While teaching at Louisiana State University and the University of Tennessee, he consulted for the USDA and the American Brahman Breeders Association in Central and South America. While at the University of Tennessee, he coordinated the Southeast Regional Beef Cattle Breeding Program for the USDA. This work required extensive travel throughout the southeastern United States. During this time, he studied methods to increase tropical livestock production in Central America for the U.S. Department of Agriculture.

International experience. Dr. Temple joined the staff of the Food and Agriculture Organization of the United Nations (Rome, Italy) working both at headquarters and in the field. At headquarters, he supervised livestock projects in South and Central America, Africa, and the Middle East. In Mexico, he served as livestock specialist, working with beef, dairy, sheep, and goats. His projects were in the tropical areas around Tampico and Chapingo as well as in the northern drier areas. After 9 years with FAO, he joined the staff of the newly formed International Livestock Center for Africa (ILCA) in Ethiopia. At ILCA from June 1975 to August 1979, he held positions of director of animal science, acting director general and coordinator of the Ethiopian Research Program. He developed livestock production systems in the tropics and subtropics.

Livestock production. Since 1979, Dr. Temple has served as consultant in livestock development and production to USAID, the World Bank, FAO, IADS, Winrock International, and Dames and Moore. Responsibilities include national, regional, and international research; training, advisory, consultant, and technical assistance activities; program development, implementation and evaluation; institution building; and university development. A specialist in population genetics and beef cattle breeding, he also has extensive experience in livestock development with sheep, goats, dairy cattle, camels, and poultry.

Work History

- 1989-Date Senior associate, Winrock International Institute for Agricultural Development, Morrilton, AR. Provides mature skills in short-term project leadership, project evaluation, and technical backstopping.
- 1979-Date **Examples of International livestock consultant missions.**
- 1988 **Devres, Inc. Livestock specialist, Ministry of Agriculture, Government of Swaziland, Mbabane.** Follow-up mission.
- 1987 **Devres, Inc. Ministry of Agriculture, Government of Swaziland, Mbabane.** Reviewed the ministry's program of work and proposed restructuring where necessary. Served as the livestock consultant.
- 1986 **FAO. Livestock research, Bangladesh Livestock Research Institute, Dhaka.** Leader of five person team for follow-up visit on development of livestock research.
- 1986 **Winrock International.** Livestock research, review of Western Sudan Agricultural Project, Khartoum, and extensive travel in country.
- 1985 **FAO.** Research planning for the development of the Bangladesh Livestock Research Institute, Dhaka. Leader of team which wrote Master Plan of Research for institute.
- 1985 **FAO.** Research planning/programming specialist for the development of the Bangladesh Livestock Research Institute, Dhaka. Organized staffing structure of institute and initiated systems research and development programs in Bangladesh villages.
- 1984 **International Agricultural Development Service (IADS).** Livestock research as part of Agriculture Review for Government of Zambia.
- 1983 **FAO. Dairy development in Khartoum area, Sudan.** Wrote project for FAO for continued assistance from the World Food Program to Government of Sudan for improvement of dairy industry around Khartoum.
- 1983 **FAO. Livestock development in People's Republic of China, Xinjiang Province.** Completed Livestock Development Plan for Xinjiang Province which included project proposals for cattle, sheep, and goat improvement.

- 1982 **FAO.** Worked on livestock development plan for Xinjiang Province of the People's Republic of China. Six weeks were spent in field in Xinjiang Province, China.
- 1982 **FAO.** Developed proposal for livestock survey of Saudi Arabia. Conducted field trips throughout country and made supervision visit to purebred Arabian horse project at Dirab. Visited site of new Saudi Arabian Livestock Research Station at Al Jouf.
- 1981 **International Agriculture Development Service, New York.** Sinai Development Project, Cairo and Sinai, Egypt. Responsible for livestock component.
- 1980 **Consultant mission** to Rancho El Fortin, Mexico.
- 1979 **World Bank.** Member of eight-person team on development of agriculture research in Senegal. Responsible for the livestock research component.
- 1979 **Rancho El Fortin, San Buenaventura, Mexico.** Developed selection program for purebred Charolais herd and pasture management scheme for 10,000-acre ranch.
- 1978-1979 **Director of Ethiopian country program and coordinator of country programs, International Livestock Center for Africa, Addis Ababa, Ethiopia.** Responsible for all research and development programs in Ethiopia and assisted director general in coordinating programs in Kenya, Botswana, Nigeria, Mali, and Ethiopia. Was member of task force for ILCA that developed and published ILCA's Approach to Systems Research on Livestock Production Systems.
- 1977-1978 **Acting director general, International Livestock Center for Africa.** After resignation of director general, was appointed acting director for year. In this capacity, had overall responsibility for ILCA's research programs and was in charge of administration.
- 1975-1976 **Director of animal science, International Livestock Center for Africa.** As first scientist for ILCA, was responsible for hiring scientists in that department and for developing research programs. ILCA's mandate was to conduct research on systems of animal production and methods of improvement of those systems. Was member of senior scientific team which developed ILCA's system approach to livestock production research.

- 1971-1975 **Assistant to the director, Animal Production and Health Division, Headquarters, Food and Agricultural Organization, Rome, Italy.** Carried out program planning and budgeting for division and conducted division's program for Prospective World Study of Agriculture for FAO. Developed division's International Meat Development Scheme which conducted long-term improvement programs in South America and Africa. Initiated International Breed Comparison Study for division which compared breeds in selected western and eastern European countries.
- 1969-1971 **Beef cattle specialist, FAO Project, Monterrey, Mexico.** Responsible for teaching courses in animal breeding, statistics, beef production, and general animal husbandry at the Instituto Tecnológico y Estudios Superiores de Monterrey. Beef cattle research programs were developed in the "Huasteca" area near Tampico, in the tropical area around Chapingo and in semiarid area of the north near Musquiz. Programs included nutritional improvement, pasture development, selection, and crossbreeding to improve the breeds.
- 1966-1968 **Beef cattle production officer for the Animal Production and Health Division, Headquarters, Food and Agriculture Organization, Rome, Italy.** In addition to developing worldwide beef cattle improvement programs, acted as project supervisor for livestock improvement projects in Central and South America, Africa, and the Middle East. He was instrumental in developing beef feedlot program in tropical area of Kenya at Nakuru.
- 1961-1966 **Coordinator of the Southeastern U.S. Regional Beef Cattle Breeding Research Project, U.S. Department of Agriculture; and professor of animal science at the University of Tennessee, Knoxville.** Responsible for coordinating 13 southeastern states' beef cattle breeding project funded in part by the Agricultural Research Service, USDA. Administered program and technically supervised projects. Prepared annual reports and conducted annual meeting of technical research committee. In addition, he had part-time teaching responsibilities in Department of Animal Science at the University of Tennessee. Continued to work on beef cattle production systems and assisted the National Extension Service in developing a national beef performance testing program which became the Beef Improvement Federation. In 1963, he was a member of a team of six USDA specialists who went to Brazil to

develop livestock improvement programs in tropical and temperate areas. In 1964 the Animal Husbandry Research Division of the USDA sent him to Central America to survey livestock production systems in tropical areas and to make recommendations for improvement.

1959-1961 **Assistant professor of animal science, Louisiana State University.** Taught animal breeding and statistics (the research program of beef cattle crossbreeding was the largest crossbreeding research program in the United States). Worked closely with the Louisiana Extension Service and cattle producers to develop the Louisiana-On-Farm beef cattle testing program and the improvement of beef cattle production systems. He consulted with the American Brahman Breeders Association in Peru and Colombia on herd improvement in tropical areas.

Languages **Fluent:** English
 Other: Spanish, Italian, French

Selected Publications

- Temple, R. S., F. Dolberg, S. Schuking, E. A. Wells, and I. H. Marshall. 1986. Master Plan of Research, Bangladesh Livestock Research Institute, Savar, Bangladesh. November 1986.
- Temple, R. S. 1986. Institution building for agricultural production systems research in developing countries. Symposium: Farming Systems Research. Kansas State University, Manhattan. October 1986.
- Temple, R. S. and I. Reh. 1979. A systems approach to research on improvement of livestock production. Beef Cattle Science Handbook, Vol. 16, Agriservices Foundation. January 1979.
- Temple, R. S., C. Carrera, M. H. Butterworth, and C. Augustini. 1970. Short duration feeding of Mexican Criollo steers. *J. Animal Science* 31:169 (abs.).
- Butterworth, M. H., R. S. Temple, and C. Carrera. 1970. Consumer preference for meats and meat products. *J. Animal Science* 30:180 (abs.).
- Ramsey, C. B., J. W. Cole, R. N. Terrell, and R. S. Temple. 1968. Effects on type and breed of British, Zebu and dairy cattle on production, palatability and composition. IV. Yield of gastrointestinal tract and other non-carcass components. *J. Animal Science* 24:120.
- Fitzhugh, H. A., Jr., T. C. Cartwright, and R. S. Temple. 1967. Genetic and environmental factors affecting weight of beef cows. *J. Animal Science* 26:991.

- Temple, R. S. 1966. Reproduction of beef cattle in the South. USDA Southern Cooperative Series Bulletin 118. December.
- Fitzhugh, H. A., Jr., T. C. Cartwright, and R. S. Temple. 1965. Effects associated with beef cow weight. *J. Animal Science* 25:848 (abs.).
- Temple, R. S. 1965. Reproduction of beef cattle in the South. Florida Beef Cattle Short Course, University of Florida, Gainesville.
- Ramsey, C. B., R. S. Temple, R. S. Sliger, and D. L. Ruffman. 1965. Changes in beef muscle area and configuration during slaughter. *J. Animal Science* 24:283.
- Cole, J. W., C. B. Ramsay, C. S. Hobbs, and R. S. Temple. 1964. Effects of type and breed of British, Zebu and dairy cattle on production, carcass composition and palatability. *J. Dairy Science* 47:1138.
- Reynolds, W. L., T. M. DeRouen, J. W. High, Jr., J. N. Wiltbank, E. J. Warwick, and R. S. Temple. 1964. Evaluation of pastures in terms of reproduction of beef cattle. *J. Animal Science* 23:890 (abs.).
- Temple, R. S. 1964. What the Southern cattle breeders are doing toward improvement of their beef cattle and how they are going about it. Colorado Livestock Producers Day, Colorado State University, Fort Collins. February 1964.
- Temple, R. S., H. M. Jamison, and C. M. Kincaid. 1964. Reproductive performance of beef cattle in the South. *J. Animal Science* 23:305 (abs.).

Aston S. Wood

Proposed Project Role: Institutional Specialist

Education:

- Ph.D. University of Minnesota (animal science), 1964
- M.S. University of Minnesota (animal science), 19610
- B.S. North Carolina A&T State University (animal science), 1959

Summary of Qualifications:

Dr. Wood is an animal scientist and agribusiness advisor with more than 35 years' experience in human resource development, training, and livestock and poultry research. He has completed consultancies in animal production, conducted feasibility studies, and performed technical appraisals for private- and public-sector enterprises throughout Jamaica. Familiar with international donors and agriculture centers, he has completed assignments with the Inter-American Institute for Cooperation on Agriculture (IICA), the Inter-American Development Bank (IDB), and Caribbean Development Bank. Dr. Wood also has a long history in education and training, having served as lecturer, assistant professor and principal of animal science departments and agricultural schools in Canada, Nigeria, and Jamaica.

Project management. As managing director of Agrocon, Ltd., leads consultants and staff in agricultural production, training and human resource development projects. Was project manager and animal production consultant on Midland and Agricultural Development Corporation farm study. Served as management consultant to Jamaican cigarette company for study of tobacco production. Led technical appraisal of Urban Development Corporation's 2500-acre commercial farms in St. Ann. Served as program director of Caribbean agricultural middle management training program for livestock farm managers in CARICOM region. As such, developed curricula, supervised and coordinated with session leaders, and acted as liaison between farming community and participants conducting operation audit attachments. Services as livestock/animal husbandry expert to IDB-funded Bahamas Agricultural Services Development Project.

Livestock and poultry research and administration. Served as livestock officer, Bodles Agricultural Station for Ministry of Agriculture and Lands, Government of Jamaica. As graduate student at University of Minnesota, conducted research for dairy husbandry department. Completed consultancy as part of Caribbean Development Bank project on study of canefeed livestock. Completed animal production consultancy for development/feasibility study of Clarendon Plains. Conducted feasibility on agricultural development of reclaimed

bauxite lands in Jamaica and commercial farms of Jamaica Agricultural Development Corporation for Jamaica national Investment Company.

Education and training management. Beginning as lecturer for animal science department at University of Nigeria, continued serving as educator as assistant professor for animal and poultry science department at University of Guelph, Ontario, Canada. Later served 5 years as principal for Jamaica School of Agriculture. Drafted overall and supervisory management training program for agricultural project personnel for CARICOM Secretarial Workshop in Barbados. Following year, was resource person for additional workshop in Jamaica, training trainers for agricultural extension services in Caribbean. Also served as member curriculum development committee for agricultural education in Jamaica. As program director of Caribbean agricultural middle management training program in CARICOM region, developed case studies by adaptation of local training materials to upgrade training approach.

Work History

- 1979-Date Managing Director, Agrocon Ltd. Consulting firm.
- 1976-Date Consultant, agricultural production management, training and human resource development
- 1976-Date **Examples of international consultant missions.**
- 1983 Resource person for Commonwealth Secretariat, CARICOM Secretarial Workshop, Barbados. Drafted overall program and supervisory management training program for agricultural project personnel.
- 1982 Resource person for Commonwealth Secretariat, CARICOM Secretarial Workshop, Jamaica. Led session on training of trainers for agricultural extension services in the Caribbean.
- 1980-1981 Management Consultant, Cigarette Company of Jamaica. Completed study on tobacco production.
- 1979-1981 Project Manager/Animal Production Consultant. Completed Midland and Agricultural Development Corporation farm study.
- 1979 Animal Production Consultant, McNeely Engineering Ltd. and Proctor & Redfern International ltd. As part of joint venture project, completed feasibility study of development of Clarendon Plains/Pinders River Dam Project.

- 1979 **Resource Participant, Commonwealth Secretarial Workshop, Sri Lanka. Drafted training programs for agricultural project managers.**
- 1971-1976 **Principal, Jamaica School of Agriculture. Headed tertiary educational institution focused on agriculture, home economics and consumer education.**
- 1975 **Associate Consultant, Caribbean Development Bank. Completed study of canefeed livestock.**
- 1967-1971 **Assistant Professor, Animal and Poultry Science Department, University of Guelph, Guelph, Ontario, Canada.**
- 1964-1967 **Lecturer, Animal Science Department, University of Nigeria, Nsukka, E. Nigeria.**
- 1960-1964 **Research Assistant, Dairy Husbandry Department, University of Minnesota, St. Paul, Minnesota.**
- 1954-1956 **Livestock officer, Bodles Agricultural Station, Ministry of Agriculture and Lands, Jamaica, W.I.**

Languages: English

Selected Publications:

Wood, Aston S. 1977. Agricultural Education in Jamaica. IICA publication.

Has completed more than 21 publications in referred journals (e.g., J. Dairy Science, Poultry Science, Animal Science, Canadian J. Animal Science)